THE FOUNDRY

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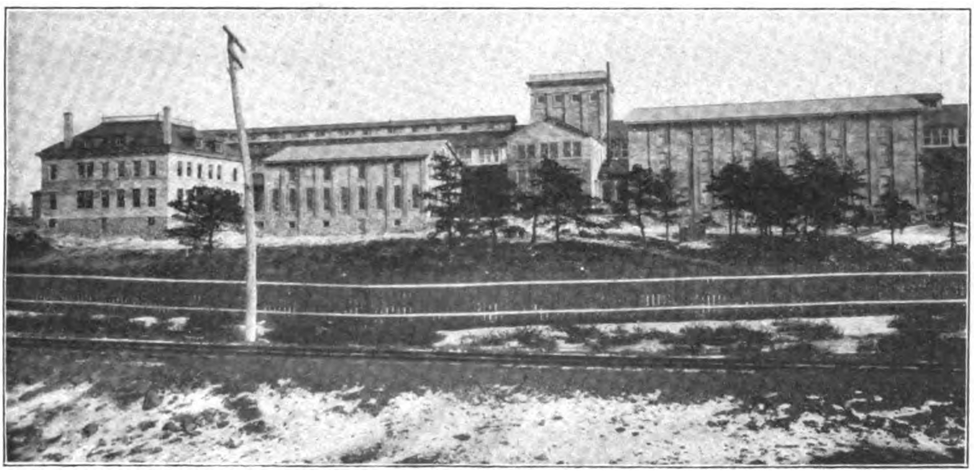
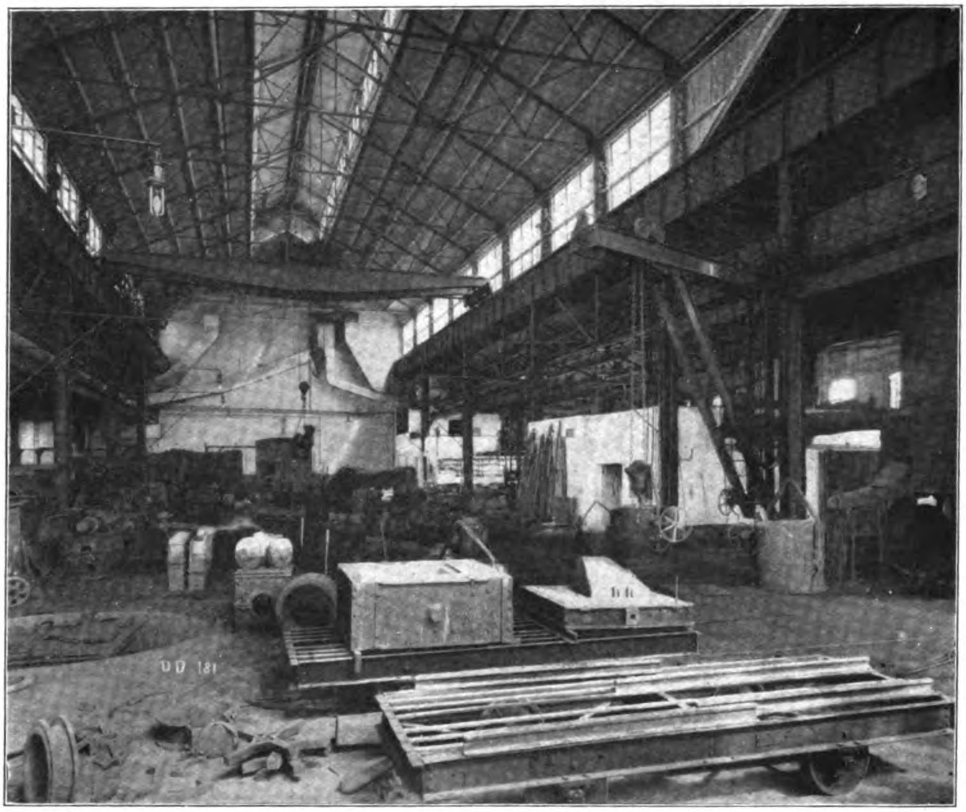
Foundry of the Jeanesville Iron Works.

The Jeanesville Iron Works is the natural outgrowth of the mining conditions of the anthracite region. The plant was formerly located at Jeanesville, in the Hazleton region. The owners made a careful study of the mining conditions and designed pumping machinery especially suited to meet those conditions. The result was that Jeanesville pumps became noted the world over as a superior class of mining pumps. The business finally outgrew the old plant at Jeanesville and they cast about for a new building site. The most available and best located site to be found was in Hazleton, only a few miles from their old works. Desiring to have the most efficient plant possible they made a careful study of the best modern plants along their line, employing Messrs. Ballinger & Perrot of Philadelphia, as architects for the buildings, and Messrs. Dodge & Day, of Nicetown, Philadelphia, Pa., as experts to look after the mechanical equipment. The plant has been designed in such a way that it is capable of expansion in all directions. The buildings are of concrete construction and either fire-proof or of slow burning construction for the interior works. Owing to the fact that they are located outside of the fire district of Hazleton, the architects constructed a tower in the center of the works. This tower is over the cleaning department. The story immediately above the cleaning department contains the engines and heating coils for use in connection with the American Blower Co.'s heating system. Above this room is located a 30,000 gal. capacity tank which contains the service supply for the entire works. There is always a sufficient volume of water on hand to fight any ordinary fire, but as a reserve they have constructed a 350,000 gal. capacity reservoir on the high ground back of the plant and installed a large fire pump to be used in case of emergency. The water supply for the works is from an artesian well.

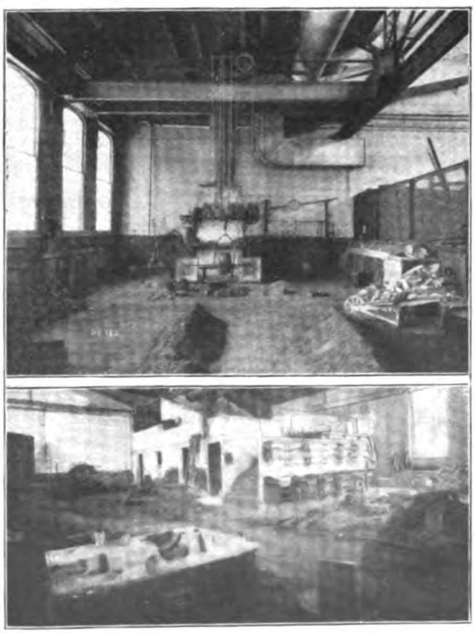


JEANESVILLE IRON WORKS.

The iron foundry is located in a building 107 by 192 feet. The central bay of the foundry is 50 feet wide and is provided with a traveling crane of 20 tons capacity, with 5 tons auxiliary, also with two wall jib cranes and two pillar cranes arranged to swing around the entire circle of 5 tons capacity each. In addition to this, there is a floor controlled electric traveling crane over the core department of 5 tons capacity, and another over the side bay of 5 tons capacity. The crane in the main bay is so arranged that it can pass out through



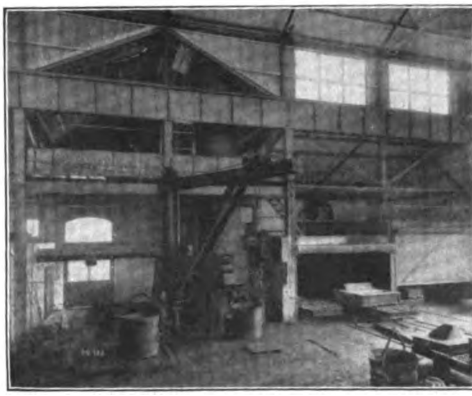
INTERIOR OF IRON FOUNDRY.



1. BRASS FOUNDRY. 2. CORE DEPARTMENT.

an opening in the end of the building and over a runway in flask yard equal to the length of the foundry. This runway is so constructed that if it was ever desired to continue the foundry the posts of the runway will form the main posts in the structural work for the additional building.

In order to take care of their special work, they have provided two pits in the foundry floor, one for cylinders and the other for plungers. These pits are served by the pillar cranes, and are also under the runway of the main traveling crane. Many of their molds are made in dry sand and require baking and hence two large mold-drying ovens have been provided at the end of the foundry. Adjoining these are located the cupolas, one of 60 inches diameter, and the other of 45 inches diameter inside the lining. Blast is furnished for the cupolas by a positive, motor driven blower in an adjoining room. The core department is located on the same side of the room as the cupolas, and there is a double core oven at the end of the department. The storage bins and department for preparing sand are also on



1. CUPOLA AND OVENS FOR DRYING MOLDS.

2. CLEANING DEPARTMENT.

this side of the foundry. The central bay is devoted to the heavy work, while a portion of the bay opposite the cupolas is devoted to light work and the balance to the brass foundry. The foreman's office is situated about midway in the length of the foundry and opposite the cupolas. One thing that has been taken into special account in designing the plant has been to arrange it so that everything would move through in a continuous line. The pig iron, coal, etc., are brought in on tracks at the foundry end of the plant. An elevated track is provided, with bins beneath it for the storage of various materials used in the foundry, and this track also runs over the coal bins at the power plant. The castings pass from the foundry directly into the cleaning department, which is equipped throughout with pneumatic tools, including 2 10 ton pneumatic traveling cranes for handling castings. From the cleaning department castings pass directly into the machine shop.

Pneumatic tools are used throughout the shop in all cases in which they will facilitate the work. Among other appliances, a drop weight for breaking heavy scrap has been installed in the yard and arranged to operate with a pneumatic hoist. The brass foundry is separated from the iron foundry by an expanded metal partition.

The foundry is lighted by what might be called a double monitor roof. In the first place, there is a monitor roof over the central bay with windows along the sides, and above this, over the center of the main bay, there is a ventilator with windows along both sides. These windows, together with the side windows, afford ample light.

FOUNDRY YARD.

FOUNDRY BLACKINGS.

N. W. SHED.

What are blackings made of?

The question is commonly answered by saying, black lead or plumbago. It is true that many blackings contain more or less black lead; but, on the other hand, it is true that a great many blackings contain no black lead at all. The question might be answered by saying, coal. This answer would be nearer right, for probably three-fourths of the blacking used in the United States is made out of hard coal pulverized. Hard coal is generally regarded as being quite uniform in composition, yet there is a marked difference in the various hard coal blackings.

As an instance of this, the experience of a cast iron pipe maker may be valuable. This manufacturer had begun using a new lot of blacking and soon noticed that the sand stuck to the pipes, giving them a very rough appearance. He went to the blacking dealer and said: "Your last lot of blacking is not good." "I am sure it is all right," replied the dealer. "Just the same as we have been sending you." But the pipe man was not satisfied and sent samples of the old and the new blacking to a foundry chemist, with these results:

GOOD BLACKING.

Ash	10 percent
Solid carbon	83 "

POOR BLACKING.

Ash	18 percent
Solid carbon	75 "

This proved that there was a decided difference in the blacking and also showed that the blacking with low ash and high carbon kept the sand from sticking to the casting. The poor blacking was made of a slaty, hard coal, what the miners call bone coal; this is the refuse of the anthracite breakers and can be obtained for little or nothing. The good blacking was made from a good quality of hard coal.

For some classes of work, such as ingot molds, an inferior blacking will do very well and the saving in expense is considerable. A sample of ingot mold blacking recently analyzed in the Foundrymen's Laboratory showed:

Ash	24.70
Solid carbon	72.90

This blacking had very little volatile matter and this indicates that it is made not from hard coal, but from coke, ground very fine.

For small castings, requiring a very smooth surface, a much finer quality of blacking is used. These blackings contain a large quantity of plumbago, yet the blacking maker is prone to put in as small a quantity of plumbago as possible and yet have the blacking fill the bill.

A plumbago blacking, called by the trade pure plumbago, had this composition:

Ash	47 percent
Volatile matter	7 "
Solid carbon	46 "

This is very far from pure plumbago, which should be 100 percent carbon or graphite. The graphite as mined has usually many mineral impurities and to this impure graphite a large amount of soapstone is added, making a product which masquerades as plumbago. It is very common to find 50 percent soapstone in plumbago blackings. In fact, there is very little pure plumbago sold for foundry use.

It would seem reasonable to demand that when pure plumbago is wanted it should be at least 75 percent pure.

The pure graphite can be recognized by its occurring in little scales with a bluish black lustre. When dropped into water these scales tend to float. If the dry plumbago is rubbed upon a porcelain plate the streak will have a greenish hue. With a good lens or small microscope the flakes of graphite may be readily distinguished from the impurities. Feldspar is often used as an adulterant and can be recognized by its cleavage.

As there are white blackbirds, so there are white blackings. Under this head are the various grades of talc or soapstone which can be used alone for some kinds of work.

Among the white blackings are preparations of infusorial earth, which is very fine silica. Another light blacking is lycopodium, which is a pale yellow dust composed of the spores of a fern-like plant. The latter are used mainly in fine steel and brass castings.

A near relative of the hard coal blacking is the sea coal facing.

In some foundries the blackings are called facings and the supply houses ship plumbago as a facing. The sea coal used with sand at the face of the mold is generally called facing. This facing, to be efficient, must give off considerable gas when the iron strikes it, and therefore bituminous coal, usually called soft coal, is used.

The name sea coal probably comes from the fact that the soft coal in England was commonly shipped by way of the sea. The name means nothing here for the soft coal used in foundries rarely visits the sea.

An extremely gassy sea coal should be avoided. Some prefer the Pittsburg coal with about 32 percent of gas or volatile matter, while many like the semi-bituminous coals of Central Pennsylvania and Maryland, containing about 22 percent volatile matter.

Westmoreland County, Pa., has shipped a large amount of satisfactory sea coal.

The best method of testing blackings and facings is by burning.

A small quantity is weighed in a platmine crucible, the crucible is covered and heated to a red heat for three minutes. This will drive off the volatile matter. The crucible is cooled and weighed; the loss in weight gives the amount of volatile matter or gas. The residue in the crucible is now like coke. The crucible is placed on its side and heated to a bright red for several minutes, stirring the contents occasionally. The ash appears gray or white, When no black particles are visible, remove the crucible from the flame and weigh again. The last weight gives the amount of ash. The solid or fixed carbon is found by adding the percentage of volatile matter to the percentage of ash and subtracting from 100.

In many of the adulterated plumbago blackings the ash will melt, owing to the adulterant present making a flux with the silicious matter of the impure graphite.

The volatile matter will usually decide whether the blacking is made of ground coal or ground coke. A ground hard coal will usually show 7 percent volatile matter. A ground coke shows usually less than 3 percent. The method of testing shown above is short and inexpensive. It would pay every foundryman to test what he calls a good blacking and when he buys a new supply hold the manufacturer to this test. This would avoid the loss and annoyance caused by poor blackings which are now being floated on the unsuspecting foundryman.

Foundrymen's Laboratory, Buffalo, N. Y.

Henry Robertson, of Wadena, Minn., has leased a foundry and machine shop at Long Prairie, Minn., and expects to place it in operation before long.

The iron foundry of Geary & Powell, of Jersey City, N. J., is now being equipped and they expect to have it completed by March 1st. The shop is 50 by 100 ft. They expect to do machinery and general jobbing work.

PRACTICAL METHODS OF ANALYSIS FOR BRASSES AND BRONZES.

BY W. W. CORSE.

The alloys of copper, classed under the general heads of brasses and bronzes, may, besides copper, contain tin, lead or zinc in any combination up to 40 percent of the total formula. Antimony, iron phosphorus and sulphur may also be present, but usually in small amounts. There are also brasses containing 2 to 3 percent of aluminum and what are known as aluminum bronzes, carrying generally about 10 percent of aluminum with 90 percent of copper.

For practical purposes it is generally sufficient to determine any or all of the first four metals mentioned and therefore only the methods applicable to these will be considered here.

If the metal is what the foundryman calls yellow, the copper content will be between 60 and 75 percent; if it is what is known as red or steam metal, it will be between 75 and 90 percent. The tin content may be as low as a few tenths of a percent in yellow metal for rolling purposes, or as high as 10 to 15 percent in gun metal or bell metal for casting purposes. The lead content varies similarly from a few tenths of a percent in rolling metal to 15 or even 30 percent in metal suitable for bearings. The average lead content in red metal is between 3 and 5 percent. Zinc varies from 2 percent in the familiar 88-10-2 gun metal mixture to 40 percent in Memtz metal for rolling purposes. The average content for yellow metal is between 25 and 30 percent and for red metal 5 to 10 percent.

Methods of Analysis.

The procedure is as follows:

Weigh out 2.5 grams of the sample into a 250 cc. beaker, add sufficient water to cover it, cover the beaker with a watch glass, add 10 cc. of nitric acid (sp. gr. 1.42) and warm until all metallic particles are dissolved. Now add hot water to make the volume of the solution 40 cc. and boil five minutes to insure the complete precipitation of the tin. If no white residue appears at this point it shows absence of tin. Antimony would appear here also if present. If a white residue is formed, filter and wash with 2 percent nitric acid to insure the complete removal of copper, dry, ignite in a porcelain crucible and weigh as stannic oxide ($Sn. O_2$). From this calculate the percentage of tin present. Stannic oxide generally carries down a small amount of the other metallic salts present in the solution, which causes the results to come about 0.1 percent high for every percent of tin present. If very accurate results are desired, the precipitate may be purified by fusion and reprecipitation, but this is seldom necessary.

To the filtrate from the tin, which should be in a porcelain dish or casserole, add 10 cc. of sulfuric acid (sp. gr. 1.84), and set on the steam bath until all the nitric acid has evaporated. An indication of this is a change of color from a deep to a pale blue. The best way is to arrange the work so that this evaporation will take place over night as then no time is lost.

Some prefer to evaporate off the nitric acid over a naked flame, but it is the writer's experience that the time gained is more than offset by the danger of loss by spurting.

Then add 125 cc. of water to the casserole and boil until the sulfates of copper and zinc are dissolved. Allow to cool, then filter off the lead sulfate and wash with dilute sulfuric acid 1:20 to remove the copper and zinc. Remove the beaker containing the filtrate and finish the washing with a mixture of alcohol and water 1:1 to remove the sulfuric acid. The latter washing is necessary because any sulfuric acid remaining in the filter will char it and make it difficult to handle during ignition. Dry the lead sulfate on the filter, then remove it to glazed paper by means of a spatula and camel's hair brush. Suspend the filter over a porcelain crucible, by means of a platinum wire, ignite it, allowing the ash to fall into the crucible. Now add two drops of nitric acid (sp. gr. 1.42) and one drop of sulfuric acid (sp. gr. 1.84) and heat gently until the white fumes of sulfuric anhydride are expelled. This changes any lead that may have been reduced by the burning paper, back to sulfate. Replace the main portion of the precipitate in the crucible and ignite it at a red heat for a few minutes. Weigh as lead sulfate, from which calculate the percentage of metallic lead.

*A volumetric method for lead using ammonium persulfate has been carried out by Walters and Affelder, which cuts down the time very materially, but the writer's experience with it has been that low results are liable to be obtained through incomplete oxidation of the lead by the persulfate. More exact conditions for precipitation may remedy this defect.

Make the filtrate from the lead sulfate up to 500 cc. in a volumetric flask. If several analyses are being carried on at once it is generally convenient to put this solution into a bottle to be taken out as needed.

For the determination of copper the method used is that of Low.*

"Standardization of the Thiosulfate Solution. —Prepare a solution of sodium thiosulfate containing about 19 grams of the pure crystals to the liter. Standardize as follows: Weigh accurately about 0.200 gram of pure copper foil and place in a flask of about 250 cc. capacity. Dissolve by warming with 5 cc. of a mixture of equal volumes of strong nitric acid (sp. gr. 1.42) and water and then dilute to about 50 cc. Boil for a few moments to partially expel the red fumes and then add 5 cc. of strong bromine water and boil until the bromine is thoroughly expelled. The bromine is to ensure the complete destruction or removal of the red fumes. Remove from the heat and add a slight excess of strong ammonia water. Ordinarily it suffices to add 7 cc. of ammonia water of .90 sp. gr. Again boil until the excess of ammonia is expelled as shown by a change of color of the liquid and a partial precipitation of the copper hydroxide or oxide. Now add strong acetic acid in slight excess, perhaps 3 or 4 cc. of the 80 per cent acid in all, and boil again for a moment if necessary to redissolve the copper. Cool to room temperature and add about 3 grams of potassium iodide, or 6 cc. of a solution of the salt containing 50 grams in 100 cc. Cuprous iodide will be precipitated and iodine liberated according to the reaction

$$2\,(Cu.2\,C_2H_3O_2) + 4KI =$$
$$Cu_2I_2 + 4\,(K.C_2H_3O_2) + 2I.$$

The free iodine colors the mixture brown. Titrate at once with the thiosulfate solution until the brown tinge has become weak and then add sufficient starch liquor to produce a marked blue coloration. Continue the titration cautiously until the color due to free iodine has entirely vanished. The blue color changes towards the end to a faint lilac. If at this point the thiosulfate be added drop by drop and a little time be allowed for complete reaction after each addition, there is no difficulty in hitting the end-point within a single drop. 1 cc. of the thiosulfate solution will be found to correspond to about 0.0005 gram of copper. The reaction between the thiosulfate and the iodine is

$$2\,(Na_2S_2O_3) + 2\,I = 2\,NaI + Na_2S_4O_6.$$

Sodium iodide and tetrathionate are formed. The starch liquor may be made by boiling about 0.5 gram of starch with a little water

*Jour. Amer. Chem. Soc., June, 1903, XXV. 632.

*Jour. Amer. Chem. Soc., Nov., 1902, XXIV. 1082.

and diluting with hot water to about 250 cc. The liquor should be homogeneous and free from lumps or grains. It should be used cold and must be prepared frequently, as it does not keep well. The thiosulfate solution made from the pure crystals and distilled water appears to be quite stable, showing little or no variation in a month under reasonable conditions."

Treatment of sample.—Take an aliquot portion of the 500 cc. solution equivalent to 0.2 gram of copper, generally 50 cc., add ammonia, boil off excess, add acetic acid and titrate exactly as described for the standardization. Calculate the percentage of copper from the volume of the thiosulfate solution used. Zinc does not interfere with the method.

If the sample is being analyzed to check the furnace man, or to get the approximate mixture used either for the foundry chemist or a customer, it is sufficient, as all the methods used are very accurate, to add the results for tin, lead and copper and obtain the zinc by difference. If, however, the analysis is being made to determine the loss of zinc by volatilization in order to figure out a formula to use in connection with either a crucible furnace or one of the many forms of oil furnaces which are now on the market, it becomes necessary to determine the zinc exactly.

The method used is gravimetric and depends on the precipitation of zinc as zinc ammonium phosphate and its subsequent ignition to zinc pyrophosphate. It is carried out as follows: Take an aliquot portion of the 500 cc. solution from which the portion for copper was taken equivalent to 0.1 to 0.2 gram of zinc, generally 250 cc. To remove the copper add 25 cc. of sulfurous acid, heat to boiling and add 5-6 grams of ammonium sulfocyanate. If the precipitate of copper sufocyanate is not white or cream color, add more sulfurous acid. Allow the precipitate to settle, then filter off and wash with hot water. Use a fine filter or some paper pulp, as the precipitate sometimes has a tendency to run through. To the filtrate from the copper sulfocyanate add 25 cc. of ammonia water (sp. gr. .90) or enough to make it strongly alkaline, and 50 cc. of a 10 per cent solution of ammonium phosphate. The presence of an excess of ammonium phosphate decreases the solubility of the zinc ammonium phosphate. Make up to approximately 500 cc., heat to boiling and cautiously neutralize with nitric acid (sp. gr. 1.20) added from a dropper, until a slight permanent turbidity is produced. Then discontinue the addition of nitric acid and add dilute acetic acid (1:25), 1 cc. at a time from a dropper. Continue the addition until only a faint odor of ammonia is perceptible. Heat the solution up again to boiling and stir until the precipitate is granular. If the precipitate does not become granular after considerable stirring, it sometimes will do so by dissolving it in ammonia and reprecipitating in the manner described. Filter off the precipitate of zinc ammonium phosphate, wash with cold water, ignite carefully in platinum, and weigh as zinc pyrophosphate (Zn_2PO_7). From this weight calculate the percentage of zinc present.

The copper may also be removed, before precipitating the zinc, by hydrogen sulfide, but the separation by ammonium sulfocyanate and sulfurous acid is much the neater of the two.

Remarks.

While the methods are all standard, the details have been given in full so that the man with an occasional analysis of brass to do will not have to work them out for himself.

These methods are published in the hope that the results coming from their use may show how important it is to regulate the composition of the metal and how many economies may be practiced, if an accurate knowledge of its composition is at hand for reference from day to day. It is the firm belief of those who have made the matter a close study that chemical analysis can do as much for the brass foundry as for the iron foundry and the sooner we realize the fact, the sooner will the brass foundry occupy the place which its history and usefulness demand.

A FOUNDRY EXPERIENCE.

BY C. VICKERS.

The story of the Dismal Swamp Foundry was enjoyable reading, although the experience itself might not have been.

It reminded me of a shop that also had a few peculiarities. This foundry was located in a southern state, and the class of work was stoves, sash weights, columns, sidewalk lights, castings for windmills, and in fact any old thing, even engine brasses when they could get them.

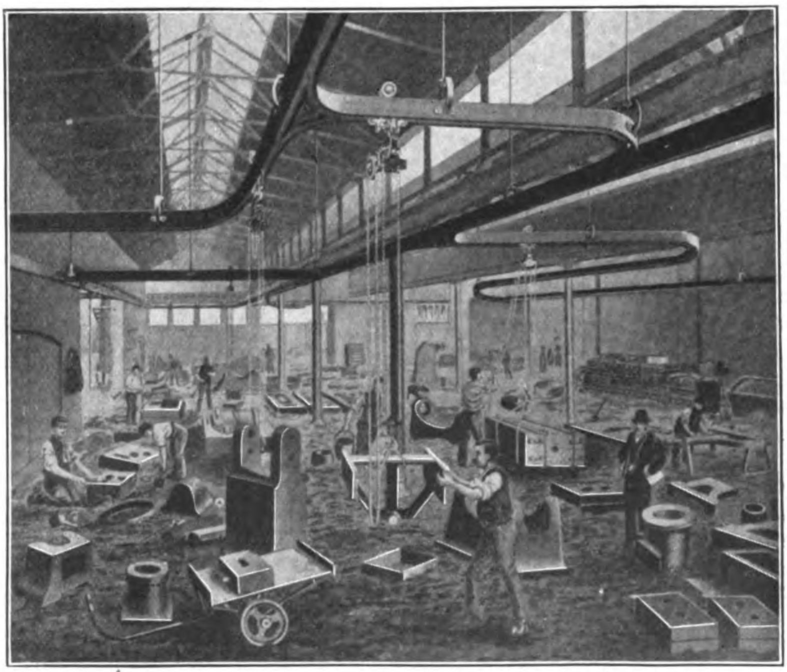
Amongst their peculiarities was a human traveling crane. This "crane" was composed of colored persons, and poor white trash, and was used to carry the metal for comparatively heavy castings to distant parts of the rambling old building.

Probably these comparatively heavy castings never weighed a ton, but the "crane" had a staggering and most profane time, carrying half that quantity of metal, from the cupola to the mold, arrived at which the ladle was placed on horses and filled up with bull ladles. When we started out, the ladle did not look so big, but the way it grew, on its progress to the mold, and the number of ladles of iron it swallowed, when there, was astonishing.

The heaviest work was made within reach of the jib crane, which of course included the cupola within its sweep. It was a wooden affair equipped with a rope, said rope being more or less frayed. I was more afraid of the jib crane than of the traveling crane, and I think of the two it was the noisier and most decrepit.

There was a small machine shop connected with the plant, six p. m. was the machinists' quitting time, and was supposed to be ours, only our foreman mistook the whistle as the signal for putting on the blast so we were too busy to think of going home, until from 7 to 8 o'clock, long before which time it was dark, and as it had never occurred to the proprietors to provide any kind of illumination in the foundry, it was up to the foreman to do something in that line, and he arose to the occasion by installing a private gas plant. He procured a dome of heavy sheet iron about three feet in diameter, in the center of the dome was a hole, in the hole was screwed about four feet of 1-inch gas pipe, which terminated in a common burner minus the tip.

The gas plant was operated by placing this dome over a hole dug in the floor, the hole contained a wheelbarrow of soft coal. The first ladle of iron was dumped into this hole, through an opening left for the purpose, which opening and all other openings around the dome were then stopped up with sand in the same manner and with the same ceremonies that are observed in "stopping up" a leak in a mold. A light was then applied to the burner and a flame flared up that made an effective torch, while it lasted.



OVERHEAD TRACTION FOR FOUNDRIES.

This illuminated the scene around the cupola, the more remote corners of the shop being "lighted" by bits of waste burning in shallow tins of oil.

The roof of this shop was propped up by pieces of old rails from a convenient railroad and in the smoke, steam and gloom of casting time, these rails were invisible and collisions not unfrequently occurred.

It was one of these collisions in which I figured, together with a bull ladle of iron, which convinced me my health was too delicate for the job. So when through that night, I tumbled out of a window, for I could not find any door and gathering together my pieces from amongst the flasks, boards and things that had gently broken my fall, I wiped the tears from my smoke-blinded eyes and shook the sand of that "foundry" from my shoes forever.

OVERHEAD TRACTION FOR FOUNDRIES.

The firm of Rowland Priest, of Cradley Heath, Eng., has developed a method of overhead traction for shops and foundries. The system has been especially designed to meet the requirements of those desiring as simple and inexpensive a construction as possible. The company has made a flat bar runway which is devoid of levers, springs, switches or cords at the cross-over points. The arrangement consists of a pair of flat iron bars running parallel and on edge with sufficient space between for the carriage, the latter being suspended by two rollers running side by side on the top edges of the rails. The rolls are fitted with ball bearings and easily twisted around in a horizontal plane by a corresponding turning of the load beneath. This slight twist—and in practice it is said to be almost imperceptible—of the load operates on two guide rollers acting between the rails. These guide rollers are fixed fore and aft of the two main rollers and thus direct the carriage to any desired angle for running smoothly over the junctions of the rails without jerking or cramping of the carriage. The makers claim for the device: Easy handling of the load along the rails which being flat ensure a smooth motion; moving over rail junctions merely by slight twisting of the load in the direction it should travel; freedom from sticking at junctions or impediment to motion by rollers dropping into openings as the supporting rollers are of sufficient width to avoid any danger of this kind and the carriage will run readily around a 2-ft. curve.

A PATENT FLASK PIN.

James Cunningham, of Florence, Mass., has a patented pin connection for aligning the cope and drag of a flask and clamping them together. The pin can be inserted from above or below the bracket lugs and may be withdrawn and used for other flasks, etc.

The three first views show the pin applied to the two sections of a flask. A bracket comprising a plate and ear A is fastened by screws to the cope and a similar bracket is attached to the drag, both brackets being in the same vertical plane. The ears project forward from the plates and have slots B. On the side of the ears near the supporting plates are cam surfaces C, one of them starting from the side of the forward slot B and ending at the corresponding side of the rear slot B, increasing in thickness from front to back. A similar cam surface is around the other side of the opening through the ear. Flanges are formed on

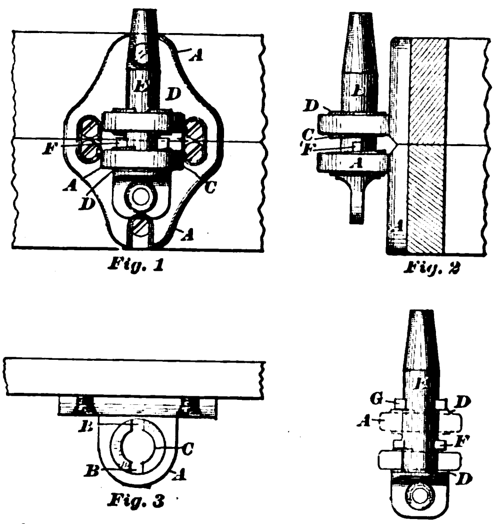


Fig. 1 Fig. 2 Fig. 3 Fig. 4

A PATENT FLASK PIN.

the ears as at D as bearing surfaces for the head of a pin E. These flanges bound opposite sides of the holes and slots in a similar manner to the cam surfaces C.

The pin E has the head at one end and oppositely disposed lugs F intermediate of the head and the other end of the pin. The pin E fits the hole in the lug and the projections F slide through the slots and when the pin is turned ride on the cam surfaces C. The rotation of the pin locks the ear between the lugs and the head.

In addition to providing means for aligning the halves of a flask it may be necessary to fasten the sections together so that the cope cannot be lifted from the drag. In Fig. 4 two additional lugs G extend from the pin E between the lugs F. These lugs are arranged to engage the flanges D on the ear through which the pin last passes when the latter is turned to bring the projections F into engagement with the cam surfaces.

THE FOUNDRY.

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TRADE OUTLOOK.

The pig iron market has not changed greatly during February. There have been a number of quite large sales of iron, including one of 40,000 tons of Southern No. 2 foundry, at $13.50 Birmingham, and another sale of 15,000 tons of Northern No. 2 foundry at $16.00 at the furnace, and several other large sales, at about the same price. The United States Steel Corporation has purchased quite heavily, including the purchase of 30,000 tons of basic for the Pencoyd works. A number of founders who purchased iron quite heavily a few months ago have been reselling the surplus, and these re-sales have tended to keep the price from going high, and in fact, in some cases sellers have shaded slightly under the market price. The pig iron situation, however, seems to indicate a firm market. The production at present is at the rate of over 21,000,000 tons per year, and this will probably be increased to 21,500,000 tons within a very short time. In this case it is interesting to note that the largest production ever made during any calendar year in the United States was 18,000,000 tons.

The railroads are placing orders for cars more freely and this results in the placing of orders for a considerable amount of work with the malleable foundries. Other lines of malleable iron have also been more active than for some time. The gray iron foundries all over the country report an increase in business, and unless business conditions are disturbed in some way the year 1905 bids fair to be a record breaker.

Selling prices for castings, however, are still pretty close to production costs and it will take careful management on the part of the foundrymen to make profits even with the increased volume of business.

EDUCATION OF FOUNDRYMEN.

No matter what angle we approach the problem from, all interested in foundry matters are agreed upon one thing, and that is, that the continuation of American foundry practice on its present high plane necessitates the education of a large number of men as skilled molders; and second, that from these skilled molders or from some other source, must be recruited a body of men to act as foundry superintendents, foremen, and assistant foremen. The foundry problem has been seriously complicated of late years by the introduction of many methods, devices and processes hitherto unknown. These have come from within the foundry. From without have come the demands on the part of manufacturers for castings made according to rigid specifications on the one hand, and the ever increasing variations in the composition of pig iron on the other hand. To meet these conditions, it has become necessary for some one connected with each foundry to understand the mixing of iron by analysis, either chemical or mechanical, in order to control the foundry mixture and enable the foundrymen to fill specifications.

Another point upon which there can be no disagreement is that no education is complete without a knowledge of the actual work itself, that is, without the doing of the work. If a man is to be a foreman, in the fullest sense of the word, he should primarily be a molder, or at least, have had sufficient experience in molding to be able to judge good work, both as to quality and output.

To furnish the technical knowledge necessary in connection with our modern foundry practice, those interested in foundry subjects have put forth their efforts along several different lines. First, there are the trade papers, which have published practical articles upon the subjects. Second, there are the foundrymen's associations for technical purposes, such as the American Foundrymen's Association, together with the Foundry Foremen. Third, there are the correspondence schools, with their courses in shop and foundry practice.

Thus far, no residence schools have attempted to impart foundry practice with the idea of fitting men to follow the foundry business. Practically all technical schools of the higher grade have pattern shops, machine shops and foundries in connection with their equipment, but the object of these is to familiarize the student with the processes carried on in these departments of the manufacturing concerns so that they may become more intelligent designers and draftsmen. Such shops are usually more in the nature of laboratories than in the nature of manufacturing establishments.

Realizing that the present channels were apparently not providing the future supply of foremen and skilled workmen as rapidly as the demand was increasing, many prominent manufacturers and others have been interesting themselves in the subject of technical education as applied to practical subjects. Prof. Sweet read a paper on this subject before the Engineers' Club of Syracuse recently, in which he advocated a scheme by means of which the school would own a factory and manufacture some line of goods. At the start a large number of journeymen would be employed in each department to act both as journeymen and instructors. After the school had been running three or four years, the young men in their third or fourth years would be sufficiently advanced to fill all the positions as journeymen, as far as the work was concerned, but it would be necessary to maintain a small force of journeymen to act as instructors. Prof. Sweet's idea was to have a four years' course which would include certain hours of study and certain hours of work. The exact line which a man would follow would be left for him to decide at the end of the first year, or at some time during the early portion of the course. All men would be given some experience in each department of the shop. That is, in the foundry, the pattern shop and the machine shop. They would then be given an opportunity to choose the department which they would prefer to follow and the balance of their experience would be in connection with it.

Prof. Sweet's idea was that this school would turn out especially high grade journeymen, with a sufficient amount of technical education to enable them to become foremen or superintendents after a few years of practice in actual manufacturing establishments.

The Carnegie Institute of Pittsburg also proposes to devote a considerable portion of its equipment for use along foundry lines and is planning to give instruction, especially along such lines as the foremen would require. They seem to be aiming more to fill defects in education by drawing their recruits from men who have had some experience in the shop and then giving them a sufficient amount of information to enable them to handle the problems of modern foundry foremen.

The Winona Institute, of Indianapolis, Ind., is a school which has recently moved to Indianapolis and taken the old buildings which formerly constituted one of the United States arsenals. It is the plan of those in charge of the school to introduce courses in various trades and crafts. The lithographers have already opened a school for instruction in lithography which bids fair to do very creditable work.

A call has been sent out to foundrymen throughout the country to come to the assistance of this institution by furnishing the means necessary to equip and maintain the foundry, the object being to educate men as molders and also as foremen.

One great fault that seems to have been present in practically all attempts which have thus far been made along this line, seems to be that the educational institution was conducted along theoretically educational lines more than along practical educational lines, that the shops were run too much like laboratories and that the boys never learned to do work for work's sake, but got an idea in their heads that they wanted to get out of doing the actual work and rise to positions where they would be in charge of the work. In other words, they wanted to wear a boiled shirt and not a pair of overalls. It is certainly a laudable ambition for any one to have a desire to rise as high as possible, but many a good workman has been spoiled in the attempt to make a poor foreman, draftsman, or designer out of him.

We cannot help but feel that Prof. Sweet's plan bids fair to produce the best workmen. Prof. M. J. Higgins, now of the Norton Emery Wheel Cc., of Worcester, Mass., who formerly had charge of the department of mechanical engineering in the Worcester Polytechnic Institute, of Worcester, Mass., has long advocated the idea of a half time school, in which the boys would work one-half the day in the shop and spend the other half in the school room. This idea is not very different from that advocated by Prof. Sweet.

What seems to be necessary for the carrying out of Prof. Sweet's or Mr. Higgins' idea, is not only the endowment of a school and its equipment with the necessary machinery, but the securing of a man to administer the affairs of the school who will be able to outline its policy and conduct its work in such a way that it will be primarily, if not a manufacturing establishment, at least a manufacturing school in which the young men will be imbued with the spirit which should exist in manufacturing plants.

MOLDING SAND.

The United States Geological Survey are preparing a report on the molding sand deposits of the United States, and wish to obtain the addresses of all parties owning or operating molding sand deposits, or those dealing in molding sand, so as to enable them to locate all the deposits, including molding sand for all classes of gray iron, malleable iron, steel, brass and bronze castings.

It would be a great favor, both to the Geological Survey and *The Foundry*, if all the foundrymen throughout the country would notify either this office or the department at Washington as to their source of supply for molding sand, and we hope that our friends in the foundry business will understand that this notice is intended for them and respond with a hearty good will which will make the collection of this data easy and insure reliable statistics.

CAR WHEEL CASTING DIFFICULTIES.

The writer is connected with a jobbing foundry, our specialty being railway, car and engine castings. We often have logging truck wheels and mine car wheels to make, with which we have been having varying success, the trouble being mostly the cracking of the spokes. One wheel which we make is a 16-inch flange lumber truck wheel, weighing 66 pounds, having six spokes and a light hub to bore 1½ inches. The metal in the rim and arms is about 7-16 of an inch thick and three inches deep. The pattern for this wheel was made from dimensions taken from a sample wheel furnished by a customer, who obtained it from a foundry making a specialty of this work, and hence we suppose that the design is correct. When we use No. 3 Southern pig in casting this wheel, there is little trouble. If we use car wheel scrap and pig the spokes crack. A customer recently ordered a lot ot these wheels and insisted that they have chilled faces. We objected, as we had never chilled these faces before and feared cracked spokes. He insisted and agreed to pay the expense of the pattern for the chill, etc. We tried the experiment, using No. 3 pig and with the result as expected, that is, cracked spokes. The spokes and the hub were uncovered as soon as possible to equalize cooling, but the thin rim chilled too quickly. I should like to know if this could reasonably be expected to chill successfully when so thin a rim is used.

Another wheel is a 22-inch plate wheel, straight ribbed, and having a heavy hub, being used for a logging car. The axle is 3½ inches in diameter, to be pushed on with not less than 15 tons nor more than 30 tons pressure. The dimensions for this were also taken from a standard wheel. At first we made this from No. 3 pig, but the chill was not deep enough. We then added car scrap and hubs of car wheels and built a pit in which we built a fire to dry and warm it before depositing the wheel in it. As we only cast one or two at a time, they retained their heat but a short time. In order to protect them still further a plate was placed over them while they were still hot, and they were covered with warm sand and other castings. These wheels were a little better in chill, but very hard to bore and still cracked. Sometimes the cracking occurred in pressing on the axle and sometimes shortly after when they were hit a slight blow. We also have the same trouble with our 14 and 16-inch solid plate wheels.

Now for the mine car wheels. The kind we make are 14, 16 and 18-inch spoke wheels. These are known as self-oiling mine car wheels and are made by almost all foundries in the mining districts. The accompanying sketch, Fig. 1, shows a cross section of the hub and one side of the rim. Our first experience in making these wheels was a total failure. The dimensions and drawings were furnished by a

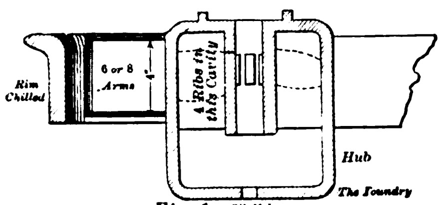


Fig. 1

mine company, and the rim and arms were about 7/8 inch thick. The metal in the hub was about 1/2 inch, the arms straight and the weight of the wheel about 150 pounds. Nearly every wheel had cracked spokes. We tried No. 3 pig alone, also pig and scrap, also pig, scrap and car wheels. We then changed the wheel pattern so as to use curved spokes, and made the metal 1/2 inch in the hub and 3/4 inch in the rim and arms. By using No. 3 pig alone these were cast very successfully and bored well. They were also strong, but the chill was not satisfactory, as it was only 1/8 of an inch or less in thickness. A short time ago we ran entirely out of pig iron, and had an order for quite a lot of these wheels on which the mines were pushing shipments. The management insisted that we make them out of scrap, regardless of my protest. The wheels were cast and could hardly be bored. When they were tested by a light blow from the hammer, all cracked.

Another wheel which is giving us trouble, and which is the one that has made me decide to throw up my hands and ask for advice, was sent to us from a mining company, with the information that if we could make them satisfactorily, we could have their trade, there being no patent on the wheel. We attempted to compete for the trade. The wheel was similar in design to that shown in Fig. 1. The metal in the rim was 11-16 inch thick, the arms 11-16 inch and the metal in the hub 1/2 inch. The wheel had eight straight arms. We first tried making it with No. 3 pig iron, and the result was that all the spokes cracked. We next tried No. 3 pig iron and scrap, and still all the spokes cracked.

Next we tried 75 percent No. 3 pig and 25 percent car wheel scrap, and still the spokes cracked and the chill was only 1/8 of an inch or less. I then reduced the metal in the hub to 3/8 of an inch with no better results. We also tried uncovering the arms and hub, but to no purpose.

Now I believe the trouble is with our mixture, for the sample wheel furnished had a chill of about 1/4 inch and we could pound it with a sledge without breaking the spokes, in fact, we broke the rim first. It is evident that the trouble is not in the design, but either in the mixture or in the method of handling in the foundry. These wheels all require a chill of about 1/8 inch for work on railroad rails. They must also be tough, so as to withstand shocks, and the hubs soft enough to bore easily. These mine car wheels are made in many foundries, and are never annealed, so far as I know. I should mention that our chills are about 2 1/2 to 3 inches thick. We have also tried using chills from 1 1/2 to 2 inches thick, but these thin ones crack too often. I wish that some one could tell us what core materials and treatment should be used to produce a perfectly clean hub, inside, as the least sand left in is loosened by the oil and grinds the axle.

"A SUBSCRIBER."

The Union Iron Works, of Portland, Me., have elected the following officers for the ensuing year: Chas. V. Lord, president; Linwood C. Tyler, clerk; Chas. A. Walters, general manager.

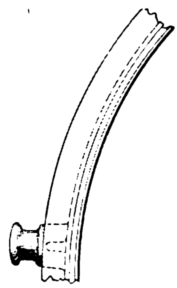
The National Scale Co., of Boston, Mass., is to build an iron foundry at the junction of East First and Second streets, So. Boston, Mass.

The National Steel Foundry Co., of New Haven, Conn., is to increase its working force, on account of a contract for castings for an underground railroad in London, England.

CASTING ROUND FLASKS IN CORES.

BY H. J. M'CASLIN.

The accompanying illustrations show one method of casting round flasks of large diameter in cores which has given very satisfactory results, and a saving in pattern expense, as well as in the floor space required for pattern storage. A plan and cross section of a portion of the required flask is shown in Fig. 1. It will be noted that there are two lines of cored bolt holes about the flask and a sand strip on the inside of the top and bottom. In most cases, four trunnions are cast on each flask, one of these being shown in Fig. 1. A cross section through one side of the assembled cores is shown in Fig. 2, illustrating the manner in which the cores are placed together. In making up the mold a hole is dug in the floor to a depth equal to the height of the cores and with the aid of straight edges a level bed is struck off. With the segment attached to and revolving about the stake as shown in Fig. 3 an offset shown at A, Fig. 2, is rammed up to assist in setting the cores. The number of separate pieces or cores is governed by the diameter of the flask. The circle formed by the offset is divided by four equidistant lines, and the centers of the four cores containing the trunnions are set to these lines. At the completion of the setting of the remaining cores, sand is banked and firmly rammed around the inside cores, as well as in the space between the outside of the cores and the wall of the hole or pit. To avoid the banking of sand around the inside of the cores, a flask of convenient diameter and height can be placed within the enclosure formed by the cores and the space between the flask and the cores rammed firmly with sand. The core box used in forming the outer cores is shown in Fig. 4. The trunnion and rib portions are loose from the box, allowing these parts to be removed when the plain cores are being made. The bolt holes are spaced off accurately, and taper prints are set to receive the separate cores for these holes. By giving the core prints ample taper, they can be rigidly attached to the box. A covering core is used in connection with this box to form part of the trunnion, this portion



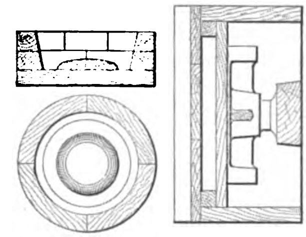


Fig. 5

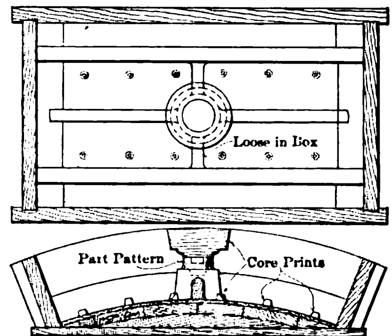


Fig. 4

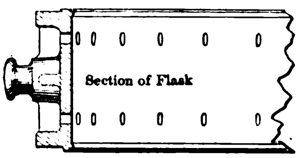


Fig. 1

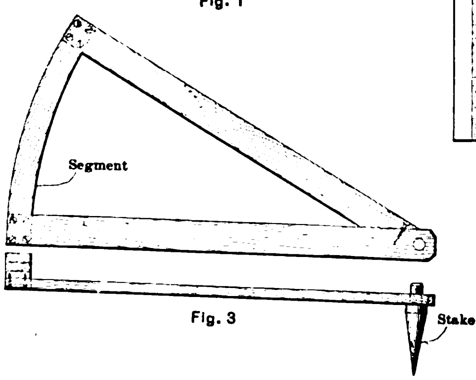


Fig. 3

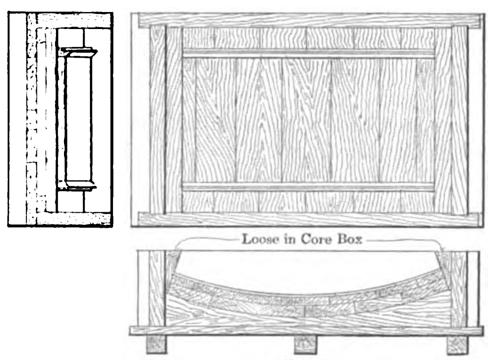
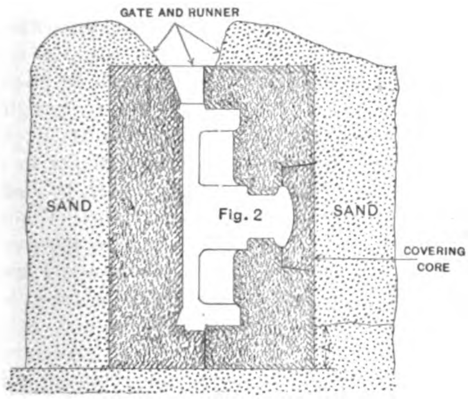


Fig. 6

of the box being parted as shown with the core print above and extending to the bottom of the box.

When the print has been withdrawn the core made in the core box shown in Fig. 5 is placed in this impression so as to close the opening and form the flange or outer end of the trunnion. The core box used in forming cores is shown in Fig. 6, and it will be noticed that loose wedge pieces are used to form the radial ends of the cores. To simplify the construction of the box and facilitate the drying of the core, the open side of the box is made flat in place of conforming to the



diameter of the mold. Gates are filed in the tops of these cores at different points, and runners built up as shown in Fig. 2.

BELLS.

One of our friends on the staff of *The Ironmonger,* of London, has sent us a clipping from a London paper, telling of the casting of the new bells for the Rochester Cathedral. These bells were to be rung on the last Monday of November, which was St. Andrew's day. Of the eight great bells of the cathedral, which weigh altogether nearly four tons and a quarter, six have just been cast, partly with old metal from the former bells, and partly with new by Messrs. Mears & Stainbank, of the famous Whitechapel Bell Foundry. This foundry was established in 1570, in the reign of Queen Elizabeth. The other two bells, the great tenor and the mediant, were re-cast in the same foundry in 1834, and these two are almost as good as ever.

Of the six which were worn out and have just been replaced, the oldest was dated 1635, unless it be that one of the bells which bore no date was older. One of the other bells which was cast in 1635 was re-cast in 1770, at the Whitechapel foundry. Another bell bore the date of 1712, and the last one of 1683.

The foundry which has done this work has passed through the hands of a half dozen proprietors since its foundation 334 years ago. Generally the changes have come about from the succession of a foreman or manager to his master's position. In 1762, Chapman, who was foreman for Lester and Pack, went to Canterbury to cast a bell for the cathedral. Seeing a young man who took a very deep interest in the work, he said: "Come to London with me and I will teach you the business." So the youth, whose name was Mears, went and became an apprentice under Chapman. In due time Chapman became a partner and later Mears joined him. Eight generations of the family of Mears have since owned the old foundry, the name still appearing in the title of the firm.

The reporter stated that when he visited the foundry he saw the six new bells just out of the molds and being cleaned with scratch brushes. The other two bells were there also, —the tenor, to which all others must conform, and the sixth of the series, which was being tuned down by having some of the metal cut from its inner surface. The six bells which were re-cast were all poured from metal of a single melting, so as to have them uniform in composition, which would result in more uniform tone.

The article goes on to state that the metal used for a bell is three parts copper and one part tin and that this composition is almost as old as the known history of mankind, for it has been discovered that the bells of old Nineveh were made of this mixture.

Concerning the breaking or cracking of bells, he states that sometimes an enthusiastic ringer bumps the bell against the wooden stay above and thus cracks it, and sometimes the long continued falling of the clapper on one particular spot will make a crack. A bell for continuous use should be turned every generation or so in order to make the clapper fall in a new place. Clock hammers are the bells' greatest enemy, for they strike it sidewise and not in the direction of its swing, and besides they sometimes catch it as it swings past. The ringer who, to save his muscles, rings by a rope attached to the clapper, will destroy the bell in next to no time.

Silver has now and then been tried for bells, but strange to say, is almost as unmusical as lead. In the Middle Ages, when a great bell was to be cast, crowds of the faithful would sometimes make sacrifices of their gold and silver ornaments and plate by casting them into the melting pot, but the only effect was to depreciate the tone of the bell.

In China and other Eastern lands, bells are rung to frighten away devils, and some of the biggest bells in the world are in Buddhist temples. Even in Christian England it was long believed that bells would dissipate storms and when they were cast there was a solemn ceremony at which they received names. This was called by the common people the baptism of the bell. Many old bells had quaint and curious inscriptions. A bell in Sherborne in Dorsetshire, dated 1652, was evidently intended chiefly as a warning in case of fire, for it was inscribed:

"Lord, quench this furious flame;
Arise, run, help put out the same."

The greatest bell in the world is that of Moscow, weighing about 190 tons, but apparently there was some accident at its birth, for there is no record of its ever having been rung. In England the greatest bells are the Great Paul, of London, made in 1881, and weighing nearly 17 tons; Big Ben, of Westminster, made in 1858, and weighing 13½ tons, and Peter of York, made in 1845, and weighing 10¾ tons. Big Ben and Great Peter were both cast by the Whitechapel foundry. Great Peter cost about $10,000 and is over 12 ft. across. When it was cast at the Whitechapel foundry it was allowed 12 days to cool before it was taken from the mold.

The above is of especial interest to Americans, on account of the great age of the foundry. In this country we rebuild and change with such rapidity that it is impossible for any foundries to grow old and hoary, and if a foundry has run through two or three generations it is a decided exception. Of course there are a few exceptions of foundries which were started in the early part of the last century, but they are few. It would be interesting to look up the history of some of these older American foundries.

The Columbus Brass Co., Columbus, O., has increased its capital stock from $75,000 to $200,000. The officers of the company are Chas. H. Lindenberg, president; Frank H. Lindenberg, vice president and general manager; Geo. W. Lindenberg, secretary, and Paul Lindenberg, treasurer.

AUTOMATIC CORE OVENS USING OIL AS FUEL.*

BY S. E. BARNES.

Natural gas is the only proper fuel for the core oven, when it can be had. But when gas can not be had, it becomes necessary to choose between coal, coke and oil. Of these three articles of fuel, coal is the least desirable for the average core oven, on account of the uncertain quality of fire to be obtained by the draft of a core oven, the time required to get a fire when wanted in a hurry, as is often the case, and the ashes which have to be cleaned out and hauled away each day. The price of coal is fully as high as any other fuel. Coke is some better than coal, as the fire to be obtained from it is sure to be good, when you get it. Coke requires less draught than coal, the result of which is a hotter oven.

But there still remains the want of fire in a hurry many times, when it is not to be had, and the handling of ashes and coke. While these two fuels have served well in the past and will continue to do so in the future, I feel certain that they must give way in time, to some extent, to a more modern and convenient fuel. By invitation of your secretary, I am here to describe to you a system for burning oil, which I consider absolutely safe, economical and convenient. In order that the points claimed for this system may be fully understood it will be necessary for me to give a brief history of my experience in burning oil.

About three years ago, the management of the shop at which I am employed, decided to do something to help the coremakers along, as they were very busy and crowded into small space, as coremakers usually are. The result was the use of oil instead of coke in two large ovens and the purchase of oil burning torches. At the time that these changes were made, the writer did not consider them of any great importance. But as we became better acquainted with the use of oil, results began to appear in the way of convenience. In many cases where it had previously been necessary to put large cores in the oven the second and third times to dry blackening and joints, the torch does this work in double-quick time, and does it well.

Large patches can be made by the use of the torch, by putting on thin layers at a time and drying each one in turn, which would re-

*Paper read before the Philadelphia Foundrymen's Association, Jan. 4, 1905.

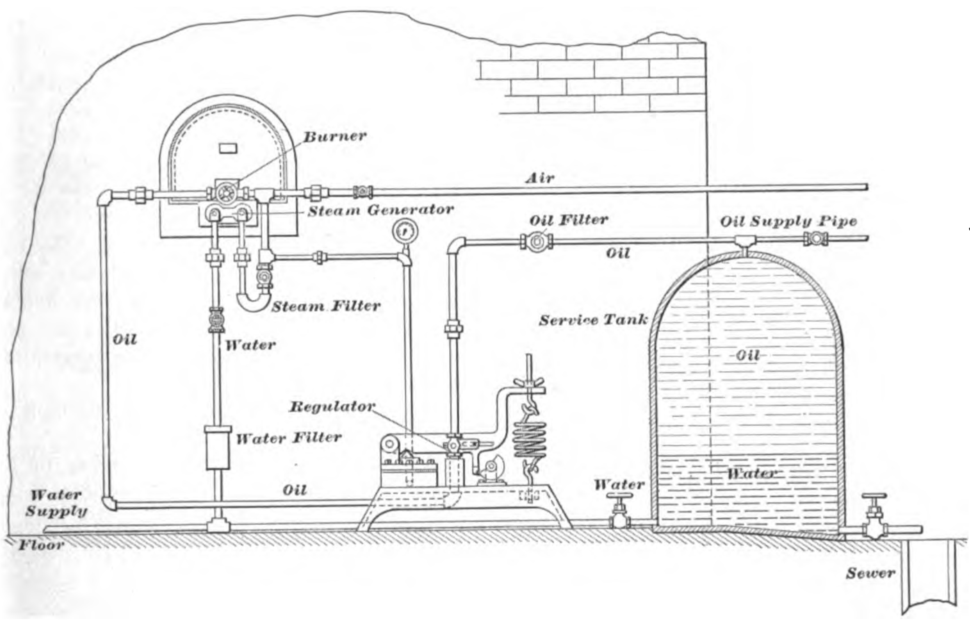
quire much more time and cost by drying in the oven. The torch is also useful to skin-dry molds, thaw the ice and snow from flasks and boards in quick time, and for light and heat in cases of emergency.

At the time we started to use the oil in the ovens the machine shop was very busy, requiring the engine and air compressor to run all day and night, thus furnishing air for the burners at any time except Sunday. When the machine shop became slack, and they ran the engine only in the day time, the small air compressor that was run by steam in the night for the ovens did not furnish enough air; and besides it was always getting out of repair, as well as consuming about as much coal in the night as would be required to run the ovens with coke, not to mention the cost of oil.

It soon dawned upon me that these conditions could not continue long, and being anxious to continue using the oil, I decided to try another way to burn it. Having read of oil being burned to advantage with steam as the blowing force, I tried it in this way. I had often observed the rapidity with which steam is generated by throwing a small amount of water on a piece of hot iron, or into a hot pipe. I acted on this principle and made a cast iron return pipe about three feet long, with a ⅞ in. hole from one end to the other and back and placed it in the fireplace, leaving the open end flush with the outside wall of the furnace. I then connected the city water to one end of the ⅞ in. opening and the other end to the air or steam end of the burner, and turned on the air for a few minutes to heat the generator, when the air was turned off again.

Now to get the steam by the new system, turn on the water by means of a needle point valve, which allows a very small stream of water to enter the generator; thus instantly generating very dry, hot steam at any pressure that may be required by a slight turn of the valve either way.

Thus we have the steam to run the fire continuously; but when there is no air there is nothing to feed the oil to the burner, as the steam is only used to spray the oil into the furnace after both have been brought together by different pressures. The pressure for the oil is obtained by simply connecting the city water to the bottom of the oil tank, thus forcing the oil, which is lighter than water, out through the top of the tank to the burner.



This system was used for a time, bringing the cost of fuel down to the actual cost of the oil. But I soon discovered that to complete this system, it would be necessary to regulate the oil, so that it would flow in proportion to the steam pressure, which may range from 1 lb. to 40 lb., as needed for the amount of heat required. An old damper regulator was taken from the boiler room and remodeled so that it opened and closed the oil valve automatically, with the rise and fall of the steam pressure. This completed the most perfect and economical arrangement for burning fuel oil.

This way of burning oil is the safest, because oil is dangerous only when it is thrown into a hot furnace without sufficient steam or air to spray it properly; then it will instantly explode with some force.

The oil regulating valve prevents the above conditions, because it is impossible to get any oil through the burner until after the steam has been turned on, and then only in exact proportion to the steam pressure. Should the steam pressure, by any accident or otherwise, cease, the oil valve will be closed at the same time, and locked so that it can not be opened again, should the steam pressure return without the aid of the operator.

This system is the simplest, requiring only one valve to operate, start, raise or lower it. This is the water valve, by opening which steam is generated instantly, the steam blowing through the burners and the pressure opening the oil valve, all other valves being secondary and precautionary. The system is the cheapest, because it is maintained only by a very small amount of city water or any other water pressure. The whole cost for this oil for core ovens, two torches and large Babbitt's kettle, which is used almost continuously during the day, is just equal to the cost of coke for the core ovens. It is the most convenient system, because a fire can be had at any time, Sunday, Monday, night or day. There is one thing that is not quite as perfect as I think it might be, and that is the generator. It will only last about two months, when it has to be replaced. But the job is small.

I have done it many times with the aid of one helper in half an hour. But I think by the use of different metal, and some protection from the blaze of the fire, the generator can be made to last much longer.

The last thing I have to mention, but not the least, is the filter. The water passes through a fine gravel filter, to prevent the rust and dirt of any kind from stopping the flow through the small needle valve. This filter is so connected with valves at top and bottom that the water can be run through it backward, cleaning it out as often as may be required. The oil filter is an ordinary check valve with screw cap, the valve of which is replaced by a perforated plug screwed into the valve seat. This can be cleaned out at any time by removing the cap, about one minute's work. This filter will catch all pipe scales or other dirt that would be large enough to interfere with the oil valve or burner. The air filter is the same as the oil filter, and its purpose is the same.

Discussion.

The method explained in the paper which has developed into a very successful core oven, was devised entirely by Mr. Barnes and is in practical use. In the discussion of the paper the following points among others were brought out:

Q. What size are the pipes?

A. Half inch; you can have them larger if you want. Various sizes have been used, simply as a matter of convenience in erecting at the time.

Q. How much oil will the tank hold?

A. About ninety gallons. We burn just about eighty or eighty-five every day.

Q. What is the size of the oven?

A. We have two, about 9 x 16 x 12 ft. high. Both are the same size.

Q. Is it crude oil you use?

A. Crude oil at 4 cents a gallon. We burn less than 100 gallons a day, including everything. It amounts to about $4. We average about three or four tons of sand in one oven over night. The oil used covers everything—kettle and torches.

Q. What method do you use to light the oil?

A. A piece of paper or anything of that kind. There is only a small flue, 8 x 8, and sometimes a little smoke is created but not any more than by using wood in starting coke fires.

Q. How long has it been in use?

A. I have been burning oil about three years, and with the steam system for about 18 months. I have only had the regulating valve about five or six months. The regulator is the proper thing to have on any oil burner. No matter how much the pressure ranges you can get enough oil, according to the amount of steam or air pressure. We use a three deck car and put large cores on the top, medium size in the middle and small at the bottom.

Q. Do you have oil in the small ovens?

A. No, because there is a certain amount of small coke waste that they wish to burn.

Q. What sort of burner do you use?

A. An ordinary burner, furnished by Gilbert Parker of Springfield.

Q. Does the steam pressure vary?

A. It keeps very steady.

Q. You depend on the water valve to regulate the fire?

A. Yes; and to put the fire out you close the water valve. After running two or three hours it is hotter than when it was first started.

Q. Have you ever had any explosions?

A. I had my hair singed a couple of times before I got thoroughly acquainted with it, but that is now impossible. You cannot get any oil in the furnace.

Q. Do you ever run the generator to destruction?

A. There is nothing to it. You lose the steam pressure and the oil shuts off.

Q. How long does the generator last?

A. Two months. You can put one in in half an hour. It burns four gallons an hour or at the rate of sixteen cents an hour.

Q. Did I understand you to say that coke costs 50 per cent more than oil, in addition to the labor and more trouble?

A. Probably not quite so bad as that, but coke costs $6.25 a ton. We get more fire out of the oil than we do out of the coke and there is less labor required.

MELTING SCRAP ALUMINUM.

BY HARRY MALONE.

I remember once hearing a story about a boy who said he was not going to school one day and some one asked him: "What is the matter? Don't you know your lesson?" He said: "That's just the point. I know my lesson. It's when I don't know my lesson that I want to go for an explanation." I am afraid that the writer is somewhat in the fix of the aforesaid boy on the days that he went to school. In other words, he has gotten far enough into the problem to come to the conclusion that he does not know much about it and hence he wants to tell what he does know in the hope that some one else will give the rest of the solution.

There is a lot of scrap aluminum of various classes on the market. Some of it is in the form of borings and turnings, and some in the form of sheet aluminum scrap from which punchings have been cut. It is all good high-grade metal, but when it comes out of the melting pot something is wrong with it. If an attempt is made to press or roll the casting it will be sure to crack. Now the following are facts which we know. It is not difficult to melt scrap brass and produce a casting which can be bent, pressed or rolled as well as the original metal, but we also know that if the attempt is made to take the best kind of sheet copper rolled from good lake metal and melt the scrap in crucibles, the resulting castings cannot be bent or rolled without more or less of a tendency to crack. In the case of the copper, we know that the difficulty arises from the fact that copper oxidizes very readily and that the red oxide of copper is absorbed by the metal without changing its color or appearance in any way, but that when the metal is worked the oxide makes it brittle, just as the presence of so much sand in its composition would. If the above mentioned scrap copper be melted with a liberal charcoal covering somewhat better results are usually obtained. If, in addition to the charcoal covering, the metal be poled with a green pole, that is, if a green pole or stick be introduced into the molten metal, which is well covered with charcoal, and used for stirring the metal, it will often reduce the oxide and result in pure metal. The addition of a little phosphor copper will produce the same result, on account of the fact that the phosphorus is oxidized and removes the oxide from the metal.

Now with the above facts in mind, if we turn to the aluminum problem we are confronted with the following conditions. The copper oxide was lighter than copper, but was soluble in copper. When this oxide was reduced with phosphorus, it formed a dross which could easily be skimmed off. In the case of aluminum, we are not so fortunate, as the specific gravity of aluminum oxide is nearly 3.9, while that of aluminum is only 2.5. It will be seen, therefore, that the aluminum oxide would settle into the metal as fast as it was formed and we would expect it to go to the bottom so that we could pour off the metal and leave the oxide in place of skimming the oxide and leaving the metal, but this is another case where the metal does not do as it ought to do, for the oxide becomes entrapped in the metal and will go neither to the top nor to the bottom. The color of the oxide, as in the case of the copper oxide, is such that it does not show in the resulting castings, but if we attempt to roll or form the castings, the metal will break.

We know that aluminum oxide is not reduced by charcoal, and hence a covering of charcoal will have no effect whatever on the crucible, except that it may maintain a layer of carbon dioxide gas over the surface of the aluminum and thus exclude the air. In other words, it protects, but does not reduce. The aluminum sheet or scrap is so thin and light that no ordinary amount of flux will protect it from the air. A small amount of scrap can be disposed of by plunging it in a crucible of melted metal just as it comes from the furnace, but beyond this the writer knows nothing as to how to get rid of this scrap, and we would like to know if some one cannot go ahead with this story and bring it to a successful finish.

AN OLD MAN'S KICK.

What is the matter with the foundry business? I see the poets are now butting in. It seems to me these fellows have missed their vocation. The question which exists between the chemist and the foundry foreman, as to which shall be the whole thing in the foundry, it seems is a hard case of the green bug on both sides. I will pass a few remarks in reference to both and a few other things which the writer has observed in his travels, trying to get what the chemist calls salary and F. F. calls wages. Now, I have seen some of the worst iron possible produced by some of the best foundry men in the country, both from furnace and cupola, and I have been in another neck of woods, where two first class chemists had full charge of furnace and pot, with the help of a furnace man at $30 per week and the iron produced was a great deal worse. So you see there is no use for the kettle to call the pot black. A great many foundry foremen are mad because they don't understand C-CC and high and low S and P. In other words they are not chemists, and if they have been in the foundry twenty-five or thirty years they are too blamed old to learn and the chemist is just as mad as the F. Foreman. So I will say to the young man going in the foundry, get a gait on and learn both before the film under your hat gets too thick, and you will get the salary, when both the other fellows are writing poetry, at a penny a verse.

If the foundry foreman will only broaden his gauge and get the idea out of his head that he must go out the back door when the chemist comes in the front, he will rest better at night, and be better able the next a. m. to produce castings at a profit to his employer, and a credit to himself. I will say to you foundry foremen, be loyal to your employer, honest with the men under your charge, and don't forget to be always pleasant and nice to the apprentice boys, for you know what their parents told you when they asked to have them taken in the foundry to learn the trade: That they were the only good boys in the world. Of course they are all good boys for the first sixty hours they reside in the foundry, and after that they change from mother's pet to an inventive genius of deviltry. But we like the boys for all that.

One word with the apprentice boys. Try and keep your mind on your work; do as your foreman advises you to do. If he don't know as much as you do, he is older than you, and you should respect old age, for you know the old man has to get out soon, for the young chemist wants the easy chair; and, boy, don't stop work and wait for the whistle at 11:45 for she won't toot until 12 noon. Do your best while at your trade, for you have a long, hard road to travel if you want to get as good as the best of them who pound sand.

My brothers of the craft, right here is the chestnut burr under the horse's tail which has caused the kick in the factory where they make iron castings and cast iron scrap. The chemist makes his by using one to ten, the other fellow makes his any old way. We have with us now, in the foundry, the young man of affairs, of course not in every foundry, but in some, and he is there all right. He is the young man who fell heir to his father's foundry, stock and fixtures, reputation and million or so, which the old man made when he was running the foundry fifty years ago, and up the last few years. Some of the old man's early day castings are doing business at the old stand yet. Now, Mr. Chemist, don't jump on the grand old man of the foundry. The young man of affairs takes a stroll through his foundry and his chemist is standing to meet him with one foot on a very nice casting made under the supervision of the F. Foreman and the chemist gets a nice bunch of flowers after their chat. The heir to the foundry strolls on a little farther and sees a rough casting and perhaps bad. iron mix by chemist, and casting made under the supervision of same foreman. The chemist has left the earth, he don't live down here only at such times as above. The F. F. gets ripped up the back and a bunch of garlic over the long distance phone from the young man of affairs.

Now the old man that used to run the foundry and does yet, and will for some time to come, comes down and has it out most any place and tells you what is what; he gives you neither flowers nor garlic but talks good common sense. The chemist will tell you that a few points of the different elements in iron will make a vast difference in the quality of your castings. I will give you an experience of mine with a few of them. We melt four or five hundred tons per month and get most of our iron from one concern. Two carloads did not come up to standard, did not find it out by analysis, only by horse sense, so sent in our kick. The furnace people sent analysis of the two cars to prove that it could not be the fault of iron, of course not. Well, the writer took four pigs haphazard and sent drillings from same to different chemists, the result was that none agreed with furnace report and differed as much as 20 to 30 points with each other in the different elements, so that the result desired proved useless, and led the writer to believe that some chemists must lie—and some don't know their business any better than the F. F. does his and some are too lazy to go through pow wow. Cost of analysis, $15.00; information gained from chemists, *none.* Two car loads used by using more or less strong No. 2, a little scrap (remelt) and a few pounds of other iron on each charge. Result, good tough casting machined readily. Transverse test, 1 in. sq. bar 2.760 common rule measure, 1⅛ in. run 2.670. The above has made me consider whether it would be advisable to mix iron by long distance phone. Some of the chemists should tell the old men of the foundry some things they have done for the foundry. The writer knows of a foundry the chemists run to a standstill. There are a couple of old foundrymen getting a move on it now.

If the publishers will permit me at some future time I will state my reasons for thinking why the chemist should be at the furnace and give the foundrymen an honest count and also some things in reference to cupola practice and a few other things seen while passing through the foundry. An old man's kick, but not the last.

Messrs. Albert and Robert Fitzgerald, of Albany, N. Y., are preparing to open a brass foundry at 19-23 Lawrence street, Albany, N. Y.

SOUVENIR NUMBER THE BLACKSMITH AND WHEELWRIGHT.

This special number has been gotten out to commemorate the 25th anniversary of the starting of the *Blacksmith and Wheelwright.* The paper with its regular cover has been enclosed in a special souvenir cover, with a suitable picture on the front. This number is gotten up very neatly indeed, one novel feature being that they have printed the advertisements of the firm which have advertised in the paper for ten years or over on colored paper and called them their roll of honor. The reading pages of the number contain especially interesting matter. One of the features is a page devoted to an illustrated rendering of the poem, "The Village Blacksmith." We certainly wish to congratulate this paper on its success in the past and on its souvenir number, and wish it a long and successful career in the future.

FOAMING SLAG.

A very interesting case of foaming slag has recently been brought up by one of the subscribers of *The Foundry.* After melting about 7½ tons of iron, the slag hole of the cupola was opened, and remained open during the balance of the heat. There was about one-half as much slag as usual flowed out and after that, although the slag hole was open for the balance of the heat, no more slag was run out but the slag remained in the cupola and foamed up through the charge clear to the charging door. All of the iron required for the balance of the heat had been charged and the charging door closed. The next morning, when they came to open the charging door, they found the cracks about the doors and about the door frame full of slag, and that the portion of the door frame which extended beyond the edge of the brick work was all burned off. Also one course of brick at the melting zone was burned of. The lining was a new one, this being the third heat. The iron mixture was the one that had been used for a week without giving any bad results. The writer has had experience with a number of different cupolas, and this is the worst case of foaming slag that he ever saw, and he would like to know if some one can enlighten him on the subject and explain it in any way.

A SUBSCRIBER.

The Bellefontaine Foundry & Machine Co., of Bellefontaine, O., has increased its capital from $50,000 to $75,000.

MAKING A SPIRAL DRUM IN LOAM.

BY JOSEPH HORNER.

I propose in this article to give a detailed description of the molding of a large spiral drum, or screw barrel, for a powerful Titan crane. It is a class of job which is hardly ever done outside the crane shops, and is an excellent example of heavy loam molding.

Figs. 1 and 2 show the casting of the barrel complete, Fig. 1, to the right, being a half external elevation, the view to the left a half

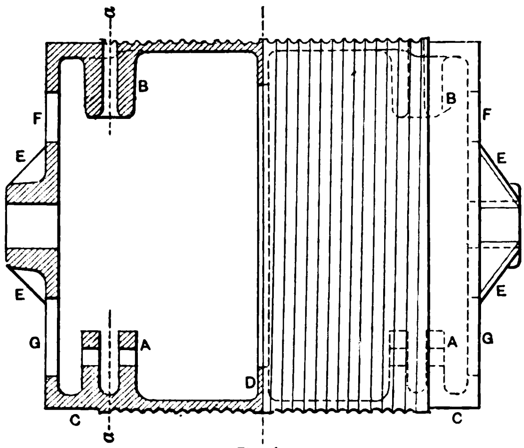


Fig. 1

longitudinal section. Fig. 2 is a transverse section taken through the plane a-a in Fig. 1.

The barrel has two single-threaded screw grooves, right and left handed, respectively. In these lie two divergent wire ropes, for lifting the load in unison, the ropes passing from the barrel to a suitable snatch block. They are attached to lugs A cast within the barrel.

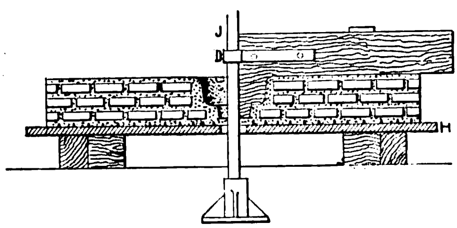


Fig. 3

Figs. 1 and 2. An eye splice is made at each rope's end, which is slipped between the double lugs A A and held with a pin fitting in the holes in the lugs. Each rope passes thence through its hole in the lugs B opposite, and so out into its groove.

The toothed wheels by which the barrel is revolved are keyed upon the plain portions C C. An annular rib or ring D is cast inside the drum midway in the length, to stiffen the central portion of the body. Ribs are cast at E from the shaft bosses to the plated ends, to stiffen and support both. Holes are cast at F to act partly as supports to the central main core, partly to carry off the air from that core. Larger holes are cast at G to permit the pins to be passed through to anchor the wire ropes in A, and they are big enough to allow free access for the workman's arm, and they also help to support the core.

A job of this kind is necessarily struck vertically, that is on end, with the shaft bosses

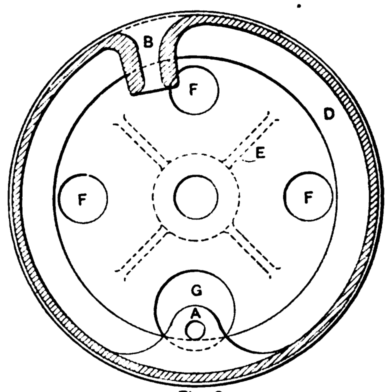


Fig. 2
SECTION *a-a* Fig. 1

above and below. The first portion of the mold to be made therefore is that which forms the boss and flat face at one end. This, like all the main portions of a loam mold, is built upon a massive cast iron plate, made in open sand, and rigid enough to stand hoisting about with its load of bricks, without springing or buckling out of truth. The springing of a light plate would cause the mold to crack, and risk a waster casting.

This plate, shown at H. Fig. 3, is about 3 inches thick, large enough to carry the bricks, and is furnished with lugs to be lifted and lowered by. Upon it the bottom part of the mold, the skeleton of which in this case consists of three layers of bricks, is built. The figure shows the bottom of the mold as it appears on completion. First, the plate H is leveled on timber blocking on the floor, three blocks to the circle, the spindle J is stepped vertically in its socket, with a plumb level, and a plain striking board is fastened to it, as shown, by means of the strap. Being planed parallel on top and bottom edges its truth is tested with a spirit level. Then the plate is daubed over with loam a little deeper than the prods, and the first course of bricks bedded down on it. Spaces are left, being filled with fine sifted ashes mixed with the loam, for the exit of air. The two following courses are next laid on, also with joints well open, and filled in with loam and fine ashes similarly. Clear spaces are left for the striking of the central boss, and also for the bedding in of the four ribs E, Figs. 1 and 2, which are also well laid in thin loam, 1½ or 2 inches of the latter between the pattern ribs, and the nearest bricks. These do not appear in Fig. 3, the plane of the view being taken at a position about midway with the plane of the ribs.

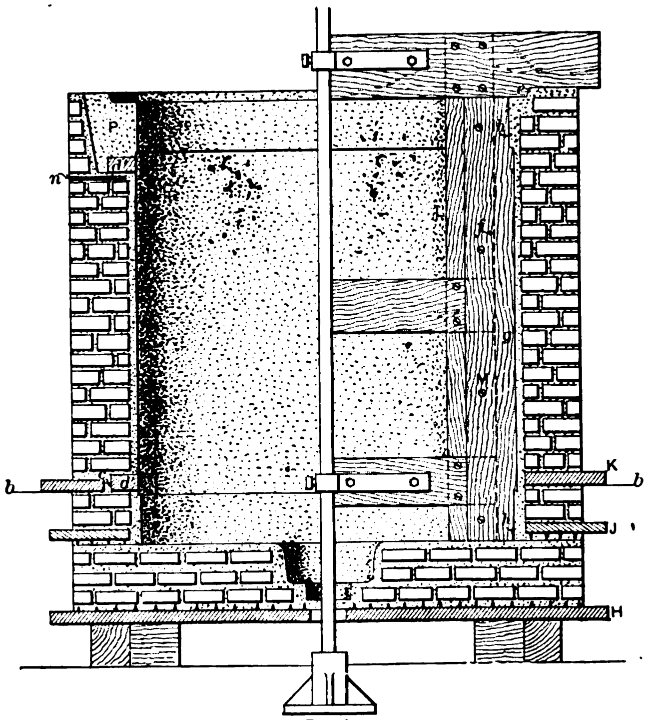


Fig. 4

After the mold is roughed up, the bricks all laid, and coarse loam swept over the whole surface, it is left for a few hours to stiffen. Then the final coat of loam, thin, and passed through a fine sieve, is swept over smoothly with the board shown in Fig. 3. Finally the entire bottom is lifted and put into the core stove to dry and hardened preparatory to the next stage, shown in Fig. 4.

On this bottom, when dried, a ring plate J is now laid, with parting sand strewn between the bottom of the plate and the top face of the mold just finished. This plate has to carry two courses of bricks to give a joint face b-b Fig. 4, coinciding with the bottom of a print that has to carry the core for making the opening B, Figs. 1 and 2, through which the wire rope passes to the outside of the barrel. The plate J has to be turned over once, being laid first with its lower prodded face uppermost, to have a coat of loam swept over. When this is dried, the plate is turned over into the position seen in Fig. 4, to receive the bricks bedded in coarse loam. On the second course, a coat of fine loam is strickled off smoothly on the joint b-b, and dried. Upon this face is then laid a third plate K, which has to carry the whole superstructure up to the cope. This plate is shown in plan in Fig. 5. A recess is cast out of it at c, and the metal thickened up around that. The recess is provided to afford space in which to lay the print d, that has to carry the core for B in Figs. 1 and 2. The reason why it is necessary to break the continuity of the bricks by the plate K at the joint b is that the mold must be divided in that plane to permit of the insertion of the core for B.

The plate K having been thus laid upon the joint face, built up to the plane b, parting sand intervening, numerous courses of bricks are built upon it, as shown in Fig. 4. Before commencing to build, the striking board L is fixed in position on the striking bar. This

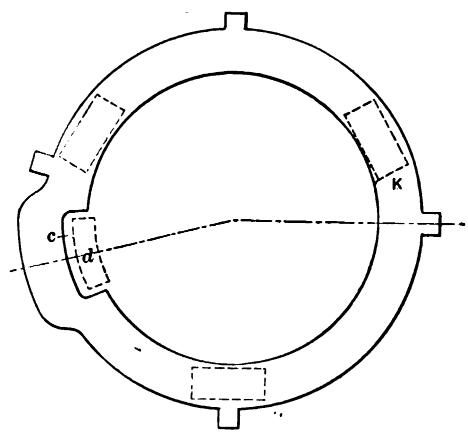


Fig. 5

board is framed together with half lapped joints. Two of the horizontals are secured by means of strips to the central bar; the middle horizontal serves only as a strut or distance piece, abutting against the bar to resist the tendency of the board to yield inwards under the pressure of the loam.

The edge e of the board forms the checked joint for fitting the cope concentrically by. The edge f, which is the actual edge of the board L, forms no part of the mold. It is cut to a radius of about an inch less than that of the finished mold. So that the vertical

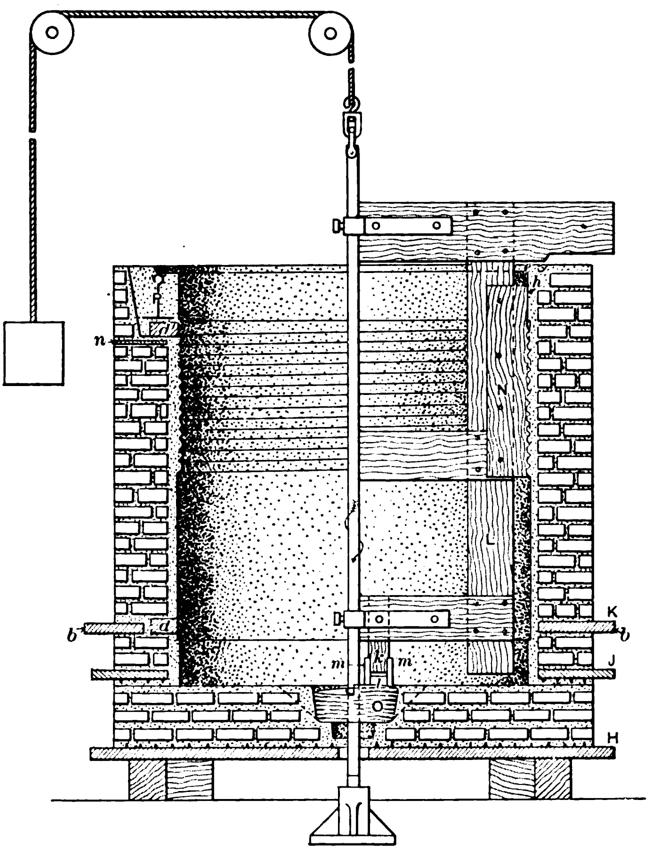


Fig. 6

member of L forms simply a means of attachment for the actual boards by which the spirals are struck, as follows.

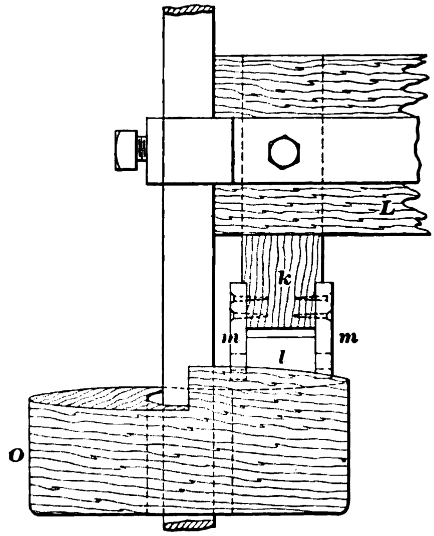
In the first place, a board M with one straight edge chamfered, is screwed upon L. The edge g of M comes within 1/8 or 3-16 in. of the bottom edges of the grooves in Fig. 1. With this board screwed on thus, the whole of the interior of the mold from the bottom to the cope joint is roughed up; that is, courses of bricks are built one above another with overlapping joints, having coarse loam between vertical and horizontal joints, no ashes, however, being necessary in this portion of the mold, and the inner faces are swept with coarse loam, and struck roughly circular, but not smoothed much with the edge g of the board M. Only the upper face e of the checked portion of the mold is finished with fine loam at this stage, and the belts h, h, corresponding with the smooth belts C, C, in Fig. 1 for the bores of the wheels. The mold is then allowed to stand to become partly set for the space of a few hours. In the course of this stage of the work certain bricks have to be omitted, but it will be better to consider this presently in connection with Fig. 6.

The board M is next removed, and preparation made for striking the screw thread that comes uppermost in the mold. If the lower screw were struck first, and the upper one afterwards, the loam would tumble down from the latter, and mess up the bottom screw. Striking the upper one first, this trouble is avoided.

The board that strikes the top screw is shown at N in Fig. 6 attached to the board L, at the exact radius required to make the diameter of the thread right. The extreme portion of the board stands 1/8 or 3-16 in. within the roughed up surface of the loam struck by the edge g of the board M in Fig. 4.

To strike the screw, a special apparatus has to be rigged up, comprising a templet or former screw, O, enlarged in Fig. 7, cut to the pitch of the screw that has to be struck. It is made from a solid piece of pitch-pine, or of red deal. The diameter of the outside is made only as a matter of convenience to fit into the boss struck in the bottom of the mold by the board in Fig. 3. In cases where there is no boss, or only a very shallow one, or one small in diameter, a special recess is struck large enough to take the former screw, and is filled up afterwards, or made good to the proper dimensions by bedding in a suitable pattern boss. The former screw should never be less than 10 in., and is better if 12 or 14 in. in diameter.

To the bottom of the board L, in Fig. 6, a piece of wood k carrying a small roller l (compare with Fig. 7) is bolted. The roller runs between two plates m, m, screwed to the sides of k, holes being drilled in the plates to receive small journals turned on the roller ends. As the molder draws the board round, the roller runs up the incline of the former, and the board strikes the upper screw. But the



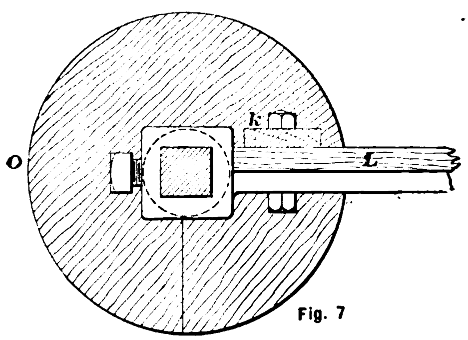


Fig. 7

board and bar are heavy, and the friction of the small roller is considerable. A counterbalance weight, Fig. 6, is therefore attached to the top of the bar, at the top, with a shackle, and swivel, from which a rope passes upwards, and over light pulleys having bearings on a beam overhead. Without this counterweight the pulling round of the board would be a work of considerable difficulty.

The loam for the spiral is first thrown against and daubed on and pressed against the roughed-up surface with the hands, swabbing being first done, and the board is swept round until the rough semblance of a screw is obtained. In places where the loam is deficient in quantity, it is made good with the hands, until after about half a dozen good sweepings good outlines are obtained. At the termination of each revolution the board is dropped down from the highest to the lowest position of the screw O in readiness to commence another rotation. The swept up screw when

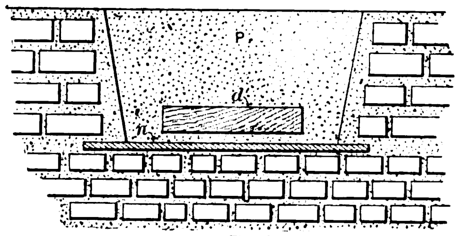


Fig. 8

brought well into shape is allowed to remain for about an hour to stiffen, and then about half a dozen final sweepings round the board, using fine loam, complete the outlines.

Since the board is dropped on the templet screw at the termination of each revolution, the thread is destroyed in the loam at that location, in a width exactly equal to the thickness of the board. This space is doubled with loam on the completion of the sweeping up, and when dried is filled to the screw shape.

But before this stage is reached the provision will have been made, as mentioned in connection with Fig. 4, for carrying the top print d' for the recess B, corresponding with

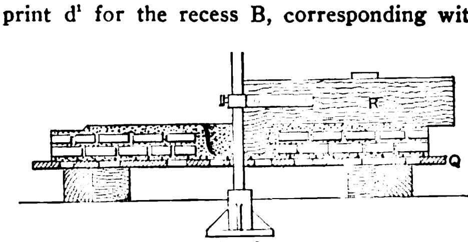


Fig. 9

the similar one d below, and which we will now consider.

At P in Figs. 6 and 8 there is shown a recess with beveled edges, formed in the bricks, and a plate n is inserted in the recess. Upon this plate the top print d', corresponding with the bottom print d, is bedded in loam, in its appropriate position. This does away with the necessity for a large plate like that, K, used in the bottom. The top print is set vertically over the bottom one with a straightedge and spirit level. When the print is set the loam can be swept up and finished.

After the top spiral has been struck, the board N is removed and screwed to the lower portion of the board. Another templet screw of the other hand is substituted for O, and the bottom spiral is struck up in the same manner as the first. The mold is then dried, either in a stove or by means of devils or open cages containing coke, lowered down within the mold. In the meantime other portions of the mold will be going on.

The cope is carried on the plate Q, Fig. 9, prodded all over to assist in holding the loam. cast in it. The bricks are loamed over with a board R attached to the striking bar. The finished cope, when dried, fits by its check into the checked portion of the top part of the mold, shown at Fig. 6, and must consequently be concentric with it.

We now consider the main or central core for the drum. This is built upon a plate S, Fig. 10, the outside diameter being made a little smaller than that of the core, and beveled round the edge. The diameter of the central hole must be large enough to admit the

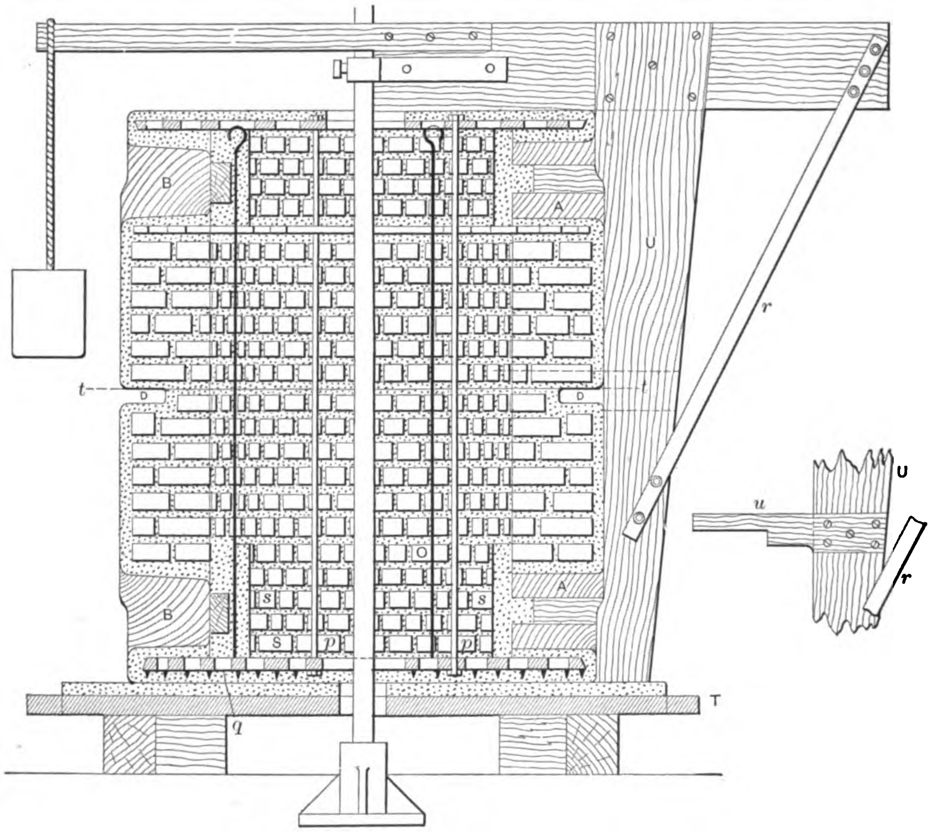


Fig. 10

In the case of a perfectly level surface, or even one that is not much out of level, as say, slightly curved, or recessed, nothing more than loam would be requisite in any plate that has to be turned over. But in this case as there is a rather deep top boss, the necessary thickness has to be made by bricking up, similarly to the bottom. To prevent the bricks from tumbling off when the plate is turned over into position, a number of the bricks, at intervals, are secured with stout binding wire to the plate, the wire being passed round the bricks (this is not shown), and through numerous holes shaft core. Eyes are cast at o (compare with Fig. 12) to lift the plate by, and holes at p for bolting the top and bottom portions of the core together by—compare with the plan view of the plate, shown separately in Fig. 11.

The bottom of the plate is first loamed over and dried, to form a joint face later on with the bottom of the mold. When dry it is placed upon any level bed, usually a loamed plate T, as shown in Fig. 10, and the bricking up commenced on the top face.

The striking board U, Fig. 10, is strutted at r, and an overhanging end, screwed on, takes a counterweight to relieve the weight of the board itself.

Before commencing work, note must be made that the lugs A, B, in Figs. 1 and 2, have to be built into the core. The position of these are indicated by the letters A and B in the plan view, Fig. 11, which shows the pattern lugs imbedded in place. A kind of cage of vertical bars s is cast in the plate, standing up around each of these spaces, to help support the loam there.

cooled down to the black heat. The bricks are built up similarly to those in the outer mold. Wider spaces filled with fine sifted ashes are left here and there. Through these the vents escape into the central hollow portion of the core, which is left open and destitute of bricks.

The board U is carried straight up to the full depth of the core. But the core itself is made in two portions, divided on the line t-t, corresponding with one face of the internal rib D, Fig. 1. This rib and the joint face are

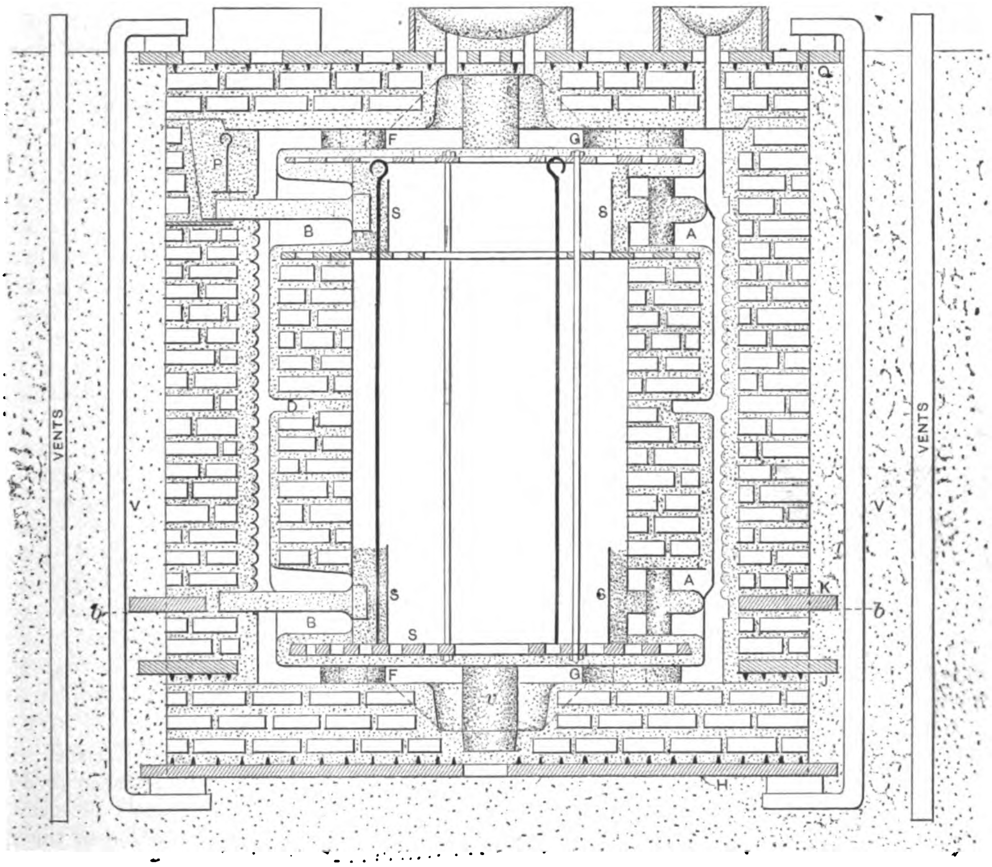


Fig. 12

struck with a suitable tongue piece u, screwed upon the board, indicated by dotted lines in position in Fig. 10, and separately to the right of that figure. After the rib D and joint face t-t are swept, the piece u is unscrewed from the board. When the core is finished thus far it is lifted by the eyes o, and put into the drying stove.

As metal will shrink around a core, this shrinking involves the risk of a fractured casting, unless provision is made to permit of such contraction. As hard bricks will not yield, loam ones must therefore be inserted all down the core on three or four sections. These become crushed by the shrinkage, and allow the core to yield inwards. But in addition to this provision it is usual and necessary to break up the core by dislodging the bricks with the crowbars before the casting has

On removal from the latter the portion D is filled up with ordinary sand level with t-t, and the remainder of the core is built up similarly to the lower portion. The lugs A and B are bedded in the loam at their proper height, and plumb over the corresponding bottom lugs, being checked in the same manner as the prints were in Fig. 8. The core is again put in the stove; when dry the lugs are withdrawn, the core scoured over with glasspaper and is then ready for trying in the mold.

A great deal of care is required in putting the various parts of the mold together, and in making due provision for pouring and venting. The mold is put in a casting pit, so that its top is brought about on a level with the foundry floor. First, then, the lowermost plate H, Fig. 12, is well bedded on the bottom of the pit. The middle core, Fig. 10, is then put in, and centered, being supported on cores F and

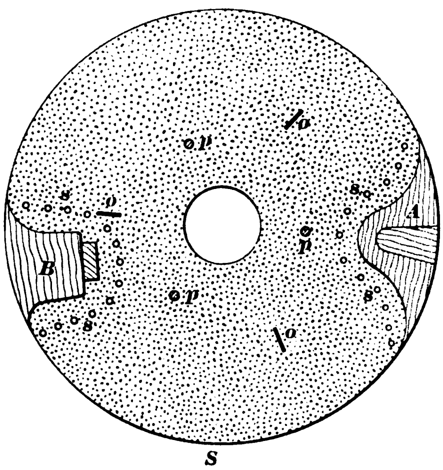


Fig. 11

G, which form the holes F and G in Figs. 1 and 2, and the core v for the central shaft is also inserted. The latter, Fig. 12, v, fits in the print impression struck by the board in Fig. 3. The others, F, G, are simply set in by measurements, being of the same thickness as the metal in the end of the barrel.

Next the portion of the mold carried by plate J is lowered, and the cores A and B are placed in position, followed by the upper portion of the mold carried on plate K from the joint b-b, then the upper cores A and B are inserted, and the filling-in cod-piece P put back into place. The details of this work call for a little explanation.

The cores A and B are made from boxes shown in Figs. 13 and 14, respectively. It will be seen in Fig. 12 that the cores A, B, have to be inserted in the print impressions in the main central core before the outer ring is lowered into position, in the case of three of the cores, the fourth being covered by the cod-piece P. And unless the outside were jointed at b-b the lower core B could not be inserted and supported in print impressions at each end. This is an important detail, because if the core were supported at one end only thus, and with chaplets elsewhere, there might be risk of displacement, or of blowing. There is no difficulty of this kind with the cores A A, which fill up and are steadied in their pocket print impressions, hence these are inserted in the main core without requiring any further support.

Lastly, the cope, Fig. 9, is lowered down

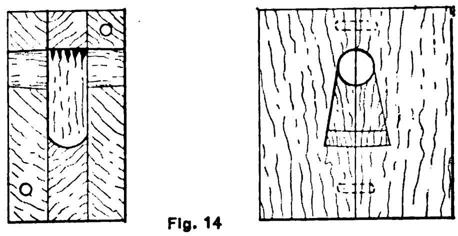


Fig. 14

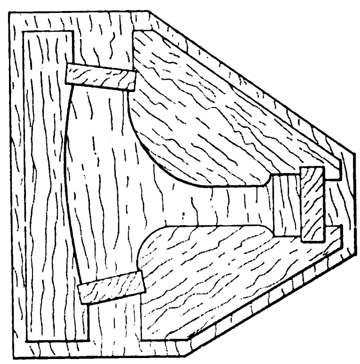


Fig. 18

and the pouring basin and runners made. But there are many points to be attended to during these operations. Thus, after the central core is put in position, the whole of the interior which was left destitute of bricks is filled with cinders. This is done to prevent an explosion of gas, since it must be remembered that the air from the core all strikes inward between the joints of the bricks. If there were no cinders in the central portion, this gas would accumulate in a large body, and mingling with oxygen would ignite and cause a blow up. Being diffused, however, among the cinders it escapes and does not ignite until it reaches the vent holes.

Then, further, there is enormous liquid pressure in a deep mold, and this necessitates secure bolting of the top and bottom parts together. Bolts p pass from the top to the bottom plates in the core, and clamps b pass from the cope plate Q to the bottom plate H, being slipped over the lugs cast upon the plates and wedged.

To resist pressure tending to bulge the outer mold, the space between the walls of the pit and the bricks of the outer mold is filled up with floor sand shoveled in, and pressed down hard with hand rammers. If the pit is very much larger than the mold it is usual to form a temporary wall round the mold with a series of iron rings, and ram sand between the mold and the rings.

HIGH SILICON PIG IRON.

There has been considerable discussion in *The Foundry* at different times concerning the composition of various irons and the statement has been made repeatedly that a chemical analysis sometimes fails to reveal all of the properties of the iron. For instance, it is stated that an iron made from one of the southern ores which may apparently be identical in composition with the northern iron will frequently have very different physical properties, especially in regard to its chilling properties. It is probable that these qualities may be due to varying amounts of elements which are not ordinarily determined in the chemical analysis of pig iron, but the fact remains, nevertheless, that these unexplained differences do exist. This matter was brought to our attention recently in some correspondence concerning a high silicon pig iron sold under the name of Globe pig iron, Chas. G. Shepard, 401 Ellicott Square, Buffalo, N. Y., being the agent. This pig iron is peculiar, in that it is manufactured from an iron ore occurring in Jackson county, O., and containing only about 25 percent of metallic iron. In order to produce the high silicon irons made at this furnace, it is necessary to use a very much greater proportion of coke than is required for melting the ordinary ore to produce an ordinary grade of pig iron.

They have grades ranging from 6 to 10 percent in silicon and with the carbon ranging from a little less than 3 to less than 2 percent. This grade of iron has been made and placed on the market for a great many years and it is used by many stove manufacturers and others to counteract the bad effects which result from the necessary melting of a large proportion of sprues or remelt. As is frequently stated, this iron will take the "sting" out of the mixture, which would otherwise result from the large proportion of remelt.

Many of the users of the iron claim that better results can be obtained by introducing a certain proportion, that is, from 5 to 10 percent of this brand, into their mixture, and thus avoid the changing of the quality of the iron greatly, but at the same time increasing its strength by counteracting the effect of the sulphur. It would be interesting to know whether or not this result is due wholly to the high percentage of silicon present, or whether or not it is due to other elements not ordinarily determined. It is probable, however, that the principal secret lies in the fact that this iron is remarkably pure and serves to introduce a considerable proportion of silicon without introducing other and undesirable elements. Another point is that while this iron costs considerably more than ordinary pig iron, it is undoubtedly cheaper to introduce a certain amount of silicon in this way than it would be to buy an iron of the desired grade of silicon in the first place.

It would be interesting to hear from others who have had experience with southern irons which are said to have quite different properties, even though the analysis may be apparently identical. A. READER.

A CASTING DIFFICULTY.

BY P. M. WOODEN.

In the December number of *The Foundry* there is an article with the above title, by G. L. B. If he will heat his shaft to a red heat before putting it into the mold it will help matters. It does not have to be red hot when put into the mold, but should be heated to a red heat just previous to this time. It should also be anchored in the cope side, the same as they would with a dry sand core, for the molten metal flowing along the under side or drag half, expands one side, causing the ends to move out of center. He should also build a flow off gate and flow 50 or 75 pounds of iron through the mold, which will remove all tendency to produce honeycombed or spongy iron. I hope that this will help the brother out of his difficulty.

The H. E. Hessler Co., of Syracuse, N. Y., have secured additional property in what is known as the North Side of Syracuse, and will build a plant there to work in conjunction with their other stove foundry.

REVIEWS.

PRODUCING SOUND CASTINGS.

Eisenzeitung, Oct. 6.—Another discussion on this question. Care should be exercised in the selection of the molding sand. If not open enough, gas pockets are sure to result. If too open, the metal will tear away particles and cause scabs. Drying the mold suitably may overcome defects in the molding sand somewhat. Thus a gummy sand must be dried with a pretty sharp heat; while a lean, open sand must be handled cautiously, and with low temperatures. Furthermore, sufficient new sand must always be well mixed with the old before new molds are made.

If at all possible, the mold should be placed in such a position for pouring that the cope side receives any machining to be done subsequently. This removes the portions likely to be unsound, as well as shotted places and other surface defects.

The gates must be just large enough to pass the necessary amount of iron, and no larger. Pouring the castings with dull iron is apt to give sounder castings than with very hot metal, as the latter keeps on disengaging gases which may be held under the skin.

Pouring from the bottom with whirl gates gives cleaner iron than top pouring, a fact readily seen in roll making. Specially good molding materials must be used in this case, as the cutting action of the stream is severe. Plenty of risers are recommended as a paying proposition.

Finally, it is necessary to use the right kind of metal. At least 2% of silicon, and as little manganese as possible, is essential. To give good wearing qualities, add 10% steel to this mixture.

MOLDING MATERIALS.

Eisenzeitung, Dec. 29.—Under this caption the various materials going to make up a mold are discussed. We take therefrom the main points which are of interest at the present time, inasmuch as the U. S. Geological Survey is now engaged in studying the natural molding sands of the country.

Molding sands in general must have the following characteristics: They must allow themselves to be molded up, retaining their shape well. Must be able to resist the pressure of the metal as well as its cutting action. They must be porous enough to allow the gases to escape through them readily. They must be refractory enough to stand the temperature of the metal without burning on or disintegrating. They must be free from substances which give off gases, as for instance carbonates; as well as fluxes, such as lime and iron oxide. Finally the molding sands must crumble easily after shaking out, so that they may be readily tempered up again.

To go into more detail. In order that the molding sand may be suitable for foundry work, the particles of sand must possess certain required properties. They must be as rough and angular as possible, and not round or smooth. The water used for tempering acts as a binder to some extent, and must be replenished as it evaporates. The molder judges this by the feel of the sand. If the sand is not porous enough, this water on being brought in contact with the molten metal, and turning to steam, is forced to pass through the body of the metal, causing it to boil, and always makes trouble. Hence the necessity of copious venting occasionally with some sands.

The two properties of sand, to be plastic enough to mold up well, and at the same time to be quite porous, are really diametrically opposite, and hard to combine in the same sample. The property of molding up well is due to a large amount of clay in the sand, making it plastic. This in turn makes the sand denser, and less permeable to gases. Experiments have demonstrated that very fat sands, that is with less than 85 percent silica, and 10 to 15 percent clay, are impervious to the passage of gases, and only when heated up to 575 to 625 degrees F., or in other words, "burnt." will they pass the gases in the iron. The finer the sand the greater this difficulty. If fine sands must be used the microscope should be taken to see that the grains are rough and angular. The size, while hard to designate absolutely, should be about one sixth of an inch in diameter (which would seem a little large). Finally the sand should be as uniform as possible in the size of the grains and be free from dust. To test the permeability of sand for gases, the samples should be put into suitable receptacles, pressed equally hard, and then brought to equal dimensions. Water is then dropped on with a graduate or burette. The sand which takes up the most water will be the one which passes the gases best.

A sand must keep its shape when the hot metal strikes it. If the sand cracks up in its grains and goes to dust there will be trouble. Thus the sand may contain carbonate of lime, which decomposes under heat. Or there may be hydroxides which disengage water and destroy the integrity of the material. Finally there may be hair cracks in the grains of quartz which have moisture in them. When the hot metal strikes these, they fly apart. In any of these cases the presence of the proper amount of clay will not give the desired results otherwise obtained.

For heavy pieces of work, or for steel, a sand is used which has more clay in its makeup. In fact it is a clay which would shrink too much on heating, and hence has added to it quartz, burnt clay, ground crucibles, and the like. Here the shrinkage of the clay portion creates hair cracks which, however, are not continuous, as the grains of sand or other material breaks their continuity. The result is that no trouble is experienced from that source and the gases can pass off all right.

For loam work, the material used shrinks very much, and hence it is necessary to add some organic matter as a binder to counteract the deleterious shrinkage effects. Short straw, cow-manure, calf's hair, increase the binding power and when baked the mold will pass off gases all right. Sea-coal dare not be used as a facing, as the gases formed are too voluminous, and could not get away. Hence graphite or coke dust is used for the wash. The more sand is found in the loam, the less graphite or coke dust may be used, and vice versa.

Among the substances which may be used for binders in coremaking, we note potatoes, boiled and mashed, then being mixed with the core-sand.

MEMORANDA ON GERMAN MALLEABLE CASTINGS.

Giesserei-Zeitung, Dec. 15, contains an article by F. Eckert, from which we take a few points of interest. Swedish and English charcoal irons with 3 to 3.5% total carbon, and as little sulphur and phosphorus as possible, are recommended, the silicon and manganese being low. For the steel additions old files are specially included. For annealing purposes the spathic iron ores are used, as well as hammer scale, rusted wrought iron turnings, and occasionally oxide of zinc. The last mentioned medium is certainly a new one to us. After giving some molding directions of a general nature, which agree with our American practice, Mr. Eckert presents a table of mixtures to be used for malleable castings of thicknesses ranging from ¼ to 1¼ inches. In the first case he gives 75% gray pig iron with 25% steel scrap; and in the last, 37% gray pig iron, 8% white pig iron, and 55% steel scrap. These figures are astonishing to us here, for with so much steel it is a question of how much shrinkage we would have to contend with, what the percentage of cracked castings would be, and the certainty of a very poor anneal. In Germany, however, they anneal for a longer period, and at comparatively higher temperatures. The fracture of their castings is not black, as ours, but of a steely nature.

For comparison with our costs those in Germany are given herewith, converted to a tonnage basis (2,000 lbs.).

Iron	$28.41
Coke (crucible process)	9.09
Crucibles	6.82
Labor, melting	3.41
Molding cost	22.73
Molding material	2.27
Cleaning	2.41
Annealing labor	4.54
Annealing fuel	2.82
Annealing material	3.41
Supplies	2.73
Interest, depreciation	1.82
Total	$90.46

or about 4.5c a lb.

While these figures are claimed to be high, and the process is the antiquated crucible one, which seems, however, to be the standard for Germany, yet a few of the cost items can be compared with our practice. Thus the molding cost would seem excessive, as also the annealing labor, remembering that wages are very much less in Germany.

As we are selling malleable castings between 2.2 and 3 cents a pound at the present writing over here, the above cost figures, even conceding a high pig iron price, would indicate that we are a trifle ahead in the game.

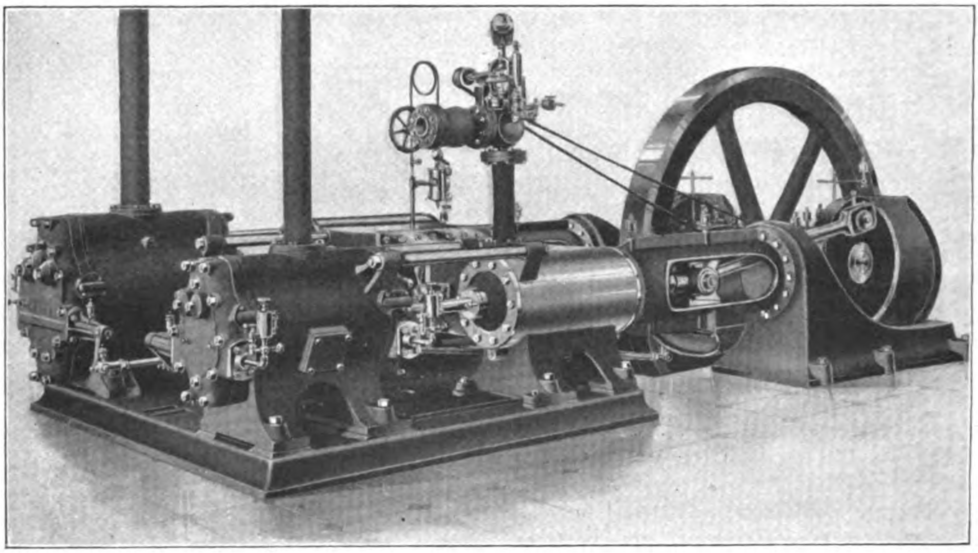
ON THE INFLUENCE OF SILICON, MANGANESE, CARBON, SULPHUR AND PHOSPHORUS IN PRODUCING TEMPER-CARBON IN MALLEABLE IRON.

Stahl und Eisen, Oct. 1.—Prof. Wuest and P. Schloesser experimented with practically pure iron to which additions of the elements named in the title had been added while in the crucible. The results were as follows: Carbon (made from sugar) added to the cold charge, in an old crucible, brought the metal up to 4.4 percent. The silicon was about 0.03, manganese 0.03, phosphorus 0.014, and sulphur 0.008. The test pieces were cast into iron ingot molds, and afterwards packed in cast iron borings in a crucible, and then annealed in an electric furnace. Temperatures were taken with the Le Chatelier Pyrometer. The conclusion reached was that the higher the carbon contents, the greater the tendency to separate out the temper carbon. The reaction begins suddenly at about 1,800 degrees F. and keeps throwing out the carbon heavier as the temperature gets higher. (Unfortunately this does not quite agree with daily malleable practice, where the slow heating up of an oven shows the separation out of the temper carbon completely beginning with 1,250 degrees F., and not running higher than 1,350. Silicon 0.35, which would indicate that laboratory experiments do not always go hand in hand with actual experience.) Silicon has a great part to play in this reaction, as it has been found, and the tables given show that with higher silicon the annealing temperature comes down considerably. This comes more nearly to actual conditions. Our experience in America goes one step further in that we notice quite a distinction between metal made by the cupola process and that from the air furnace, or the open-hearth. The former anneals at a temperature several hundred degrees higher than the latter two methods.

One statement is made which we cannot agree with either, and that is when the silicon contents goes below 0.50, the castings must be annealed twice to be of good quality. The very best malleable should contain below 0.45 percent silicon, and even with 0.28, only one anneal is amply sufficient.

The addition of manganese, made by metal produced in the Goldschmidt method, proved what most of the malleable people here have gone through, that it is very bad to have in quantity, for it obstructs the annealing process. While the presence of silicon allows a very sudden and marked change to take place, when too much manganese is there, the deposition of the temper carbon is so gradual that it may be called very slow.

Sulphur acts similar to manganese and is also known to be very injurious to the material. Phosphorus, if not present in too great a quantity, has no special effect either way.



A NEW AIR COMPRESSOR.

A NEW AIR COMPRESSOR.

The accompanying illustration shows one of the air compressors recently furnished the Penna. R. R. Co. for their new shops at Altoona, Pa. These machines were designed and built by the Chicago Pneumatic Tool Co., at their compressor plant at Franklin, Pa. They are designed to run non-condensing, with a boiler pressure of 100 pounds, and the capacity of each compressor is 700 cubic feet of free air per minute when running at the speed of 100 r. p. m. The steam cylinders are provided with Meyer adjustable cut-off valves, and the air cylinders with mechanically operated inlet valves of the Corliss type and with poppet valves for the discharge. All parts are designed to give ample working surface and to insure continuous cool running. An intercooler, which is not shown in the illustration, is provided, and located between the high and low pressure air cylinders. The cylinders have comparatively small bore and long stroke, so as to reduce the clearance volume to the minimum. The governor is furnished with a pressure regulator, which stops the machine when the pressure in the receiver exceeds the desired amount. The governor is also provided with a safety device which stops the machine in case of any accident to the governor belt.

ASSOCIATIONS AND SOCIETIES.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care J. W. Paxson Co.

The Philadelphia Foundrymen's Association held its 144th meeting at the Manufacturers' Club, Philadelphia, on Wednesday evening, Feb. 1. Thomas Devlin, president, occupied the chair, and the meeting was called to order at 8:15, with 65 members and visitors in attendance. The treasurer's report showed a cash balance of $2,129.09, all bills being paid to date.

Secretary Evans stated that several of the members accepted the invitation and attended the annual meeting and dinner of the New England Foundrymen's Association at the Exchange Club, Boston, Mass., on Jan. 11. He then called upon Mr. Brown, who was one of the party, to make a report. Mr. Brown said that the members from Philadelphia were royally received and entertained, the meeting being quite largely attended. In presenting a neatly framed etching of the Old North Church, the hearty wishes of the New England Foundrymen's Association were extended to President Devlin and the members of the Philadelphia association, and special attention was called to the Historic Association of Boston, and in particular the history of the Old North Church. In closing his remarks Mr. Brown made a motion to the effect that the secretary be instructed to formally acknowledge the receipt of the etching referred to, and that he endeavor to have the same placed upon the wall of the meeting room at the Manufacturers' Club, provided satisfactory arrangements could be made with the board of governors.

The members were invited to attend a meeting of the Franklin Institute on Feb. 2 and hear a lecture to be delivered by Mr. Richard Moldenke on "Testing of Cast Iron."

Edwin A. Moore, president of the American Coke & Gas Construction Co., Camden, N. J., was then called to read his paper on the subject of "By-Product Coke as Made by the Coke Oven Plant of the Otto-Hoffman and United-Otto Types, Camden, N. J."

Pittsburg Foundrymen's Association.

F. H. Zimmers, Secretary, care Union Foundry & Machine Co.

At a meeting of the Pittsburg Foundrymen's Association, held at Pittsburg, Monday, Feb. 6, J. S. Robeson, president of the American Glutrose Co., Philadelphia, read an interesting paper on "Core Binders." Much information with reference to core making was given and the low percentage in mixtures of some of the binders used was a surprise to many. Most of the foundrymen agreed with Mr. Robeson that the sand for making cores was of first importance, and that the binder was of secondary consideration. While different binders were used by many of those who took part in the discussion, it was generally agreed that for overhanging cores flour must be used as a binder. One of the foundrymen showed a core to the visitors in which glutrine was used as a binder in the ratio of 50 to 1 and even this core was too hard for general practice. The proper proportion in this instance should have been 75 to 1. It was claimed that this substance was used by some of the foundrymen in the ratio of over 100 to 1 with excellent results.

New England Foundrymen's Association.

Fred F. Stockwell, Secretary, care of Barbour-Stockwell Co., Cambridgeport, Mass.

The regular monthly meeting of the New England Foundrymen's Association was held at the Exchange Club, Boston, on Wednesday, Feb. 8. Report of progress was received from the committee on pig iron storage warrant system, and it was announced that the committee expected to have Geo. H. Hull, president American Pig Iron Storage Warrant Co., present at the next meeting to give further information relative to this subject.

After a short intermission the meeting adjourned to dinner, after which the president introduced Mr. Henry Souther, of the Henry Souther Engineering Co., Hartford, Conn., who gave a very interesting address on the

"Physics of Cast Iron Practically Considered." At the conclusion of the address a unanimous vote of thanks was extended to Mr. Souther.

Cleveland Foundry Foremen.

W. H. Nicholls, 608 Gordon Avenue, District Vice President.

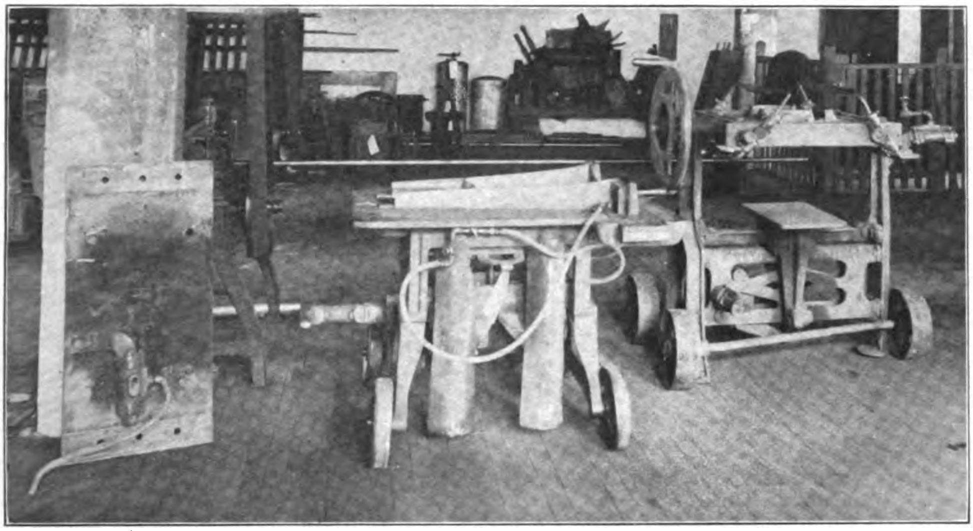
The Cleveland Foundry Foremen have had two meetings recently. On January 30th they met at their usual meeting place and then proceeded in a body to the power block occupied by the Berkshire Mfg. Co., where there was a motor, and also a grinding machine for pointing the cores. The Berkshire Mfg. Co. exhibited two of their automatic molding machines fitted up for different classes of work. One of the machines was fitted up for making car brasses, and certainly showed remarkable results as to the time occupied in making the mold, and as to the number of pounds of castings which could be obtained from a flask.

There were two papers read before the members went to the power block. These pa-

CLEVELAND FOUNDRY FOREMEN AND FRIENDS AT THE BERKSHIRE MANUFACTURING CO.

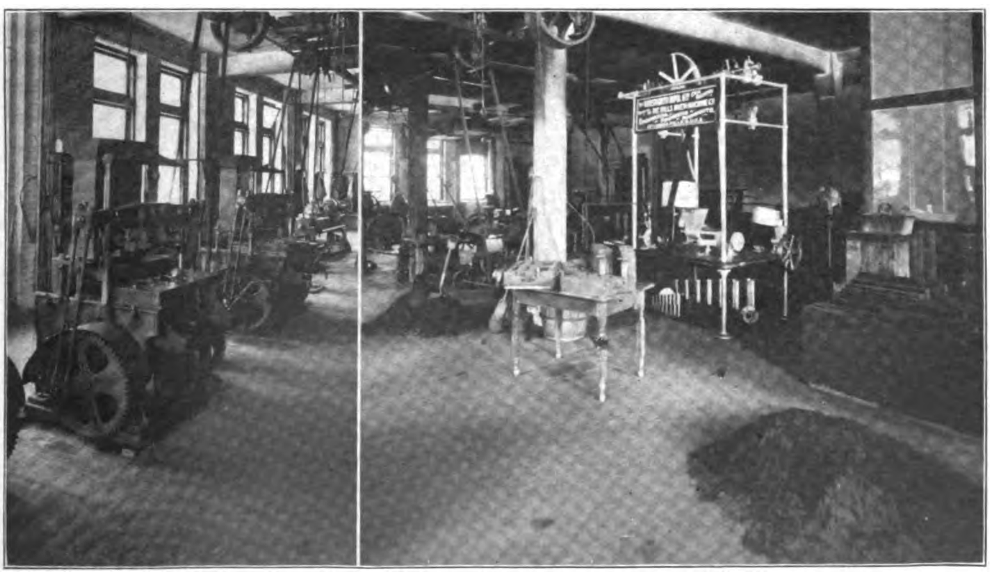
combined exhibit of molding and coremaking machinery by the Berkshire Mfg. Co., and Mr. Wadsworth, of Cuyahoga Falls, O. Mr. Wadsworth brought down a car load of machinery from the Falls Rivet & Machine Co., Cuyahoga Falls, O., including several different types of molding machines made by different manufacturers. These were exhibited to illustrate the different methods of securing the patterns to the machines. He also exhibited one of his core machines driven by an air

pers set forth the advantages of some of the machinery and explained it. Mr. Wadsworth read a paper on molding machines and prefaced his remarks with a statement concerning the object of the Foundry Foremen's Club. He urged every foundry foreman to attend the club and to make it a place where the foundry foremen could obtain help in the solving of their various problems. He also pointed out the fact that with our modern foundry conditions, including as they do the



MOLDING MACHINES SHOWN TO ILLUSTRATE MR. WADSWORTH'S PAPER.

molding machine, it would be necessary to have the foremen patternmakers associated with the foundry foremen, as the solution of the molding machine problem is one in which both the molder and the patternmaker are interested. He pointed out the fact that the different molding machines were suitable for different classes of work and that when a foundry was to be equipped with molding machinery, it was often best to have the foreman visit other foundries and also to discuss his problems with the foundry foreman of other plants. He then stated some of the points of interest concerning the exhibits which he had brought to Cleveland. Among the machines exhibited there was a squeezer machine intended for light work where small or medium quantities are required. A match plate machine of the old type made about 15 years ago, which, on account of the great expense of the match plates, is not used extensively at present, was exhibited, and Mr. Wadsworth stated that they were now making but few patterns for these machines.



1. BERKSHIRE AUTOMATIC MOLDING MACHINES. 2. EXHIBIT OF WADSWORTH IMPROVED CORE MACHINES.

The match plate machine originally had a ratchet vibrator attached to it, but about twelve years ago it was removed and an air vibrator substituted for it. There was also a hand ram and stripping plate machine, which was arranged partly as a stripping plate and partly as a vibrator machine.

Mr. Wainwright, of Cuyahoga Falls, also read a paper on core room practice, in which he pointed out the difference between past and present practice in the core room. He made a plea to the foundrymen to allow their foremen to go about and see what was being done in other foundries, and also for the introduction of more modern methods and tools in the core room, his own core room being equipped with modern drying ovens, core machines, etc., he stated the advantages which his company derived from them. He also pointed out the advantages of machines for riddling and mixing sand.

The accompanying illustrations show a flash light group of a few of the foundry foremen and their friends who were present, together with some of the machines which were on exhibition. After spending an hour and a half looking over the machines and exhibits, the foundrymen adjourned to the office of *The Foundry,* where a discussion on molding machines and core making took place, in which many interesting and useful points were brought out.

On February 14th there was a lecture on thermit at the Case School of Applied Sciences, by Mr. Stutz, vice president of the Goldschmidt Thermit Co., of New York City. The arrangements for the lecture were made jointly by the Civil Engineers' Club of Cleveland and the Foundry Foremen's Club. There was a large attendance and every one reported having had a good time and having learned a good deal about the application of thermit. Some of the foundry foremen came in from distances varying from 100 to 200 miles to attend the lecture.

On the afternoon of February 15th there was a demonstration of the use of thermit in the foundry at the Interstate Foundry Co.'s plant, which was attended by many of the foundry foremen, foundry managers and chemists.

Titanium thermit was introduced into a ladle to show its effect in purifying the iron, and several test bars made from the metal both before and after the introduction of the thermit. The use of thermit on the riser for reviving dull iron was also demonstrated.

Erie Foundry Foremen.

W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

The Erie Foundry Foremen held their regular monthly meeting in Marquette Hall, Feb. 6th. President Grunau presided and there was a full attendance. After reading the minutes of the previous meeting and transacting the routine business, a very interesting talk was given on "Chemistry as Applied in the Foundry," by Mr. Jas. A. Evens, Chemist of the Erie City Iron Works, and Mr. Henry C. Pritham, who conducts a laboratory in the city, also spoke on the same subject. The talks were most interesting and appreciated by all present. A vote of thanks was tendered the chemists and a hearty invitation extended to them to meet with us regularly.

Philadelphia Foundry Foremen.

W. P. Cunningham, Secretary, Pencoyd, Pa.

The Fifth regular meeting of the Association was held at their new meeting place, 1425 Filbert St., Wednesday evening, Feb. 15th. President A. T. William was in the chair and in the absence of Mr. Cunningham, the secretary, W. O. Steele, acted as secretary. There was a good attendance in spite of the intensely cold and stormy weather. The subject of the evening's discussion was shrink holes and feeding heads, and it was very ably handled. Pieces of defective work or descriptions of different difficulties along this line which were brought in by the members were examined and discussed to the mutual advantage of all. The chemical end of the problem was discussed and the effects of the various elements of the "mix" were argued pro and con to the profit of all present.

Some new core compounds also came in for their share of discussion and the results which some of the members were obtaining with them were reported.

After the meeting a good social time and a fine luncheon were thoroughly enjoyed by every one. Meetings will be held regularly on the third Wednesday of each month at the new meeting place, where a large and well lighted room has been set apart for the use of the Association on its regular meeting nights.

THE ASSOCIATED FOUNDRY FOREMEN.

Frank C. Everitt, Secretary, 2413 Third Ave., New York, N. Y., care The J. L. Mott Iron Works.

NEW YORK FOUNDRY FOREMEN'S ASSOCIATION.
S. M. Williams, Dist. Vice Pres., 221 Third St., Elizabeth, N. J.

INDIANAPOLIS FOUNDRY FOREMEN.
W. H. Holmes, Dist. Vice Pres., care American Foundry Co.

CHICAGO FOUNDRY FOREMEN.
David Spence, Dist. Vice Pres., 142 Bunker St.

MILWAUKEE FOUNDRY FOREMEN.
Thomas Glasscock, Dist. Vice Pres., care Pawling & Harnischfeger Co., Milwaukee, Wis.

MOLD DRYING METHOD FOR STEEL CASTINGS.

Forgings are gradually being replaced by cast steel in the construction of locomotive frames not only on account of the lower cost of the steel but because the steel suitable for frames shows a tensile strength of about 75,000 lb. per sq. in. as compared with 53,000 to 54,000 lb. per sq. in. for the best hammered iron.

Owing to the length of the frames, varying up to nearly 40 feet, considerable difficulty has been experienced among steel casting manufacturers in producing them without shrinkage cracks and the consequent loss of an unduly high percentage of castings. C. C. Smith of the Union Steel Casting Co., Pittsburg, has a patented method of drying molds in his plant by which this difficulty has been entirely overcome. The common practice of drying the molds throughout is objectionable in the manufacture of large steel castings, not only on account of the danger of injuring the mold in its removal to the drying oven but also because the baked mold does not break or disintegrate under the shrinkage of the casting, and as a result the latter becomes strained and frequently full of shrinkage cracks. By the new method only the face of the molds is baked, leaving the main body easily friable, so that the mold will readily break down under the strains due to the shrinkage of the casting.

In drying the mold the cope is superimposed

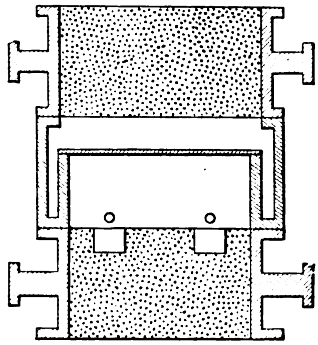


FIG. 1. METHOD OF PLACING COPE OVER DRAG.

on the drag shown in Fig. 1, and a perforated gas pipe is introduced between them, the gas being burned in the mold cavity between the cope and the drag. A flask section is placed between the cope and the drag to hold them some distance apart, and to prevent the drying of the cope to a greater extent than the drag a baffle wall of thin metal prevents the flame from coming in contact with the cope face. The heat can be continued for any length of time so as to get thoroughly dry mold faces. While the face of the mold will become dry and hard the greater portion of the mold body will still be moist and will easily disintegrate or break down. In the drying of molds for locomotive frames two perforated gas pipes are used as in Fig. 2. This method of drying can be carried out on the molding floor, not necessitating the removal of the drag or cope to a drying oven, the cope receiving a minimum amount of handling, while the drag is not moved at all.

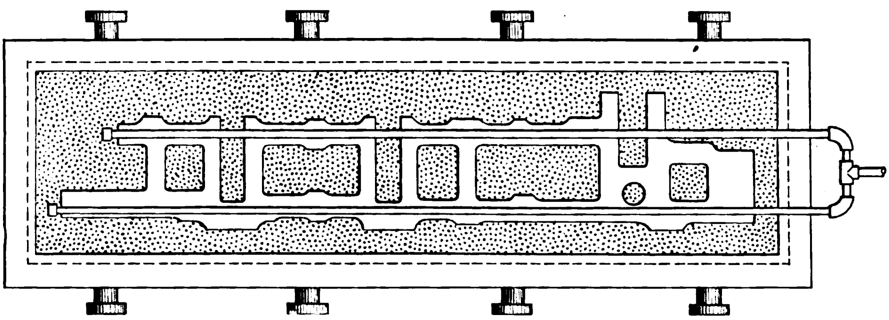


FIG. 2. PIPING ARRANGED FOR DRYING LOCOMOTIVE FRAME MOLD.

METALS IN FOUNDRY PRACTICE.

Devoted to Inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Steel, Brass and Bronze.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.

J. B. Nau, Metallurgy of Steel and Steel Castings.

Dr. Richard Moldenke, Malleable Castings.

C. Vickers, Brass Castings.

We have also made arrangements with several others to act as special contributors upon Brass, Bronze and other subjects. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

Aluminum in Iron.

Question. What is the proper way to use aluminum when mixing it with iron?

Answer. As the influence of aluminum in cast iron is the same as silicon, it is cheaper to use silicon for changing combined carbon into graphite; but as it takes only one-sixth as much aluminum as silicon to produce a given effect it is used to make a mixture of cast iron and steel scrap fluid enough to fill a mold and to prevent blowholes about one-tenth of one percent of pure aluminum is placed in the ladle before it is filled with molten iron. The mixture is instantaneous.

Trouble with Sulphur.

Question. Our coke has never contained over .90 percent of sulphur in any case; in this particular case it analyzed .64 percent. The iron charged should produce a casting with .093 percent sulphur, but the analysis showed .114 percent. We used limestone for a flux.

Answer. The limestone evidently contained pyrites. This can be seen by wetting the stone, when they will appear as bright golden spots.

Blowholes in Castings.

Question. We are having trouble with our gray cast iron foundry mixture on account of blowholes. These are clean, i. e., show no graphite deposit in the blowholes. We thought that the proportion of graphite to combined carbon was at fault, but on getting opinions they differ so that we are no better off than at the beginning. The composition seems good, viz., Si. 2.00, S. 0.08, P. 0.49, Mn. 0.60, Total C. 3.75, Graphite 3.00 to 3.30. We do not dare to make the silicon any lower.

Answer. There is nothing wrong with the iron, but with some condition connected with melting or not sufficient venting of the mold. This will disappear in time and it might be impossible to locate the trouble. The amount of silicon must depend upon the quality of castings that you desire, but increasing the silicon would be likely to decrease the blowholes. Melting the iron hotter would also be likely to get rid of the blowholes. For immediate remedy add to the ladle about one ounce of commercially pure aluminum to one hundred pounds of iron (not "casting aluminum"), or place in the ladle before filling it with iron about one-half a pound of granulated ferro manganese. The increase of silicon or the addition of aluminum will make the castings softer while the manganese will not affect hardness or will slightly increase it. It is usual to lay all trouble with blowholes to sulphur in coke.

To Figure a Cupola Mixture.

Question. I want a mixture for ingot molds for brass of the following composition: G. C. 2.21, C. C. 1.06, Si. 1.16, P. .39, S. .10, Mn. .38 percent. I want to make the mixture from the following six pig irons.

Answer. He gives complete analysis of the six irons. Silicons are 2.30, 2.50, 1.76, 2.42, 0.75, 1.60. Phosphor in all but two are twice that desired and Mn. in all but one is nearly double. Evidently these are not actual analyses of the irons. Irons must be purchased that can be mixed to produce the proportions desired. It, however, seems foolish to make so expensive a mixture for this purpose; and why all pig iron? What are you going to do with your remelt?

Suppose that you purchase three pig irons with as low P. and Mn. as you desire and with silicons that will produce the desired percentage in the mixture. To have 1.16 in the casting it should be 1.40 percent in the mixture.

Suppose you purchase A pig iron with 1.00 percent Si., B pig with 1.25, and C pig with 2.00 percent silicon and good machinery scrap with about 1.50 percent silicon. Your home scrap will contain 1.16 percent silicon and we will suppose that you must use 600 lbs. to a charge of 3,000 lbs., so as to use it all up each day. Let us use 1,200 lbs. of the foreign scrap and say that we do not care about the proportions of A, B and C.

	lb. in Mix.	% Si.	lb. Si.
Home Scrap	600	× 1.16 =	6.96
Foreign Scrap	1,200	× 1.50 =	18.00
	1,800		24.96
Charge	3,000	× 1.40	42.00
Needed	1,200	× 1.42 =	17.04

1.42	A pig iron	1.00	—.42	58		58	Total parts 175
	B " "	1.25	—.17		58	58	
	C " "	2.00	+.58	42	17	59	

1,200 ÷ 175 = 6.86 lbs. to one part.
58 × 6.86 = 397.88 lbs. of A.
58 × 6.86 = 397.88 lbs. of B.
59 × 6.86 = 404.74 lbs. of C.

Proof using even weights:

Home Scrap	600	× 1.16 =	6.96
Foreign Scrap	1,200	× 1.50 =	18.00
A Pig Iron..............	400	× 1.00	4.00
B Pig Iron	400	× 1.25	5.00
C Pig Iron	400	× 2.00	8.00
	3,000	× 1.40 =	41.96

If it had been desirable to use a large quantity of any of the pig irons on account of a shortage of some others, figure the quantity of such pig iron in with the home and foreign scrap and balance only two pig irons.

The usual way is to estimate all of the quantities and then figure the silicon in such mixture as in above proof. If too small or too great a percentage is found vary irons and figure again as in proof, and so on until you get the correct mixture.

To make a success of mixing by analyses you must first get a correct analysis of each iron used. If you guess at the analyses of the different irons you might almost as well guess at the amounts to use in the first place.

You must in any case guess at the composition of foreign scrap and to find whether your mixture is satisfactory you had better measure the shrinkage of a test bar from the same iron as the casting and compare it with the shrinkage of a test bar from an iron that has proved satisfactory.

If the shrinkage of your mixture is less you can decrease silicon by using more A pig; if the shrinkage is greater increase the silicon by using more C pig iron. This saves all analyses and saves all figuring, is inexpensive and the result is obtained as soon as the test bar is cold. This is mechanical analysis.

MALLEABLE CAST IRON NOTES.

BY DR. RICHARD MOLDENKE.

E. K., of Sheffield, England, writes as follows: We are using ordinary draught and clay pots for melting our white iron for malleable castings. Ours is a small shop employing six molders, and we have a variety of work from ounces to 100 lbs. Can we use a small cupola to advantage?

In answer to this I would say that for so small an output, by all means stick to the crucible process. In any case the use of the cupola for malleable castings weighing 100 lbs. is not to be recommended, as the product will be inferior to your present castings. If you desired to increase your capacity, and had the bulk of it in very small castings, the cupola would be all right, provided you can get pig iron with lower sulphur than seems to be the rule in England. When your output reaches two or three tons daily, you can put in a small air furnace to advantage. This air furnace, by the way, is not a reverberatory with crucibles; but for direct melting on the hearth.

E. K. writes further that his iron requires at least six days for the complete annealing process, and asks would "black heart" iron take less. In England black heart metal is the name given to our malleable castings, their own product being annealed until the carbon has all passed out of the metal leaving it nearly like steel. While our black heart castings can be annealed in less time, we never take less than six days for this purpose, unless pressed on deliveries. And then the work is bound to suffer. Black heart malleable castings will therefore be not cheaper than the white castings of England, in fact they might be dearer, for the pig iron used must be of good quality to get the black heart at all. Pig irons with sulphur over 0.07 are apt to give trouble in that respect.

BRASS FOUNDRY NOTES.

BY C. VICKERS.

Lead in Alloys.

We should like some practical information relative to the best method of treating brass and bronze mixtures containing a large percentage of lead and zinc so as to secure a uniform mixture, or in other words, prevent their separation at the time of cooling without having to plunge the castings in water.

Answer. Copper alloys with zinc in all proportions, it is a perfect alloy, and the zinc never separates from the copper.

Copper and lead do not form a perfect alloy, the lead always has a tendency to separate, but the copper will retain the lead much better if no zinc be present in the alloy. When zinc is added in large amount to a copper-lead alloy, the copper alloys with the zinc to form brass, and lets go of the lead which oozes out of the castings. Small quantities of lead and zinc, will, however, form an alloy with copper; for instance, two ounces each of lead and zinc alloy with sixteen ounces of copper to form a variety of red brass.

But when it is desirable to alloy a large amount of lead with copper as in the pot metals, zinc should never be present, as it will promote a segregation of the lead.

No method of treatment will compel the copper to retain the lead in large amounts; it will always ooze out more or less. This is why an alloy of eight ounces lead to sixteen ounces copper is known as "wet pot metal."

The retention of lead may be promoted by the addition of tin in small quantities by the use of antimonial lead in place of soft lead, and by constantly stirring the alloy while casting.

Brass Mixtures.

Question. I am an iron molder, but at times am called upon to make brass castings ranging from 1 oz. to 1,200 lb. The heavier castings I make out with all right, but it seems impossible for me to turn out small castings with a clean skin and a good color, and that will file easily. Have tried many mixtures of copper, tin and zinc. The nearest I have come to getting what I want is to use a composition of 85 copper, 5 tin, 5 zinc, 5 lead and ½ lb. metallic phosphor. This gives me a good working metal for lathe work, but does not file very easily, and if knocked out hot the color is not good, but if left to cool in the mold it has a very nice color. Now, I would like to get some information on this subject.

My sand is Philadelphia sand and I do not think it is fine enough for light work and it contains a grit that gives trouble in cutting gates. It works nicely on castings weighing from 10 to 100 lb. The metals I have are copper, tin, zinc, lead and metallic phosphor.

Answer. I must say this correspondent is very fortunately situated with regard to metals.

With copper, tin, zinc and lead at his disposal, not to speak of "metallic phosphor," he ought to turn out brass castings with a color like a sunflower.

The mixture given is pretty near an "ounce metal." It is a good alloy, but not quite suitable for small castings that must machine easily. Try the following alloy:

Copper	50	pounds.
Zinc	5	"
Lead	5	"
Tin	1	"

The tin may be omitted in castings desired very soft.

The sand is evidently too coarse for small castings; get some fine brass sand, or if that is not obtainable, take the coarse sand, strew it on the floor and let it get trampled on and dry as dust; screen this dry sand through a fine sieve. The one I use I call a No. 60, but I never counted the mesh. This sieve will take out all the grit and by constantly screening all dust, a pile of fine sand will be gradually accumulated, which can be kept to itself and used for small work. New sand may be added as required by drying and screening.

Do not get any iron molders' facings mixed up with this sand, if you want a color on the castings; dust flour only on the molds for small brass work.

Also keep iron out of the metal. Too much enthusiasm in stirring with an iron skimmer has spoilt the color of many a heat of brass.

Another thing, do not cut huge gates on small brass castings; experiment to see how small they can be made and not "draw," "shrink" or run "cold shut." Where there are small chunky castings put a feeder near them, in the shape of a boss, in the cope of runner or gate.

Shake out the castings; as soon as the redness has cooled from the sprue tap the sand off and quickly dip them in water; get them under water before the orange color fades to green. My remarks at the beginning were called forth by the fact that many founders do not furnish the component parts of the alloys, deeming them too expensive. All you get is a pile of junk, a pig of lead and a slab of zinc, out of which one is calmly expected to make "nice red brass," "bell metal," "steam metal," "gun metal," "yellow brass," "phosphor bronze" and so forth, so that any one who has access to copper, etc., is indeed fortunate and only needs a little perseverance in experimenting along the lines laid down to make a grand success.

A WHISKY BOTTLE CUPOLA.

BY JAS. A. MURPHY.

A writer in the January *Foundry* in an article on a Dismal Swamp Foundry happily alluded to a certain style of cupola designed after the fashion of a wine bottle. It was rather an appropriate name for the several monstrosities that are scattered over the country. Some of them melt iron well, but they are all without exception killers of men, and several costly losses have been recorded against them on account of the men being suffocated on the charging scaffold, by the volumes of gas discharged through the door that should be carried up the stack. I well remember one evening having a 15 ton heat which was a little larger than the average and having a large job to pour after the small work was done. I had my large ladles ready and one of them filled, when to my dismay I discovered the cupola was empty. On investigation I found my two cupola men lying out full length in the snow where they had managed to crawl after they were suffocated on the cupola platform. This same thing happened on several occasions afterwards, and was of such frequency particularly in the winter that I had a bell rope suspended from the scaffold in a convenient place so that the men could give an alarm when they found they could not stand the gas and heat any longer, and I then sent a relay of fresh men to finish charging.

Some years ago this contracting of the cupola above the door seemed to be a sort of a fad among the designers of cupolas, although most of what I have seen of them was the handiwork of foundrymen themselves or some of the engineering profession who thought they knew something of foundry practice.

The idea of course was to keep the heat as much as possible in the cupola and use less coke or other fuel. How the heat is to be kept in while the door is open is more than I could ever figure out, as the door is open seven-eighths of the time while the stock is being charged. The flame and gases instead of going up the stack partly come out the door, the amount depending on the amount the cupola is contracted, in other words the smaller the area of the stack above the door the greater the volume of gas that will come through it to cause suffocation and oftentimes fire.

I believe something in the way of sheet iron and bricks could be saved by contracting the shell a couple of inches above the door, but in all cases it is the best practice to have the inside lining straight. This is not meant to attack the excellent practice of leaving the lining project a few inches above the tuyeres. Acting upon the theory that the contraction of the cupola above the door kept in the heat and probably figuring on surprising the whole engineering world by melting at the hitherto impossible ratio of 1 to 20 or even more, a central western mechanical engineer who owned a foundry took off his coat and jingled both his pocketbook and his powerful intellect in the interests of the foundry fraternity. The whisky bottle was his model. His first attempt took the form of the hip pocket variety, oval cupola, but his latter-day designs were all after the common form with which Kentucky and all those living adjacent to its shores are so familiar.

It was rather a laughable circumstance to visitors to see a small pipe sticking through the roof which they always took for the core oven flue. On being told it was the cupola they invariably indulged a good hearty laugh.

When the blast was on, a little smoke issued through it, but at the door it was a sight to see. A huge tongue of flame illuminated the whole surroundings, while from behind a cool corner a faithful workman constantly played a hose.

It had one redeeming feature, the scaffold was high, and nearly always the amount of the heat could be got in before putting on the blast.

If any more had to be put in, the blast had to be shut off, for a man dressed in Harveyized armor plate could not approach it. No door would last more than two heats, so all hands got tired of making any. The cupola floor, the tracks and the iron walls were all warped and twisted out of shape.

Someone may ask why don't they remove the trouble? Well, the people are easily satisfied, then they are well used to that and other troubles, and then again such mistakes as contracting a 54-inch pulley to 16 inches above the door was costly in the first place and would be doubly costly to have it righted again.

Then again some people don't like to have to admit the making of blunders, particularly those who like to save at the spigot and lose at the bunghole.

SHOT IRON.*

BY JAMES BOYLE, SALEM, O.

This subject is an old one, but it has been brought right home to us lately, as we have installed a wet grinder for crushing and washing our daily cupola dump. The product from this grinder has been a surprise. The amount of clean iron reclaimed daily is so great that we feel assured it pays for the expense of grinding it. During April of this year the amount of clean shot, with many good sized nuggets in each barrowful that we reclaimed daily, was over 1,200 pounds.

This is too much iron to throw away, although it is being done by a large number of our foundries. While it seems an easy matter to just charge it into the cupola as scrap, our experience and perhaps that of everyone else is that it is a hard problem to solve.

At first we began to use the shot iron this way: On each of the last two charges of the daily melt we put 500 pounds shot iron. We put it in loose on top of scrap iron, in addition to the regular charge, without any change of kind or amount of pig iron or scrap in the charge. We added extra coke to melt the additional weight.

The result was without any apparent effect on the looks of the castings. For several days we began to think it an easy matter, but from reports that came to us from the machine shop, our first conclusion was dispelled, and before we were through, we found it about as hard a nut to crack as were some of the castings to drill.

We then cut out of the last two charges 500 pounds of scrap iron; in its place we put 500 pounds of shot iron, and on top of this we put 500 pounds of soft silicon pig iron. We took care to pour this mixture into heavy work, with better results, but the shot would show itself, although it apparently melted, and we poured it without trouble. A singular result during this stage was apparent in some wheels poured with iron in which was some of this shot mixture. One wheel 10 feet in diameter, 14 in. face, with rim 4 in. thick, 11,000 in weight, poured through hub and arms, was a good sound casting in every way, but when face of rim was turned off, groups of bright spots the size and shape of the shot iron, were bunched at and near the middle of the rim, mostly opposite the arm of the wheel, with a few stray spots above and below the center. At top and bottom of rim no spot appeared, and the iron there was our regular blue color. The wheel was soft enough to turn off easily and no difference in cutting qualities was noticed between the bright spots and the regular blue iron. I can not explain why these spots were bunched in that manner.

We now began to use more shot iron. We made an extra charge above our daily wants of soft pig and shot iron—equal parts of each—which we poured into pigs. In following heats we used this "shot pig" in our cylinder mixture. The result was better, but castings poured from same ladle would sometimes be of different grades of softness.

From the trials we have made of this side issue, we have found the following to produce the most satisfactory results: It is best to charge shot iron in center of the cupola with pig or scrap piled around it forming a nest.

Shot reclaimed from dump in which there is a large proportion of slag, is not worth the trouble to use. It reproduces so much slag in cupola that it is extra work to overcome its effects. We cart away all the slag we can pick out of the daily dump.

It pays to riddle the shot iron. We use a No. 6 riddle—the smallest pieces we put with the machine shop turnings for sale and we use only the larger shot.

We find that to put on top of the shot charge of 1,000 pounds, about 40 pounds of carbide of silicon helps to reduce the hard and non-mixing effects.

We had the best results pouring heavy work with this shot mixture. In small work it seems to chill so quickly when it comes in contact with the damp mold, and runs hard in lugs and projections reaching into the cope of flasks.

As yet we do not charge the shot iron into the cupola with the assurance we would like. That there is a way to do it we feel certain, but we have not yet solved the problem to our entire satisfaction, and we would be very glad to hear from some of the older and more scientifically equipped foundrymen.

* Paper read at A. F. A. Convention, June, '04.

Since the collapse of the United States Shipbuilding Co., the old Moore Foundries, of Elizabeth, N. J., have had rather a checkered career, but under the wise direction of the Sheldon Co., which now has charge of the property, things are picking up and a large number of new employes have been put to work. The company has a number of contracts, which will keep it busy for several months.

NEW BOOKS.

"A Treatise on Tooth Gearing," by J. H. Cromwell, published by John Wylie & Sons, New York, N. Y., price $1.50. The author of this book states that he is aware that he is treading on well worn ground and that the subject is about as old as the hills, but that in his experience as mechanical engineer he has sought often and urgently, but always in vain, for a terse, compact, yet complete and comprehensive work on the subject of tooth gearing. So that, after having made the subject a study for years he has attempted to boil down the results of these studies into just such a practical work as he himself wanted, and hence he hopes that it will be of interest to other busy men.

Algebra has been used in the book in a number of cases, but parallel with the algebraic solution a rule is always stated, so as to enable a man who does not understand algebra to solve the problems, and the author states that any problem in the book can be solved by any man who has a knowledge of arithmetic. He first takes up the underlying principles of gearing, showing how they may be applied, and how the theoretically perfect form of tooth is developed. He also shows the effect of different sizes of rolling circles upon the character of the teeth, and many other points which will be of interest to those dealing with gearing problems.

In addition to the ordinary spur wheels, he takes up many special forms, such as lantern gears, gears having very small numbers of teeth, bevel gears of all classes, including external and internal, screw gears, including worm and worm wheel and hyperbolic gears. Succeeding this portion of the book there is a section treating on trains of gearing, giving numerous examples of the calculation of such trains. He also takes up the subject of the strength of gear teeth, the strength and design of rims, arms and hubs and other parts, both for plain and curved arms. These design problems are illustrated by examples worked out in detail, showing the complete design of spur, bevel and worm gears, also of internal gears and of gears and racks. The work also contains a treatment of special forms of gears having elliptical, spiral and other special curved outlines. The author also treats intermittent and mutilated gears. The main body of the work treats of epicycloidal gearing, but there is an appendix which treats of involute gearing. This work should certainly be of interest to all patternmakers.

"The Credit Man and His Work," by E. St. Elmo Lewis, published by The Bookkeeper Publishing Co., Ltd., Detroit, Mich. Price, $2.00. This book certainly stands in a class by itself and it would be very difficult indeed to give a review which would furnish even a fair insight into its valuable and interesting contents. In this age we are beginning to look more closely to profits and to figure to see what can be done to produce our product at a lower cost, so that we will continue to make a profit in the face of the ever declining market. The element of credit is one to which very few business men have given serious thought and yet when we consider that 90 per cent of the world's trade is carried on credit, the importance of the subject cannot help but make itself felt.

Experts in credit are now found among those employed by large concerns and are considered essential to any large enterprise, but the average business man has not had time or has thought he did not have time, to give this matter serious thought. The volume under consideration will certainly give to such a man a very instructive and interesting piece of reading, dealing as it does with all phases of the subject. The author first takes up the subject of "what is credit" and then proceeds to discuss its relation to various forms of business and enterprise, as for instance, the care of the business, the organization of the business, the personal character of the management, and so on through a long list of factors which enter into the problem.

Among some of the chapters we may mention at random "Cost of Production," "The Salesman and the Credit Man," "The Slow Pay Customer," "Going to Law," etc. We believe that this work is certainly entitled to the serious consideration of every business man.

A Grate Bar Difficulty.

The writer had trouble with a grate bar difficulty similar to that which has been described in *The Foundry*, and finally got around it by having the center bar or bars, when there were more than two, swabbed so as to make this part of the mold a little damper than the outside part. This chilled the center bars more quickly and equalized the cooling.

"A. SUBSCRIBER."

Lloyd & Son will start a new brass foundry at Rock Falls, Ill.

TRADE PUBLICATIONS.

The Colburn Machine Tool Co., of Franklin, Pa., are sending out a 4-page circular entitled Bulletin No. 17. This is devoted entirely to the work of their Colburn saw table and the work which can be produced upon it. The illustrations show examples of screw cutting and a large variety of practical work for joints, ornamental work, etc.

Baldwin, Tuthill & Bolton, of Grand Rapids, Mich., are sending out a 192-page catalogue, entitled "Saw and Knife Fitting Machinery." While this catalogue is intended primarily for the users of large saw and knife machinery, such as saw mills, planing mills, veneer cutters, etc., the paper nevertheless contains a large amount of information which will be of value to all patternmakers. As a rule pattern shops do not pay sufficiently close attention to the care of saws and also to the care of knives for surfacers and planers. In cases where these tools are taken care of as well as they can be with the facilities at hand, the cost of their maintenance could be very greatly reduced by installing some of the special machinery described in this catalogue.

The Star Shovel & Range Co., of Vincennes, Ind., have issued a catalogue 6 x 9 in., describing the various classes of shovels manufactured by this company. The catalogue covers all classes of foundry shovels.

The Hancock Inspirator Co., of 85-89 Liberty street, New York, N. Y., have issued a small catalogue which is a miniature of their large catalogue, and is intended especially for pocket use. It is 4 by 6 in. and covers their line of goods, being simply a reduced size of their regular standard catalogue.

The Hayden & Derby Mfg. Co., of New York, N. Y., have issued a miniature catalogue of their Metropolitan injectors, this catalogue being 4 by 6 in. and intended for pocket use.

The Electro Dynamic Co., of Bayonne, N. J., have issued three circulars, describing their inter-pole variable speed motors, as applied to different classes of work.

The Model Heating Co., of Philadelphia, Pa., have issued a very useful blank entitled "Model Boiler Order Blank." It contains blank spaces for all of the various appliances which could be desired in connection with a boiler plant for heating purposes. They state that these blanks are intended not only as order blanks on which to order goods from them, but also as blanks on which to enter up the various parts when making an estimate of a contract, so that the contractor will have all of his information before him, arranged carefully and systematically.

The Deane Steam Pump Co., of Holyoke, Mass., have issued a catalogue of their condensers, entitled "D-23." In this they review the principal advantages of the several types of condensers, as applied to steam engines, also vacuum pumps, exhausters, air and circulating pumps, and other auxiliaries. It also contains matter concerning the condensing apparatus for steam turbines. On account of the fact that a steam turbine can exhaust its steam to so much lower pressure and utilize every inch of the expansion, it is evident that in turbine practice, high vacuums obtained by condensers are of greater value than in steam engine practice. Every one having to deal with steam power will find this catalogue of interest and value.

The Ridgway Belt Conveyor Co., 29 Broadway, N. Y., have issued a folder describing their new Ridgway two-belt conveyor system for handling materials. This system is certainly interesting and the circular should prove of interest to all having handling problems to solve.

The Cutter, Wood & Stevens Co., of Boston, Mass., are issuing a series of blotters, on which are printed advertisements for various foundry appliances.

Warren Webster & Co., of Camden, N. J., have issued another catalogue 3¼ by 6 in., entitled "The Cardinal Points of the Webster Feed-Water Heater and Chemical Purifier." This should certainly be of interest to all who have bad water to contend with.

The Ingersoll-Sergeant Drill Co., of 26 Cortlandt street, New York, N. Y., have issued two new catalogues, one entitled "Air Compressors," and known by them as Form 35, which is really composed of advance sheets of the catalogue which they are now preparing, entitled No. 36. This contains a large amount of exceedingly interesting information concerning the latest developments of compressed air machinery and compressed air installations. They have also issued a catalogue of coal mining machinery, known as Catalogue No. 52, in which they describe not only coal mining machinery, but give considerable other matter relating to air compressors, compressed air, its uses, etc.

The National Electric Co., of Milwaukee, Wis., have issued a calendar consisting of a colored picture of a riding scene, in which two horses in the foreground are taking a ditch. It is labeled "The Thoroughbreds." There is a neat little calendar pad at the lower portion of the picture, and in the upper portion in one corner, the trade mark of the company.

The American Blacksmith Co., publishers of the *American Blacksmith*, Buffalo, N. Y., have issued a very neat little Indian calendar, with a small advertisement at the top and a picture of an Indian girl, who, we presume, is Minnehaha, in the center and a neat calendar pad at the bottom.

W. H. Anderson & Sons are sending out a leaflet describing their crucible tongs, double and single carrying shanks, and foundry shovels and ladles. Their double shanks are made by a special process, so that the weld is located some distance from the shank on the carrying bar, and they claim that this produces a superior article.

The *Ironmonger*, of London, has published the *Ironmonger* Diary for 1905. This is quite a bulky book, containing over 568 pages of advertising, together with a very nicely arranged diary, the pages of which are 8 by 11 in. and are arranged with three days to the page. The diary is interleaved with blotting paper. This would certainly be a very handy book indeed for any one to keep track of his dates in, and we can readily appreciate the fact that many of the ironmongers or iron dealers of England must find this book exceedingly useful. An interesting point in connection with the present issues is that they have sent out two blank mailing cards to be filled out and returned to them. On the first is to be written a suggestion or quotation on any part of the contents of the *Ironmonger's* Diary for 1905, and on the second six questions are answered from information contained in the book. One of these questions is "Which is the best looking page in the advertising section?" Another is "Which firm has used the space occupied by its advertisement to the best advantage?" For the best answers to these cards, they will divide five guineas in prizes.

The Rand Drill Co., of 128 Broadway, New York, N. Y., have recently brought out a publication entitled "Air Power," and state that it is to be issued quarterly. In their editorial announcement, they state that the object of the paper is to keep the public posted as to what is being done by the Rand Drill Company's air power machinery.

Graphite. The Dixon Crucible Co. have issued a special number of their publication, *Graphite*, for January, entitled the "Lubrication Number." In this they take up various phases of the subject of lubrication, showing the many applications of graphite for lubricating purposes.

The C. W. Hunt Co., of West New Brighton, Staten Island, N. Y., have issued two pamphlets 3¼ by 6 in., one describing the Hunt Industrial Railways, illustrating many applications of this system and giving a large number of useful facts concerning installations of this character. The other catalogue is called an "Introduction to the general line of machinery manufactured by the C. W. Hunt Co.," and contains short, concise statements concerning the different types of machinery which they build.

The Brown & Sharpe Mfg. Co., of Providence, R. I., have issued their 1905 catalogue of machinery and tools. This catalogue has been revised and a good many new machines and devices illustrated in it. Some of the old matter has been re-written and arranged in a better form. This catalogue contains so many handy tables and so much useful information that it should be in the hands of all who have to deal with metal work, and especially in the hands of metal patternmakers.

Lord's Advertising Agency, Scranton, Pa., have issued a book called Lord's List of Trade Papers, giving the names of the various trade papers, together with a short statement concerning their specialties and other information which it is supposed that advertisers would want to know. Incidentally the list is of considerable interest for any one desiring to look over a complete list of trade journals to ascertain what journals are published along any given line.

The S. Obermayer Co., of Cincinnati, Chicago and Pittsburg, have issued a catalogue dealing especially with patternmaker's supplies. They claim that from this catalogue one can obtain anything required for his pattern shop, just as from their other catalogue any one can obtain anything required in the foundry. The catalogue is known as R 40 and will be sent free on request.

The Thos. W. Pangborn Co., 42 Dey St., New York, N. Y., are sending out a catalogue describing the sand sifting machinery, magnetic separators, and the core machines which they handle. They are also sending out a blotter, with illustrations of the Hanna pneumatic screens which they handle upon it, also a small folder advertising the corundum wheels which they handle and giving a very useful table as to speeds for rotation of grinding wheels.

The Westinghouse Machine Co., of East Pittsburg, Pa., are sending out an exceedingly neatly gotten up publication entitled "The Westinghouse Parsons Steam Turbine." One of the most striking features of the catalogue is a comparative illustration of the space occupied by the machinery and foundation necessary for a 5,000 k. w. generating unit of the ordinary Corliss type and one of the steam turbine type. The illustration of the steam engine is an outline sketch which is drawn as though it were transparent and the turbine outfit is placed inside of it. The figure of a man at one side serves as a scale for comparing the size of the two. The pages which follow are so full of interesting and instructive matter that it would be difficult to point out the especial features. It is enough to say, however, that any one who is planning on power installations should certainly give this publication careful consideration before making a decision.

The Goheen Mfg. Co., of Canton, O., have issued a large pamphlet entitled "Hitch Your Wagon to a Star," in which they have described various uses for their carbonizing coating protection for metal work. They illustrate many plants of all classes, in which the steel work has been protected by the material which they manufacture. They have also issued a catalogue entitled "Galvanum" in which they describe their paint manufactured under the above name and which will adhere to and can be used for protecting galvanized iron structures. As in the other publication, they show many illustrations of buildings and structures protected by the material.

Pawling & Harnischfeger, of Milwaukee, Wis., have issued a catalogue entitled Bulletin No. 16, describing their traveling electric hoists. For many classes of work this style of hoist has many decided advantages over the traveling crane and is being used very extensively for a large variety of work. All interested in handling devices should certainly secure a copy of this catalogue.

PERSONALS.

Mr. H. J. Stambaugh, of the Falls Rivet & Machine Co., Cuyahoga Falls, O., has resigned his present position to become the secretary and treasurer of Wm. Tod & Co., Youngstown, Ohio.

Mr. Duncan Sinclair, who has been associated with the management of the Coalbrookdale Iron Works, has recently undertaken the managing directorship of the Sinclair Iron Co., Ltd., of Wellington, Shropshire, England. Mr. Sinclair visited this country some years ago and will be remembered by many of the foundrymen who had the pleasure of forming his acquaintance.

G. A. Hassel has been appointed superintendent of the plant of the Pittsburg Steel Foundry at Glassport, near Pittsburg, where he will succeed D. MacDougal.

Mr. Chas. H. Tucker, late designer and assistant chief engineer with Pawling & Harnischfeger, of Milwaukee, Wis., has accepted the position of chief engineer with the Case Mfg. Co., of Columbus, O., Engineers, Designers and Builders of cranes and special machinery.

Walter S. Allen, who has been superintendent of the Aetna Foundry & Machine Co., Warren, O., went to Pittsburg on Feb. 1st as superintendent of the Pittsburg works of the American Steel Foundries.

C. W. Cunningham, who a few years ago managed the stove foundry at Central City, is now at the head of a new foundry at Waterloo, Ia.

DEATHS.

H. G. Forsberg, of Washington, D. C., of the firm of Forsberg & Murray, fell dead on Jan. 29th. About 25 years ago with his old time friend and school mate, Mr. Murray, he engaged in the machine and foundry business, and the partnership continued until the present time. He was well known, not only in his home town, but by many friends in different parts of the country.

Hugh Caskey, a retired brass and iron founder, of Philadelphia, Pa., died Jan. 19th. He was born in 1844, served his apprenticeship in a brass foundry in Philadelphia, later entered the United States Navy as assistant naval engineer and served through the Civil War. In 1884 he started a brass foundry in Philadelphia and in 1892 went to Newport News, Va. where he founded the H. & W. Caskey Brass & Iron Works, which has since been consolidated with the Newport News Shipbuilding Co. Five years ago he retired from business.

Frederick L. Titsworth, treasurer of the Chicago Brass Co., of Kenosha, Wis., and secretary of the Benedict & Burnham Brass Co., of Torrington, Conn., died at his home in Kenosha on Jan. 24th. He had been connected with the factory interests of Kenosha for nearly twenty years and almost all his life was spent in the employ of the Chicago Brass Co. and its allied interests.

FIRES.

Fire did several thousand dollars worth of damage to the plant of the Watkins Machine & Foundry Co., of Hattiesburg, Miss., on Jan. 31st.

The local plant of the American Steel Foundry Co., of Sharon, Pa., was damaged to the extent of $6,000 on Feb. 3rd. The most serious damage was that resulting from water which destroyed the molds in the foundry.

The plant recently purchased by John McLain & Son, of Birmingham, Ala., was damaged by fire to the extent of $3,000 on Jan 23d. It will be replaced by a modern stove foundry.

The Eureka Foundry & Machine Co.'s plant at Birmingham, Ala., was burned on Jan. 25th, entailing a loss of $2,500.

The foundry of the Pratt & Whitney Co., at Hartford, Conn., was damaged by fire on the night of Jan. 30th, to the extent of about $1,000. The fire destroyed a portion of the building adjoining the cupola.

On. Feb. 2nd the works of Stewart & Bruckner, of Nashville, Tenn., were damaged by fire to the extent of $25,000, the insurance being $7,000. The most important loss was due to the burning of the patterns belonging to the company.

The plant of the Canton Malleable Iron Co., of Canton, O., was damaged by fire to the extent of $30,000, on Feb. 7th. The buildings burned and a large number of valuable patterns were destroyed. By readjusting the work it was possible to resume work promptly without serious delay in the department.

The engine house, pattern shop, planing mill, and office of the Pittsburg, Shawmut & Northern Railroad Co., St. Marys, Pa., were destroyed by fire a few days ago causing a loss of $10,000.

Fire destroyed a large part of the pattern department of the Reliance Steel Casting Co., at Lawrenceville, Pa., on Feb. 4th. The loss is about $6,000.

The B. & O. Railroad shops at Lorain, O., were damaged by a fire which caused $100,000 worth of damage, on Feb. 10th. The machine shop, erecting shop, part of the round house, and the pattern shop, were all destroyed.

Fire at the Stanley G. Flagg & Co.'s works, Pottstown, Pa., February 11, destroyed the foundry and core house. Loss, $10,000.

The plant of Smith & Caffrey, foundrymen of Syracuse, N. Y., was slightly damaged by fire on February 9th.

NEW CONSTRUCTION.

Plans are being prepared for a new foundry which will be built as an addition to the plant of the Stacey Mfg. Co., at Elmwood Place, Hamilton Co., O.

The Aurora Foundry Co., of Aurora, Ill., are planning to build several new buildings, including a pattern shop which will be 30 by 60 feet.

The Deved Sash Weight Works, Baltimore, Md., will build an addition 16 ft. x 33 ft., one story and basement.

Shunk Brothers, Bucyrus, O., are building an addition to their foundry. The building will be 40 x 70 ft. and will be used for the storage of patterns.

The Eureka Stove Works, of Birmingham, Ala., will build a foundry 80 by 102 feet, also an office building, pattern shop and machine shop. John McLean, Sr., is president and E E. Howard, secretary.

The debris of the plant of the Economy Foundry Co., in Syracuse, N. Y., is being cleared away, to allow the plant of the Central Iron Works to be erected. This new plant will cost about $50,000.

The recent fire at the plant of the J. L. Mott Iron Works, New York City, did not do a large amount of damage and manufacturing has not been interfered with. The company is equipping its new plant and expects to commence operations there in about a month.

The Kinnear Mfg. Co., Columbus, O., has completed plans for the construction of a new plant, 200 x 400 ft., which will be fireproof. The old plant at Fourth and Lincoln streets and the foundry at Scioto and Water streets, will be sold with the land on which they are located.

With improvements contemplated by the Norfolk & Western railroad, the capacity of the shops at Portsmouth, O., will be practically doubled this year. A new tank shop 150 x 175 ft. will be erected this spring. A foundry may also be added to the shops.

The Southern Skein & Foundry Co., of Chattanooga, Tenn., has completed the plans for two buildings, one of which will be 75 by 200 ft. and the other 75 by 125 ft.

The Favorite Stove & Range Co., Piqua O., will erect an addition, 55 x 125 ft., to be used for polishing and japanning departments. Work on another large addition is now making rapid progress.

The Economic Stove Co., Jacksonville, Ill. has purchased a site and will erect a foundry as soon as the weather will permit. It is now having its castings made in Quincy, Ill. The company may also equip its foundry to do a jobbing trade in addition to its own work The following officers have just been elected for the ensuing year: President, C. F. Tonn; vice-president, James .O. Priest; secretary, John A. Unglaub. The capital stock has been increased to $25,000.

Herzler & Henninger, of Belleville, Ill., are planning to add a foundry to their plant.

Contracts have been let for the enlargement of the Western Foundry Company's plant at Chicago, Ill. The addition will be 70 by 100 feet.

The Gibson White Co., Chattanooga, Tenn., recently incorporated, will soon begin the erection of a foundry building.

The Phillips & Buttorff Co., of Nashville, Tenn., are planning to enlarge their foundry.

Golden's Foundry & Machine Co., of Columbus, Ga., are excavating foundations for an addition to their foundry 100 by 250 feet.

The Chattanooga Implement & Mfg. Co., Chattanooga, Tenn., will begin the erection of a new foundry as soon as the weather will permit. The floor space of the foundry will be 20,000 ft. At present the plant of the company comprises both implement and foundry departments. When the new foundry is erected, the present plant will be used only for the manufacture of implements after the castings are made. The present capital of the company is $50,000, but application has been made for permission to increase it to $100,000.

The Des Moines Bridge & Iron Works, of Des Moines, Ia., are planning to build a structural iron foundry this coming spring.

An additional annealing oven is now in course of construction at the plant of the Iowa Malleable Iron Co., Fairfield, Ia. An additional room for shipping purposes will also be erected.

The F. V. Deckert Mfg. Co., Ft. Dodge, Ia., which manufactures the Economy Air Radiator, has made arrangements for the erection of a plant the coming summer.

The Duff-Trowbridge Stove Co., Hannibal. Mo., will erect a new building four stories and covering an area 65 x 150 ft. The first floor will be used as a mounting room and the upper stories for storage purposes.

The Hartwell Iron Works, of Houston, Tex., are making extensive additions to their plant.

GENERAL INDUSTRIAL NOTES.

The old Joice foundry at Brattleboro, Vt. has resumed operations under a new management after being shut down for several years.

The Genesee Metal Works, of Rochester. N. Y., report that the year just closing has been a very successful one for their business and that the sales of phosphor tin alloys alone have been sufficient to produce over 2,000,000 pounds of standard phosphor bronze castings. Their superintendent, F. W. Reidenbach, believes that the present year will see their business more than doubled.

Walter H. Storm & Co., Inc., 26 Cortlandt street, New York, are making a specialty of the manufacture of light castings, such as stair treads, risers and newel posts, having made contracts with a large part of the New York trade for the year 1905 for the stair work used in tenement and apartment houses. The company will also turn out machinery castings.

At the annual meeting of the stockholders of the Utica Pipe Foundry Co., Utica, N. Y., the following officers were elected for the ensuing year: President, Henry W. Miller; vice-president, Irving A. Williams; secretary and treasurer, John A. Kernan; superintendent, John K. Gunn.

Mr. Henry S. Manning, of the firm of Manning, Maxwell & Moore, announces the fact that he has sold his entire interest to his partner, Mr. Charles A. Moore, and requests that their many friends will continue their pleasant relations with the firm. The business will be conducted under the firm name of Manning, Maxwell & Moore, at 85-87-89 Liberty street, New York City, as heretofore.

The Reynolds-Chalou Foundry Co., of Troy, N. Y., has elected the following directors for the coming year: James E. Egan, Michael H. Fallon, Michael Norton, and William Quillinan.

The Heindel Foundry Co., Hanover, Pa., has completed the construction of its new plant, which will be equipped and ready to make all kinds of castings by March 1.

The Cleveland Foundry Co., of Cleveland, O., has increased its capital stock from $200,000 to $400,000.

The plant of the Union Foundry & Machine Co., at Catasauqua, Pa., has been sold to Leonard Peckitt, president of the Empire Steel & Iron Co., for $27,500.

Chas. Hanika, of Muncie, Ind., has completed plans for the erection of an architectural iron works and foundry in that city.

The Independent Brake Shoe & Foundry Co., of Chicago, Ill., has been incorporated with a capital of $2,500 to manufacture railway specialties. The incorporators are John P. Floan, F. V. Bissell and M. A. Theiss.

The Pilsen Foundry & Iron Works, of Chicago, Ill., has been incorporated with a capital of $10,000, to do a foundry and construction business. The incorporators are Geo. Patzcker, Emil H. Schintz and Vincent D. Wyman.

The American Bell & Foundry Co., of Northville, Mich., has elected the following officers for the ensuing year: Frank S. Harmon, president; C. S. Filkins, vice president; Wm. Phillips, secretary; R. C. Yerkes, treasurer.

Wm. L. Thomas, of Osakis, Minn., has closed out his business at that point and moved to Farmington, Minn., where he has purchased the foundry of M. Moes, which he will conduct in the future.

The Virginia Foundry & Machine Co., successors to the Virginia Iron Works, of Virginia, Minn., have made many improvements and additions to their plant, including new fire protection apparatus.

The Duggan Hardware & Foundry Co., of St. Louis, Mo., has been incorporated with a capital of $50,000. The incorporators are Marcus C. Duggan, Henry C. and Jemima A. Duggan.

The Topeka Foundry Co., of Topeka, Kan., have completed and moved into their new foundry building. This company was organized some 18 years ago, and up to the present time has been living in rented quarters. They do a general jobbing business in patternmaking, foundry work and machine shop work, though they have a number of specialties, among which is the manufacture of certain line of stoves and some agricultural machinery for local use.

The Woehrle Foundry Co., of West Newark, O., is now operating its plant with natural gas from its own well, and will commence a second well. The company has a lease of several thousand acres in the vicinity of the factory.

The Kuhn Foundry Co., Buffalo, N. Y., recently incorporated, has taken over the plant formerly occupied by the Buffalo Foundry Co. Joseph Kuhn, the general manager, has closed his shops at Niagara Falls, N. Y., and moved the tools, machinery, etc., to the Buffalo plant.

The Penna. R. R. Co. are pushing the work on their gray iron foundry at So. Altoona, Pa., as rapidly as possible, so as to have it in operation early in May.

The Bessemer Foundry & Machine Co., of Butler, Pa., has been incorporated with a capital of $50,000 to do a general foundry business.

It is reported that the foundry of the Fleetwood Foundry & Machine Co., of Fleetwood, Pa., which was burned last December, will probably be rebuilt.

The Akron Foundry Co., Akron, O., has elected the following officers for the ensuing year: President and treasurer, Frank Fiebeger; vice-president, Frank Nolte; secretary, Frank B. Theiss.

I. M. Blusinsky, of Cleveland, O., will engage in the brass and iron foundry business in Cincinnati, O., having secured a site at 511 Freeman avenue.

H. N. Hills, of Gambier, O., who purchased the plant fomerly operated by the Coxey Steel & Silica Sand Co., at Mt. Vernon, O., a few weeks ago, has practically completed the organization of the Imperial Steel Co., of Mt. Vernon, which will own and operate the plant. The entire cost of the plant was more than $400,000.

The H. V. Dockray Brass & Iron Co., of Zanesville, O., has been incorporated with a capital of $10,000.

The Dayton Malleable Iron Works Co., Dayton, O., has increased its capital from $200,000 to $1,000,000. The company increased its capital to an amount that more nearly reflects the value of the business, but with no idea of material expansion other than that made possible by rearrangement.

The change of name of the Crown Casting Co., Jackson, O., manufacturer of soil pipe and fittings, to the Crown Pipe & Foundry Co. does not signify any change of policy in its business except that it expects to add some business in the way of railroad castings and general job work.

The Electric Controller & Supply Co., of Cleveland, O., has placed Mr. Geo. Magalhaes in charge of its eastern office, at 136 Liberty street, New York, N. Y. Mr. Magalhaes is a graduate of Columbia University and is thoroughly familiar with the company's products.

The Jeffrey Mfg. Co., Columbus, O., has purchased the plant of the Ohio Malleable Iron Co. of that city. The Jeffrey company has for some time been a large holder of stock of the Malleable company.

The Buckeye Steel Castings Co., Columbus, Co., will begin work at once on a new 25-ton open hearth steel furnace. This will make four open hearth furnaces at the plant and enable it to greatly increase its output. A large number of orders are now on hand, especially in the car coupler department. A large amount of work is also being done for locomotive companies.

The Brass Foundry & Machine Works, of Fort Wayne, Ind., are increasing the capacity of their wheel department by adding five more pits and five new wheel floors. They are now making 550 wheels a day and will be able to turn out 650 when the additions to their plant are completed.

The Shirley Radiator & Foundry Co., of Shirley, Ind., reports every department very busy and states that it is exceedingly difficult to obtain as many molders as are required for its work.

The Schwab Safe & Lock Works, of Lafayette, Ind., are enlarging their works by the erection of a new foundry. The new building will be 60 by 120 ft.

The United States Brass & Specialty Co., of South Bend, Ind., has been incorporated with a capital of $10,000. The incorporators are Chas. T. White, Dr. Edwin P. Moore and Wm. H. Birwith.

The Quincy Stove Mfg. Co., of Quincy, Ill., have decided to build an addition to their foundry during the coming year. They have also elected the following officers for the ensuing year: President, August Heidbreder; vice-president, Nicholas King; secretary, Julius Klemme; assistant secretary, Chas. Heidbreder; treasurer, H. C. Sprick.

The Reedy Foundry Co., Chicago, has been incorporated with a capital of $50,000 to do a foundry and machine shop business. The incorporators are: W. H. Reedy, W. E. Wakefield and Joseph Price.

The Marinette Gas Engine Co., Chicago Heights, Ill., recently increased its capital from $250,000 to $400,000. The additional capital will be used in increasing the output of the company and also in equipping the plant with additional modern tools as they may be required.

The St. Charles Brass Mfg. Co. has changed its location from St. Charles to Elgin, Ill., and its name has been changed to the Elgin Brass & Electrical Mfg. Co. It has also increased its capital from $5,000 to $10,000.

The Western Foundry Co., of Chicago, Ill., has increased its capital stock from $100,000 to $200,000.

H. A. Scharrs is planning to build a foundry in Abingdon, Ill. The building will be 100 by 200 ft.

The Pratt Foundry of Joliet, Ill., will double its present capacity. This plant has been in existence but three years, but has had a phenomenally rapid growth.

The National Machine Works, of Chicago, Ill., whose plant was recently destroyed by fire, will rebuild and resume business as soon as circumstances will permit.

The Kemp Mfg. Co., of Kankakee, Ill., has been incorporated with a capital of $55,000. The company will do a general foundry and manufacturing business.

The foundry of the Port Huron Engine & Thresher Co., of Port Huron, Mich., which has been closed down all winter, has been started up once more.

At the annual meeting of the Detroit Foundry & Mfg. Co., Detroit, Mich., the following officers were elected: F. D. Bromley, president; J. W. Thompson, vice-president; C. F. Lawson, secretary and treasurer. Also the following directors: J. W. Thompson, F. L. Bromley, C. F. Lawson, N. D. Carpenter, W. H. Miller, H. S. Taylor and W. Thompson.

The Enterprise Foundry Co., of Detroit, Mich., has elected the following officers for the ensuing year: President, Frank Smith; vice-president, Emil Zanwanseele; secretary and manager, Charles W. Carolian; treasurer, Geo. S. Cuddy.

Mr. T. J. Thompson, proprietor of Thompson's Foundry, of Duluth, Minn., has been refitting his foundry since the fire which damaged the property some time ago. He has a new line of tools and is ready for business once more.

The Menominee Electrical Mfg. Co., of Menominee, Mich., have decided to rebuild their shop and foundry which was burned recently.

H. L. Maxfield, Norman Carle and others, of Janesville, Wis., have organized a company to build a $20,000 foundry for producing gray iron castings.

The Rogers Locomotive Works, of Paterson, N. J., has been purchased by the American Locomotive Co.

The Northwestern Foundry & Supply Co., Detroit, Mich., has increased its capital from $50,000 to $100,000. The new issue consists of $60,000 common and $40,000 preferred, all fully paid. The company has just completed an addition to its foundry 64 by 120 ft. The following officers have been elected for the ensuing year: H. D. Keller, president; Thos. E. Robinson, secretary and treasurer and John F. Sheaning, vice president. Frank H. Keller has been added to the board of directors.

The Riverside Foundry Co., of Kalamazoo, Mich., report a very prosperous year for 1904, and have elected the following officers for the ensuing year: M. J. Bigelow, president; W. M. Pomeroy, vice-president; A. M. Daily, treasurer; Millard Richardson, secretary and manager.

The St. Paul Foundry Co., St. Paul, Minn., has been awarded the contract for repairing the high bridge at St. Paul destroyed in a storm last August. The contract will amount to $59,000.

The Detroit Register Co., incorporated in Detroit for $15,000 in February, 1899, has filed articles of removal from Detroit to Milan; also articles of increase in capital stock to $50,000, of which $40,000 has been paid in.

The John Watson Sons Co., of Trenton, N. J., has been incorporated with a capital of $60,000. They expect to do a general foundry business. The incorporators are John Watson, William N. Watson and Samuel E. Watson.

The Empire Foundry Co., of New Brunswick, N. J., are planning to absorb the Criterion Gas Stove Co., of New York, N. Y., and to bring all the work to their plant at New Brunswick, N. J. This will necessitate some additions to their plant.

The deal for the purchase of the Newport Foundry & Machine Co., Newport, Ky., by molders who have been on a strike for some time, has been completed, $43,100 being paid for the plant. Negotiations were broken off through the interference of President Valentine, of the Molders' Union of North America, and Mr. Weber made arrangements to dismantle the plant and take the building, which is of steel construction, apart. After the work of removal had actually begun, the strikers decided to ignore Valentine, and said they would buy the plant regardless of his dictation. They soon came to an agreement with Mr. Weber. Saturday night the non-union men marched out and for the first time since September saw the outside world. The strikers marched into the plant and took possession. Articles of incorporation for the new company have been filed. It has a capital of $40,000, consisting of 160 shares of $250 each. It has 31 stockholders.

The plant of the Wheeling Ventilating & Foundry Co., of Elm Grove, W. Va., has been formally transferred to the Wheeling Mfg. & Supply Co., who will operate it in future. The former company was organized about two years ago and operated for a short time, but meeting with various difficulties, was forced to go into the hands of a receiver, and the new company, which was organized by the creditors, secured the plant and intends to carry on the business for which the plant was originally constructed.

The Mountain City Foundry & Machine Works is to be incorporated by W. G. Gregory and his associates, at Greenville, S. C. They will erect a machine shop 32 by 50 ft., boiler room 18 by 24 ft., and a foundry 20 by 40 ft.

The Demopolis Foundry & Machine Co., of Demopolis, Ala., has been incorporated with a capital of $50,000. The incorporators are A. R. Smith, L. W. Spaulding and W. M. Spencer.

The Western Car & Foundry Co., of Anniston, Ala., will rebuild the foundry of the car plant which was destroyed by an explosion about two years ago.

The Dimmick Pipe Co., of Birmingham, Ala., will enlarge its plant and increase its capacity 100 tons per day.

The plant of the Watkins Foundry & Machine Co., of Hattiesburg, Miss., which was destroyed by fire recently with a loss of $9,000, and having insurance amounting to $3,200, will be rebuilt at once.

The Gibson-White Co., of Chattanooga, Tenn., has been incorporated with a capital of $10,000 to manufacture stoves, sheet iron ware, and also to do a general foundry business. The incorporators are Filmore Gibson, William White, W. E. White, C. A. White and D. S. Adams.

The Clarksdale Machinery, Supply & Mfg. Co., of Clarksdale, Miss., has been incorporated with a capital of $10,000 and will erect a two-story building 50 by 160 ft., to be used as a foundry and machine shop.

The Charleston Machinery & Mfg. Co. has been incorporated at Charleston, S. C., with a capital of $50,000, to do a general foundry and machine shop business. The incorporators are Armin Hartrath, A. S. Dickison, Chas. Shimer, J. Ross Hanahan, Julian Mitchell Jr., and Geo. H. Moffett.

The plant of the Tennessee Stove and Foundry Co., at Ridgedale, near Chattanooga, Tenn., is practically completed and they expect to begin operations very soon.

The Oregon Iron & Steel Co., Portland, Ore., has for a second time won a suit involving the ownership of a large meteorite whose possession was claimed by several persons. In instructing the jury the court held that while the meteorite came from without the world and was the property of no one, still it was to be considered the gift of God to the man on whose property it was deposited. The discovery of the meteorite was made by two prospectors, Ellis Hughes and William Dale, in the autumn of 1902, and claiming the ownership by right of discovery, they moved it from the property of the Oregon Iron & Steel Co. Two other men who owned land in the vicinity also set up property rights for the meteorite, which weighs 18 tons, is 25 ft. at the circumference of the base, and is four ft. high by seven ft. wide. An analysis shows that it contains 91.65 percent iron.

The F. S. Cronk Co., recently organized at Waxahachie, Texas, has leased the plant owned by T. R. Anderson and opened a machine shop and foundry.

The Sioux City Foundry & Mfg. Co., Sioux City, Iowa, builder of the Norfolk warm air furnace, will enlarge its plant and make large additions to its machinery equipment.

F. W. Braun & Co., of Los Angeles, Cal., have received gold medals covering practically their entire line of appliances and apparatus for assayers, metallurgists and chemists, which were exhibited in three groups at the Louisiana Purchase Exposition.

The Novelty Gray Iron Foundry Co., Dallas City, Tex., has been incorporated with a capital of $10,000. The incorporators are: Phil Schanz, Edgar P. Schanz and Harry A. Schanz.

The Hopkins Bros.-Springer Co., of Des Moines, Ia., are preparing to increase their equipment for manufacturing their brazing compound and brazing equipment. Their compound is known as brazol and is used for brazing cast iron, steel, or malleable iron.

The O. S. Kelly Western Mfg. Co. will erect a new foundry in East Iowa City, Ia.

The Farmers' Mutual Co-operative Association, of Blue Rapids, Kans., have completed their foundry and machine shop and are now ready for business.

The Lewiston Foundry & Machine Co., of Lewiston, Idaho, has increased its capital stock from $20,000 to $50,000.

The Independence Iron Works Co., of Ramona, Indian Territory, expect to have their new foundry in operation in the near future.

The Kingsland-Kay-Cook Mfg. Co., St. Louis, Mo., has purchased the business of the Central Union Brass Co., the Kay-Pin Mfg. Co. and the Kingsland Foundry Co., all of St. Louis. The new company will make a complete line of electric railway supplies, car trimmings, power transmission machinery and elevating and conveying appliances, also general iron and brass castings. The company does not expect to make any additions to its various plants at present, but it expects to add a complete line of metal working machinery in the very near future.

Seymour R. Church, of San Francisco, Cal., is still acting as agent for J. H. Gautier & Co.'s crucibles, and also continues to deal in foundry facings and pig iron, coke, fire brick and other foundry supplies. It is true that the old firm has been dissolved and that Schmidt & Faure are also dealing in the same line, but they do not succeed to the business of the Seymour R. Church Co., the fact being that the firm has been dissolved, and both divisions have gone into business for themselves.

H. J. Frank, whose foundry at Davenport, Ia., has been leased to the Red Jacket Pump Works, has, at the expiration of the lease, decided to start up the foundry once more.

David Fitzgerald will start a foundry and machine shop at LaGrande, Ore.

The citizens of Woodburn, Ore., have raised a cash bonus and given a building site to John McKinney, of Bremen, Ind., to induce him to erect a foundry at Woodburn, Ore.

The Carleton Foundry Co., of Peterborough, Ont., has elected the following directors: H. Colby Smith, J. J. Gordon, W. E. Scully, E. McLeod, W. J. Irons, W. A. Cathers and W. G. Haslam.

The Sonora Foundry, of Hermosillo, Sonora, Mexico, has been started recently, with Mr. Jose H. Aguilar as manager. Mr. Aguilar was educated at the Massachusetts Institute of Technology and has had shop experience in the United States. He will have a well equipped foundry and machine shop.

The Johnstown Foundry, Machine & Car Co., of Johnstown, Pa., has been incorporated with a capital of $30,000.

The Vulcan Machine & Foundry Co., of Birmingham, Ala., has been incorporated with a capital of $10,000 to operate the plant of the Wulburn Machine & Foundry Co., which they recently purchased. The officers of the company are Edward H. Wingate, president; Geo. W. Hays, secretary and treasurer.

The foundry connected with the plant of the Wm. R. Trigg Co., of Richmond, Va., which is now in the hands of a receiver, has been leased and will be operated by W. H. Woody, Jr., and Chas. Winburne, under the name of the Shockoe Foundry Co. These men were both connected with the company before it passed into the hands of a receiver.

The Farmers' Bank & Trust Co., of Henderson, Ky., has sold the Frayset Foundry & Machine Works to J. F. Hite, of Owensboro, Ky.

The Foster Mfg. Co., of St. Louis, Mo., has been incorporated with a capital of $50,000 to manufacture and deal in stoves. The incorporators are Robert M. Foster, S. Lowry, of St. Louis, T. J. Mitchell, of Helena, Ark., and R. P. Martin, of Jonesboro, Ark.

The Mesta Machine Co., of Pittsburg, Pa., has completed plans for the erection of a new foundry, whose melting capacity will be double that of the present plant. The old foundry will be used as an extension to the boiler shop. The new foundry will be 1,200 by 210 ft., and will connect with the old shop. The present foundry contains six air furnaces, and these will be increased to twelve in the new plant. The two steel furnaces in the present plant will be increased to four in the new plant. Four additional cupolas will also be added to the present equipment. They have a new brass foundry now under construction.

The Schuchert Pattern Works Co., of Cincinnati, O., has been incorporated with a capital of $10,000. The incorporators are Clarence Oskamp, A. F. Schuchert, A. W. Bauer, W. B. Hermeling and A. E. Herbstet.

S. R. Slaymaker, of Lancaster, Pa., has bought the entire business, machinery, patterns, tools, etc., of the Thomas Slaight Lock & Mfg. Co., of Newark, N. J.

The Parsons Foundry & Machine Works, Parsons, Kansas, which has recently been purchased by Millard F. Smith & Co., will be enlarged and improved by adding a two-story building, 35 by 50 feet, as a brass foundry and also by the installation of a new crane for handling heavy castings, and a new hoist for handling the iron to the cupola charging floor.

The Dillon Iron Foundry, Dillon, S. C., has been organized, and the following were elected directors: J. D. Haseldon, chairman; T. B. Stackhouse, J. W. Moore, Dr. J. H. David, T. G. King, J. H. Hamer, T. A. Dillon. The president will be elected at the next meeting of the directors, which will be held next week.

The Detroit Automatic Stoker Co., of Detroit, Mich., has been absorbed by the Detroit Foundry & Mfg. Co., and the two companies will conduct business under the name of the Detroit Stoker & Foundry Co., with a capital stock of $110,000. The union of the two companies will enable them to increase their business and serve their customers better. The officers of the new company are F. L. Bromley, president; J. W. Thompson, vice president, and C. F. Lawson, secrtary and treasurer.

The Perth Amboy Foundry & Machine Co., of Perth Amboy, N. J., has been incorporated with a capital of $100,000. The stockholders are Freeholder Peter A. Johansen, Mary Johansen and Hugh Dickson.

The F. F. Collins Mfg. Co., of San Antonio. Texas, has sold its entire stock of supplies, its equipment and good will to the San Antonio Machine & Supply Co., of the same city. The F. F. Collins Co. has been in business in San Antonio more than twenty years and is very well known throughout the Southwest.

The Los Angeles Engine Works, of Los Angeles, Cal., has been incorporated with a capital of $50,000, and will carry on a general foundry and machine shop business. The incorporators are W. C. F. Woodward, A. H. Ruggles, J. Hawkins, Anna M. Horncastle and Laura C. Hawkins, all of Los Angeles.

The Bessemer Foundry & Machine Co., and the Union Car Wheel Co., have been incorporated under the laws of Delaware by foundrymen of Pittsburg. The Bessemer Foundry & Machine Co. has a capital of $50,000 and the incorporators are J. K. Neagley, D. B. Neagley, and L. E. McKain. The Union Car Wheel Co. will erect a plant for the manufacture of car wheels and will have a capacity of 250 wheels a day.

The Standard Sanitary Mfg. Co., Beaver Falls, Pa., has purchased a building and will convert it into a foundry. The company expects to have it in operation within 30 days.

Undisplayed Advertisements.

Rate 40c per line each insertion beginning with April issue. Answers sent in our care will be forwarded.

FOR SALE.—No. 10 Sturtevant fan, nearly new, in first-class condition. Address Box 995, BALTIMORE, MD.

WANTED.—Second-hand pulley molding machine, with patterns; for pulleys, up to 36 inches. Box L., Station B., CINCINNATI, O.

WANTED.—First-class brass molder for floor work; state wages wanted and give reference. Address Box 871, THE FOUNDRY, CLEVELAND, O.

SAMPLES FREE.—Compo Crayons for marking castings, etc.; better and cheaper than talc. Address D. M. STEWARD MFG. CO., CHATTANOOGA, TENN.

WANTED.—Cupola Man who understands melting brass in cupola; state experience, wages and references. Address Box 372, THE FOUNDRY, CLEVELAND, O.

FOUNDRY FOR RENT.—20-ton cupola. Can start on our work at once. Cheap rent. Located in good city. Address Box 403, THE FOUNDRY, LAND, O.

WANTED.—Experienced foundry foreman desires position in soft plate or light grey iron work. First-class reference from present employer. Address Box 436, SYRACUSE, N. Y.

FOR RENT.—Machine shop and foundry. Centrally located. Only one other foundry in city. Population from 15,000 to 18,000. Address Box 400, THE FOUNDRY, CLEVELAND, O.

FOR SALE.—Complete working drawings for annealing furnace, air furnace, and reverberatory furnace, furnished at reasonable prices. Address Box 399, THE FOUNDRY, CLEVELAND, O.

WANTED.—By practical iron molder, situation as foreman; has had many years' experience in heater and stove plate work, bath tubs and laboratories. Address Box 395, THE FOUNDRY, CLEVELAND, O.

FLUOR SPAR.—Every grade. Quotations delivered anywhere. Cheapest suppliers. Address GEO. G. BLACKWELL SONS & CO., Ltd., Liverpool, Eng., or agents Penna. Salt Mfg. Co., Pittsburg, Pa.

FOR SALE.—Green Positive Pressure Blower made by Wilbraham-Baker Blower Co., Philadelphia. Size No. 3. Used but little. In first-class condition. Address H. W. CALDWELL & SON CO., CHICAGO.

WANTED.—First-class brass foundry foreman who has had experience on large brass and bronze machinery castings. State wages wanted and give reference. Address Box 370, THE FOUNDRY, CLEVELAND, O.

FLUOR SPAR.—We furnish best grades on the market. Ground lump or gravel. No order too small for our attention nor too large for our capacity. Prices on request. KENTUCKY FLUOR SPAR CO., MARION, KY.

POSITION WANTED.—Foreman patternmaker desires to make a change. Progressive. Large experience on all classes of work. Good executive ability. Hustler. American, 39 years old. Address Box 398, THE FOUNDRY, CLEVELAND, O.

MANAGER or SUPERINTENDENT of foundry, thoroughly competent, practical, up-to-date in modern methods, desires to make a change; reference good; solicits correspondence. Address Box 406, THE FOUNDRY, CLEVELAND, O.

WANTED.—A foundry foreman capable of taking full charge of foundry handling heavy machine castings. One who is willing to buy an interest preferred. Established business and a good chance for the right man. Address "FOUNDRY," P. O. BOX 816, ST. LOUIS, MO.

HEATER MANUFACTURERS ATTENTION.—I am a foundryman with an extended experience on the above goods. Would like to open a correspondence with a view of engaging. Will furnish A1 references from past employers. Can mix from analysis and handle help with intelligence. Address Box 407, care THE FOUNDRY, CLEVELAND, O.

WANTED.—Working foreman for small iron foundry working two or three molders, melting two or three tons three times a week. Address SOULE STEAM FEED WORKS, MERIDIAN, MISS.

WANTED.—Core room foreman, experienced in handling men and familiar with work similar to small gas engine cores for automobile work. Good wages and steady work for the right man. Address THOS. B. JEFFERY & CO., KENOSHA, WIS.

WANTED.—Second-hand 30-ton cupola in good condition. Address Box 393, THE FOUNDRY, CLEVELAND, O.

BLOWER BARGAINS.
Roots Second-hand Blowers, bought, sold or exchanged for new ones. Address,
H. M. PAPWORTH,
120-122 Liberty street, New York City.

WANTED.—A second-hand foundry cupola in good condition—capacity, fifteen tons per hour. Address Box 394, THE FOUNDRY, CLEVELAND, O.

WANTED.—Position as foundry foreman, 25 years' practical experience on heavy and light machinery castings, also molding machine; 8 years a foreman. A No. 1 mixer of iron and handler of men. First-class reference. Address Box 404, THE FOUNDRY, CLEVELAND, OHIO.

POSITION WANTED.—By a foundry foreman who would like to make a change. A practical molder with a technical education. Can mix iron by analysis, and make analysis if necessary. An A1 cupola man. Address Box 401, THE FOUNDRY, CLEVELAND, O.

FOR SALE.—Foundry, machine and boiler shop. Best equipment within radius of 300 miles. Excellent and growing field for manufacture. Town 10,000 in Oregon. Mining, Agriculture, Saw Milling. Price right. Terms easy. Address "OREGON," Box 408, care THE FOUNDRY, CLEVELAND, O.

FOR SALE.—Manufacturing site occupied by the Brylgon Foundry; located on Lafayette Street in the city of Reading, along Lebanon Valley Railroad; lot 475 x 90 feet; large buildings with power plant; with or without machinery; possession at once. Apply to MENGEL & MENGEL, 9 North 6th Street, READING, PA.

WANTED.—Position as foundry foreman by a young man competent to handle a large force. Wide experience in green, dry sand, loam and molding machines, cupola practice and mixing iron; one competent to put a foundry on systematic working basis. A1 references. Address Box 397, THE FOUNDRY, CLEVELAND, O.

WANTED.—Foundry foreman, capable of taking charge of foundry making light automobile gas engine cylinders and similar work. One experienced in handling men and familiar with molding machines and with different iron mixtures. Good wages and steady work for the right man. Address THOMAS B. JEFFERY & CO., KENOSHA, WIS.

WANTED.—A practical molder, with 21 years' experience on stove plate, heater work and general jobbing, six years as foreman, would like to correspond with some firm who wants a foreman, or assistant superintendent; can mix and melt iron and handle men to good advantage. Good references. Address Box 402, THE FOUNDRY, CLEVELAND, O.

WANTED.—Manager, six o'clock man, energetic, with practical engineering experience, wanted to take charge from March, of new foundry and pattern shop, output 300 to 500 tons per month. Applications to be favorably considered must state fully and accurately ideas as to shop management and control of foremen, also experience and where gained, of cupola practice, mixing of metals, coke consumption, patternmaking, plate and machine molding. Applicants should also state class of work previously engaged in producing. Technical education a recommendation. Present manager regrets giving up owing to ill health. Applications treated in strictest confidence. Apply giving age and salary expected to "MANAGER," care WM. PORTEOUS & CO., GLASGOW, SCOTLAND.

(Continued on page 46.)

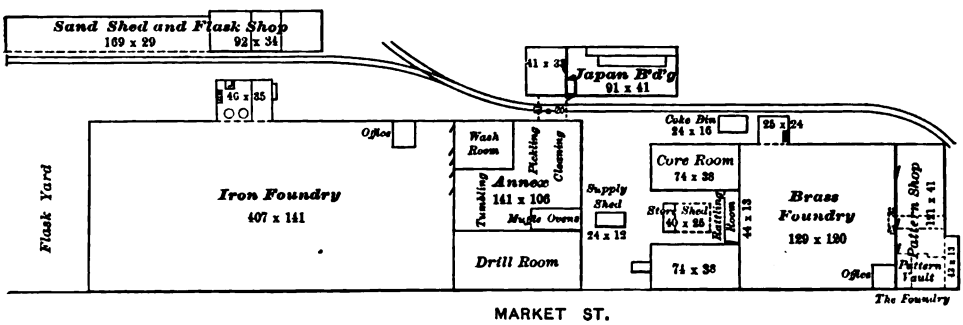
THE FOUNDRY

Vol. 26, No. 2. *CLEVELAND, OHIO, APRIL 1905.* *Whole No. 152*

Iron Foundry of the Yale & Towne Mfg. Co., Stamford, Conn.

The high grade of the product turned out by this company would lead one to expect good practice in their various departments and the iron foundry is certainly not disappointing in this respect. To any experienced molder who passes through it it shows evidence of extremely careful work, both as to the manner in which the work is conducted and as to the manner in which it is laid out. Practically the entire output is small work and hence no crane system is necessary. The foundry building proper is 141 by 407 feet. It is divided into two bays, and is amply lighted by skylights, monitor roof, and side lights. The foreman's office is situated near one end and commands a view of the entire floor. The molding equipment consists of squeezer machines, the floors for each machine being ten feet wide, and varying somewhat in length according to their position in the foundry. There are also a number of bench work floors for use especially in connection with the heavier work. As much of the work is duplicated, great care has been taken in designing the flasks so that they will produce the castings with the minimum amount of sand and also so that they will prevent all danger of straining of the mold or shifting of the parts of the flask. The flasks of each set are interchangeable.

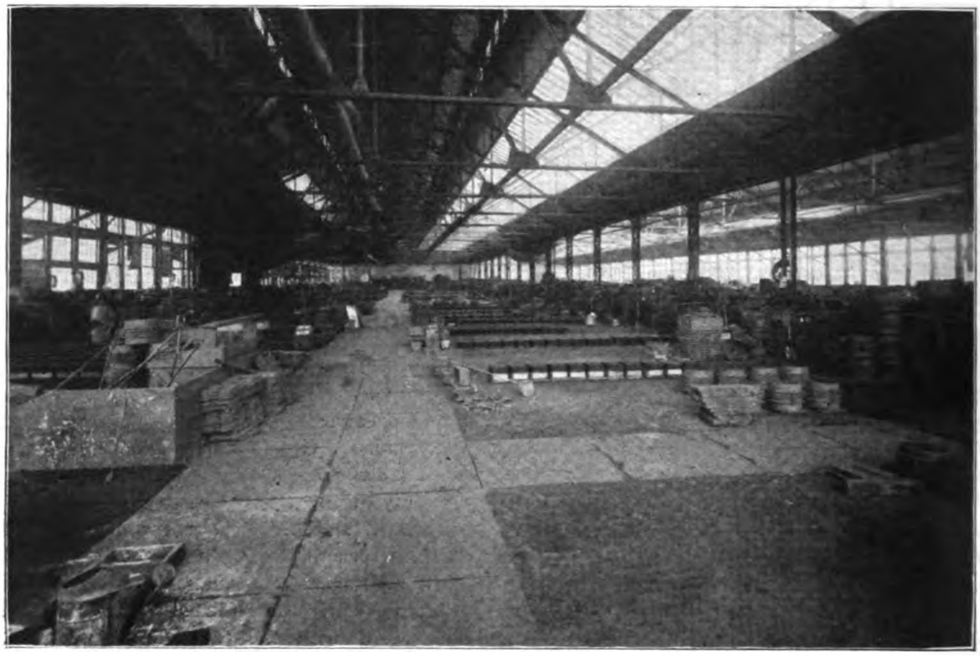
Along the center of each bay there is a runway 8 feet wide made of iron plates, and for their larger work they have truck ladles which run upon this runway. There are also suitable runways connecting the two bays of the foundry at the ends and at the center opposite the cupolas. The majority of the iron, however, is carried from the cupola in 35 pound hand ladles. Great care is taken to see that these ladles are always in good condition. It is the duty of one man to see that they are properly lined and dried. For the drying of the ladles a special stove or furnace is used. This is situated near the cupola and has six doors in the front which can be lifted up and the ladles introduced with the faces down upon iron bars inside. After the ladles have been lined and air dried, they are placed in this furnace, warmed up and thoroughly baked so that they are ready for use when the iron comes down. For the larger work ordinary shank ladles are used. The drying furnace for the small ladles is fired with coke.



FOUNDRY OF THE YALE & TOWNE MFG. CO.

Melting Equipment.

The melting equipment consists of two cupolas, 48 and 72 inches respectively, inside the shell. These cupolas are at present lined to 48 and 36 inches inside the lining. The iron and coke for the cupola are kept in the yard and in sheds adjoining the cupola and lifted to the charging platform by an elevator. The trucks are brought in from outdoors. Blast for the cupola is furnished by an electrically driven fan.



GENERAL VIEW OF IRON FOUNDRY.

Heating and Ventilating System.

The entire foundry is heated and ventilated by the Sturtevant hot air system, the ventilating plant being located near the cupolas and air distributed to the various parts of the building through suitable ducts.

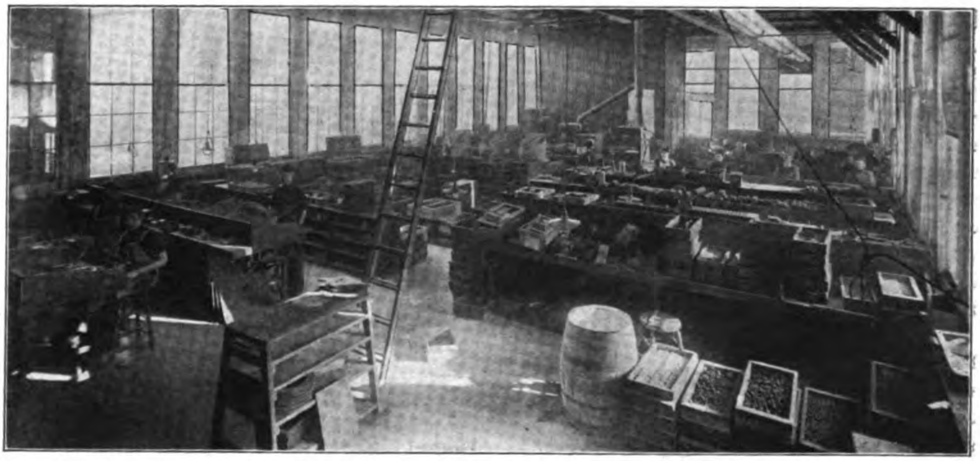
Preparation of Sand.

Bins having a capacity equivalent to nearly a year's supply are provided for the storage of different classes of sand used for both the iron and brass foundries. The sand for the iron foundry is prepared in a room adjoining the sand storage sheds in which are located a rotary sand sifter, a shaking sand sifter, and a grinding mill. The different mixtures of sand are placed in bins from which they are taken to the foundry in wheel barrows or trucks. As most of the work is light the sand burns out slowly and hence the new facing sand used is in many cases sufficient to keep the sand heap in condition, but the fact that the work is light also necessitates very careful regulation of the facing mixtures to suit them to the work for which they are intended.

Flask Shop.

Adjoining the sand sheds is located the flask

1. CUPOLAS AND LADLE DRYING FURNACE. 2. SAND MIXING DEPARTMENT.



CORE DEPARTMENT.

shop, in which the wooden flasks are made or repaired. Metal flasks may also be fitted up here. In this department the jackets for the snap flask molds are also made. The department is equipped with the necessary wood working machinery fcr attending to the flask work and whatever carpenter work may be necessary about the foundry.

Core Department.

The same core department supplies cores for both the iron and brass foundries. It is located between the two foundries and receives its supply of sand from either one of the sand mixing departments. The most of the cores are small cores made from carefully fitted metal core boxes and are dried in Millett ovens located in the room. The core department is lighted by windows on the sides and the end and also by skylights along the monitor roof. On account of the highly specialized work it is necessary to specialize in the core work also, and as a consequence very high grade metal core boxes are used in most cases, and great care is taken to design them in such a way that the operators can handle them easily and rapidly.

Finishing of the Castings.

The light nature of many of the castings necessitates very careful treatment in the finishing departments. These departments occupy several rooms at the end of the iron foundry. First, there is a battery of tumbling barrels for cleaning any class of castings for which this is suitable. There is a pickling bed for pickling castings upon which scale is objectionable, and a series of annealing furnaces for annealing the lighter grades of castings. Many of the castings require no finishing except the drilling of a few small holes and hence a department called the drilling room is located next to the cleaning room and in this much of the work is finished by drilling in jigs on drill presses, so that the parts go directly from the foundry to the japanning department or the assembling department.

1. FLASK DEPARTMENT.

2. CLEANING DEPARTMENT.

CORE SAND BINDERS.*

BY J. S. ROBESON.

It is true that every material used for this purpose is a compound; but so is the sand a compound; so is the pig iron a compound; though certainly no salesman has yet had the nerve to offer you any Carnegie chill casting compound under the impression that you would recognize it as pig iron. The materials in question are employed solely for their adhesive qualities.

You may say that they do other things, but be that as it may, the basic reason for their use is to bind the sand together so that it will take and hold the desired shape. Certainly such a material is a sand binder and when used for cores, a core sand binder. This is my plea and I hope my justification for the new name. Perhaps this question of a name is along of a line with some other points in core shop practice in that they need more attention, that they need changing, that they need reform. It has been brought forcibly to me again and again as I travel from foundry to foundry that the core shop has suffered, and is suffering from neglect.

On page 157 of *The Foundry* for December, in an article by Charles A. Smith, note the following words; "Every superintendent ought to get acquainted with his core room foreman and give him credit for what improvements and additions he can make in the department, for the core room is certainly an important department and much saving can be made here by close attention to details." That is a strong call from the man in the shop. Can you afford to be deaf to it?

Because you happen to pick up—after a few trials—a man who can make cores without much loss of labor, sand or castings with the local sands and binding materials, hence the convenient ones, or with some that he or you used elsewhere with success, then you think your problem has been solved. And you are wrong.

I believe that I am perfectly safe in saying, and this without any intention of throwing bouquets at you, that in addressing the Foundrymen's Association of the Pittsburg district; I am addressing the men who have made a closer study of the business than any other such body in the United States and yet I doubt if there are five of you tonight who can tell what their binders cost per ton of sand mixed; not half who can tell off hand, with any accuracy, what their core sand mixtures are and I will warrant if there are any who think they know, that one visit to their core room will prove they are in error.

For a reason, which is not quite clear to me, the men in this trade, do not get the assistance from the shop foreman, the foundry superintendent and the office force that the molders or the cupola-men receive. A man who is thus forced to work out his own salvation, alone and unaided, without help or assistance from that part of the management that is supposed to know more, will naturally make workable cores from the materials at hand, if he can. They may be the best, they may be the worst permissible, but he does not know the degree of their goodness or badness nor anything as to cost and this because there is no method of comparison.

Here is a trade without a literature. Can you expect progress from a nation without a written language? In what is probably the most read book of the few relating to the foundry trade, there are just 4½ pages devoted to core making out of nearly 400, and half of these 4½ pages is padding. This neglect has brought about another condition of affairs. The sand, the binders, the manner of drying have been worked out for each foundry and the coremaker that lasted long enough to get good results has held the job until he and not the office was tired. This fact has made him narrow, localized and with a high opinion of his own skill in sands and binders and therefore difficult to teach. As an example of this, and also of several other related points, I recollect meeting a boss coremaker a short time ago who was dissatisfied with the results he was having.

This in itself was remarkable, and especially so, because in my business of selling a core sand binder, I had just left the office of the company he was working for, where I had been told that they could not even listen to my story because they were getting good results from their cores and there was no use in disturbing any part of the plant that was running smoothly and well. It turned out that this man had been working for a rival concern, located a few miles away, and because of his good results had received and accepted an offer from his present employer, who at the time was having trouble from excessive breakage of cores, much blown work and many condemned castings, owing to defects in the cored work. Now he had used my binder in

*Read at the February meeting of the Pittsburg Foundrymen's Association. Mr. Robeson is president of the American Glucose Co.

the old shop and I was, of course, curious to know why I had lost his trade and anxious to secure it again. I knew something of the sands in that locality and after an examination of those he was using, I worked out the following story. The figures that I now give are not the actual ones but are relatively correct.

The sand mixture in his old shop was:

30 percent old or gangway sand..........$0 03
30 percent loamy sand, at $1.80 per ton.. 0 54
40 percent bank sand, $0.75 per ton...... 0 30

Total $0 84

One part of gluetrin to 40 parts of sand.

This binder cost 15c per gallon or 3¾c per quart delivered. The sand ran 900 quarts to the ton and on these figures the binder cost 84 cents per ton of sand mixed and the total cost for each ton of core sand, ready for cores, was $1.68.

The new shop had been using,

40 percent sharp sand at $1.20 per ton...$0 48
60 percent loamy sand at $1.80 per ton... 1 08

Total $1 56

1 part of flour to 12 parts of sand.

Flour at that time cost $25.00 a ton and on a weight of 1.1 pounds to the quart the cost of binder per ton of core sand mixed was $1.03 and the total cost for each ton of core sand, ready for cores, was $2.59 per ton. The work from these cores was bad. They had tried rosin, on and off, with equally poor results.

With these two sands, which were different from the loamy and sharp sands of his old shop, this man tried, with and without old sand, gluetrin as he had used it before and failed. He then went back to the original practice of this shop—flour—and by changing the mixture slightly and seeing that the proportions of the sands and the sands to the flour did not vary, and forbidding the coremakers to run to the flour sack whenever they liked, which had previously been allowed, he managed to get much better results than they had formerly secured. This satisfied the office but the work was not as good as in the old shop. He knew it and was dissatisfied but apparently helpless. Here was a man that looked ready for my material and, in spite of his failure, was easily persuaded to try it again.

I was certain after examining his sands that the whole trouble was in the sand mixture and several were tried, this being finally adopted as the most satisfactory and economical.

40 percent old or gangway sand........$0 00
40 percent loamy sand at $1.80 per ton.. 0 72
20 percent local bank sand at $0.75 per ton 0 15

Total $0 87

1 part of gluetrin at 3¾c a quart to 50 parts of sand cost 67¼c per ton of sand mixed and the total cost for each ton of core sand, ready for cores, was $1.54½.

This was successful, reduced the breakage of cores and did away entirely with any blown castings or trouble from the size of cored holes, besides making a clear saving of $1.04½ on each ton of core sand mixed. But note—here was an intelligent man of his class, holding a responsible position—he had charge of twenty-five coremakers—who, after one or two trials had given up his problem and drifted back into practically the same methods as this shop had always used. It seems to me that there were two causes at work here. The one that his superiors did not know enough to push him for better results nor to aid him with suggestion, and the other, that he, himself, lacked sand experience—did not realize that simply because sands look alike they may be different and that one or two trials are not sufficient to test a sand or a binder. Incidentally he learned how to figure the cost of his mixture; something he had never done before.

Under this heading of Core Sand Binders, any material possessing adhesive qualities might be included. Local conditions and sands have caused the use of some that seem absurd to the general trade. A consideration of these freaks is omitted and only those that are found in general use are considered. These are:

Solids

1. Dextrine
2. Flour
3. Proprietary Dry Mixtures
4. Rosin

Liquids

1. Fish oil
2. Glue
3. Gluetrin (Proprietary Liquid)
4. Linseed oil
5. Molasses
6. Proprietary Oil Mixtures
7. Rosin oil

At the first glance it is seen that these can be divided into two distinct classes—the solids and the liquids. It is to the difference in action of these two conditions of matter, when used as core sand binders, that I wish especially to call your attention, and not to the merits or demerits of any particular one.

Let us consider the work that is required of a binder. The local conditions in each shop vary greatly and it is only possible to name these requirements in a general way.

A good binder must make a core that

1. Is strong both green and dry.
2. Is weak and rotten after the casting is cooled.
3. Is not easily affected by moisture.
4. Will give off but little gas.
5. Will dry quickly.
6. Will not change in size.
7. Has a low cost.

The ideally perfect core sand binder is one that mixes easily with the sand, making a mass that packs with but little work in the box, leaves it freely and leaves it clean. Is strong enough before baking to stand alone, without sagging or deformation and retain sharp edges. Such a core must now bake in the shortest possible time and when baked be hard enough to stand rough handling, be weak enough to yield to the contraction of the iron in cooling, porous enough to permit the gases to escape freely, and after cooling leave the casting easily and cleanly.

The usual method of preparing the mixture is to put on the floor the required quantity of each kind of sand, previously selected by the foreman or boss core maker, and to spread or sprinkle on top of this pile the necessary amount of the dry, or liquid binder that is to be used, afterwards wetting the mass, as may be required, with water.

This pile is then cut over and shoveled, being finally put through a riddle and then delivered to the coremaker or put in a pile ready for their use. There are various modifications of this practice in the way of riddling the sand before the binder is put on, mixing in a machine, etc. Every step that is taken to increase the thoroughness of the mixing is a step taken in advance. The more perfect the mixture the better the core.

If you are using a dry binder, flour for example, and it is simply dumped on the pile of sand, wet down and put into barrows, wheeled to the coremaker and made up into cores, you will have a core that consists of a gob of flour with a little sand in it, next to a gob of sand with a little flour in it.

It does not take a very wise man to know that such a core will be weak and it is a fair presumption that when the hot metal strikes one such loaf of bread in the core there will be a large volume of gas given off at the point and a resultant blown casting. This is actually the condition that exists in every core made with a dry binder to a greater or lesser extent. The more thoroughly the sand and binder are stirred and mixed together, the more even will the distribution be and the more nearly will the ideal condition be reached of having each grain of sand surrounded and attached to the next grain by the binder. For this reason dry binders should be very finely ground—be very much finer than the sand. This condition of fineness is true of flour, not quite so true of rosin and not nearly so much so of the dry binder mixtures on the market.

Flour is delivered in a much more finely ground condition than any particle of ordinary sand and if kept dry, will remain loose and free from lumps. Rosin is not usually, in fact I think never, so finely ground but, even if so, will immediately, because of the moisture and heat in the air, under normal conditions, commence to stick together and ball up. All the dry mixtures sold will act in the same way as rosin, in varying degrees, so that the result, with these two latter materials is that, however much labor may be spent on the mixing, the mass will never be nearly so uniform as with flour.

If flour is therefore the best, let us see how bad it is. The sand is composed of grains, varying in size from particles as small as a needle point up to ¼ inch. The variation in the shape of these grains is much greater than in the size and in fact the shapes met with are so various that they cannot be numbered. This matter of shape, as long as the size is within the limits already mentioned, is the most important. Roughly speaking these grains may be divided into two kinds, those that are angular having sharp corners and numberless projections and recesses; those that are rounded, the projections having been rubbed off so that the grain is a more or less true sphere with a highly polished surface.

Some years ago I was engaged in the manufacture of steel by the basic Bessemer process and, as part of our practice, it was necessary for us to make dolomite bricks. For this purpose we used an exceptionally pure dolomitic limestone, which was crushed in a jaw crusher, then pulverized to nearly the fineness of flour, dampened with water and pressed into building brick form and size on an ordinary brick press, then calcined at a very high temperature. The work of making these bricks was progressing very satisfactorily, the breakage in handling from the brick press and in piling in the kilns being practically nothing when there was offered to us a limestone from another quarry. Repeated careful chemical analyses of this stone, showed that it differed but little from that we were using. If anything it was more nearly pure and a contract was placed for a larke tonnage. Shipments arrived and were dumped and used indiscriminately with the older stone. Later investigation showed that they were probably in about equal proportions in the stock pile, so that the pulverized material coming to the brick press was about half and half of each stone. With its use trouble immediately resulted. The bricks were very weak, as they came from the press. Fully 25 percent were broken in the handling at this point and from 10 to 15 percent more when piling in the over. Various means, such as increasing the water, the pressure on the press, etc., were tried but with no success in doing away with the trouble. Instant relief was necessary so that the use of the new stone was stopped, with an immediate stoppage of the trouble, while the investigation proceeded. The microscope finally told the story, as it showed that the older stone crushed and pulverised into granular grains, while the newer stone gave almost perfectly rounded particles. The geological explanation carried this back to the manner of the original deposition or formation. It can easily be realized that under pressure these granular pieces would knit into one another, projection into recess, so that their very shape made a strong bond, whereas the rounded grains would simply have their polished curves the one against the other—without bond and in fact of a position and of a shape to encourage a sliding or rolling action and consequent weakness and breakage. This same story is exactly and similarly true of the core sand. The bond is increased in the cores, however, by the use of some added material, that by the aid of water or of heat becomes adhesive or is so of itself. This, however, is but an aid. It does not change the condition produced by the first shape of the sand grains. The more angular they are the less work the added adhesive has to do, the more rounded, the greater the work.

There is a common expression used in the foundry, that a sand is sharp, and on examination, I have found that such a sand invariably shows the angular grains to which I have referred. I have not come across, however, any expression or word or name, that denoted the reverse of this condition, the non-sharp kind. All of the non-sharp kind that I have used contained some loam or clay, so that for want of a better name, I have called this loamy sand. Now I do not know whether it is true or not that these rounded grains only occur with the loamy admixture. It is my experience, however, that the two always appear together, and when they do so appear, that the loam acts as a binder. Thus the two kinds of sand, the sharp sand and the loamy sand, are both, in a measure, self-binding though from entirely different causes and the bond, as formed, is of a different nature. I have never found a case where, what might be termed the angular bond, was strong enough to make a core without an added binder, but I know of one loamy sand, and there are probably others, from which hard cores can be made without the addition of any adhesive.

In the New England district the universal base of all core sand mixtures is beach or bank sand and the usual binder is flour, together with a small amount of the proprietary dry mixtures. These sands are sharp, of varying degrees of fineness, and in all probability from the same source, the sea shore. The present beach sand being sometimes dug from a little distance back from the tide line, or directly on the beach, thus subject to daily intermittent soaking with salt water, or dredged from under the water. It may thus be more or less weathered or strongly impregnated with salt. The bank sand is from inland points and if these deposits are, as I think, but the remains of an ancient sea shore, then the only difference between the two sands is that the one has been weathered and washed free from salt and the other has not.

In the foundry district in and around Philadelphia there is a very large amount of Lumberton, Millville and other sands containing loam or clay used. The characteristic core sand of this section is thus a loamy sand and the usual binder is flour and a certain amount, greater I think than in New England, of the proprietary dry mixtures. Here now are two sands entirely unlike in their physical conditions and self-binding powers that are in practice bound and made into cores with the same adhesive material—flour—and requiring about the same amount. It is evident, therefore, that the binding power of the angles on the sharp sand is replaced by the adhesive property of the loam in the loamy sand. From this view of the situation, it would seem that it made no difference which sand was used, that the one was as good as the other.

There is, however, a very great difference in the structure of the two cores. With the sharp sand, the angles fit into one another but not perfectly. The flour particles press into the recesses, rest on the projections and lay against the body of the grain but not flatly, completely, perfectly, the very irregularity of the shape makes the joint between the grains of sand themselves, as well as with the binder, imperfect, and as a consequence the mass is not solid nor compact but consists of grains tightly and perfectly joined at different points to the surrounding grains but with open and unjointed parts at other points. In other words, the interstices are not completely filled. Thus the core is porous, though strong, with ample opportunity for the travel through its interior and out to the surface of any gases that may be generated.

With the loamy sand the story is different. Here the binding is entirely dependent upon the adhesive strength of the loam and the flour. With the addition of water these two mix intimately and easily, and as the rounded and polished surfaces of the sand grains come together under the pressure of the ramming, this fluid mass of adhesive, greater in proportion to the whole mass with the sharp sand, you must remember, is forced and flows into the open space between these grains a much smaller space than with the angular sand and as a consequence these intergrain spaces, that would form passages for the travel of the gases, are almost closed up. In other words, the interstices are almost completely filled. Thus the core is strong, with the same amount of flour is actually stronger than when made from sharp sand—but very dense and compact. As a proof of this you will find that the man who is using sharp sand as his base for cores, seldom or never talks about trouble from his cores blowing. He cares little whether the core sand binder offered him has gas in it or not but the man using the loamy sand is ever on the watch for that point. He knows that he must be careful and, because flour gives off so much smoke and gas when the hot metal strikes it, he is ever seeking for a substitute that will give him less trouble and reduce his loss from core-blown castings.

Now it has been noted that the binders commonly used can be divided into two classes, the solids and the liquids, and also that in preparing the core sand mass, water is invariably added. With the exception of the rosin all of these dry binders are more or less soluble in water. The rosin, after it has been mixed and molded, likewise becomes liquefied or partly so, because of the heat in the core oven. At the first glance it would seem then that they all became liquids during the operation and that there is thus really but one class of binders. This is not entirely correct, because, first, some of the mixing is usually done before the water is added, and, second, because only enough water can be added to make the mass properly damp for ramming. This amount is not sufficient to make the dry binder thin, fluid, and in a condition to run freely through the sand. The most casual examination of a rosin made core, will show that the sand and binder are very improperly mixed. The rosin can be seen in spots throughout the mass and it is, as a fact, the poorest and per unit of volume, the most expensive of the binders, mainly because of the impossibility of proper mixing. This but goes to prove, the well known fact, that a more uniform mixture can be attained when a liquid and a solid are put together than when two solids are used. The thinner the liquid the more easily will it run through the mass of sand and the more rapidly and completely will it cover each grain. It would, therefore, seem that a liquid binder would, with the least work, give the most perfect mixture, provided, of course, that it was thin enough when put on the sand to flow freely through it. It must, also, be sufficiently adhesive per unit of bulk so that the amount added will not make the sand too damp.

Some experiments recently made, for the purpose of proving this theory, showed that the efficiency of all of the dry binders could be increased by better mixing but that the expense of so doing was greater than the cost of the binder that was saved as, aside from the difference between hand and machine mixing, this means, simply, longer continued work on the sand mass. With the liquid binders a somewhat different method seemed possible. Having the idea in mind that the thinner the binder the better the mixture, a material was selected, gluetrin, that mixed easily and readily with water, and a test was then made by putting this on the sand in the form of a spray with compressed air. At the foundry where this was tried their regular core sand mixture was:

20 percent old or gangway sand..........	$0.00
60 percent Millville gravel @ $1.40 per ton	0.84
20 percent local sharp sand @ .90 per ton	0.18
Total..............................	$1.02

One part gluetrin mixed with one part of water to each 50 parts of sand.

This sand ran 930 quarts to the ton and the binder, therefore, at 3¾c a quart, cost 70 cents per ton of sand mixed and the total cost for each ton of core sand, ready for cores, was $1.72. Their practice was to put the sand on the floor in three layers as dumped from the wheelbarrows. This was then shoveled and cut over about three times while dry. The gluetrin had previously been mixed with an equal amount of water and was then sprinkled over the bed of sand from a watering pot. The pile was shoveled over once, sprinkled with water, and put through a riddle on a pneumatic shaker and taken to the coremakers. In the first test with the compressed air spraying, the same amount of gluetrin and water was used and the cores were entirely too hard. Various trials were made until now their practice is to wheel in the sand and to put it on the floor as formerly but as the sand is shoveled and cut over, while dry, it is thrown rather high from the shovels and is met by a spray of gluetrin and water. This is done twice and it is then put through the riddle as before.

The sand mixture is now:

40 percent old or gangway sand..........	$0.00
40 percent Millville gravel @ $1.40 per ton	0.56
20 percent local sharp sand @ .90 per ton	0.18
Total..............................	$0.74

One part of gluetrin, mixed with two parts of water, to 70 parts of sand. Thus the binder costs but 50 cents per ton of sand mixed, and a total cost of $1.24 as compared to $1.72—a saving of 48 cents per ton.

Here is a credit for old sand, binder and labor due to the method of mixing alone, and a small debit for compressed air. As the oils and oil mixtures are too expensive per unit of volume for general use, and this without regard to their merits or faults in any other respect, but few tests were made with them. Such as were made, however, agreed with this result.

AIR COOLED AUTOMOBILE CYLINDERS.

BY JOHN J. BEERS.

In response to the article in the February issue of *The Foundry* on the loss of air-cooled automobile cylinders, I wish to make the following statement. Possibly every one who reads *The Foundry* knows that this is one of the most delicate classes of work that the foundryman has to contend with. It requires the utmost care and attention on the part of the coremaker to produce sound castings. In my everyday practice on this class of work I follow four or five rules which I have applied in making the cylinders, and have been successful both in steam and gasoline engine work. First, be absolutely sure that the core is thoroughly vented and all vents connected. Second, be equally sure that you have sufficient outlets to relieve the core of any gas pressure from the gases formed in it. Third, if there are any outlets from the top of the jackets, take care that the projections to form these openings are not longer than the prints on the patterns, as if this is the case, the cope will press too hard on these points and strain the core until the joint opens. This allows the iron to flow into the core, resulting in a bad casting. Fourth, if the above precautions do not produce sound castings the molder should be cautioned against ramming too hard or the use of too wet sand. In my own practice I never dry the molds.

A Complaint.

Iron went up two cents today,
Will it go more tomororw?
The broker's price we have to pay,
Iron went up two cents today.
I wonder what the "firm" will say?
I'll soon learn to my sorrow,
Iron went up two cents today,
Will it go more tomorrow?

W. L. ZIMMERMAN.

Molds for Making Repairs with Thermit.

The sand used in making molds for thermit castings must be clean, hard and sharp. Such sand, mixed with an equal amount of ordinary brickmakers' clay, will make satisfactory molds. If fire clay is used the molds should be composed of 65 percent fire clay and 35 percent sand. Fire clay molds, however, are hard to dry.

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TRADE OUTLOOK.

The foundry pig iron market has not changed materially during March, though there has been a good aggregate of sales to a variety of buyers in different parts of the country. No. 2 Southern iron can still be had at $13.50 at furnace, in large lots, though small lots in some cases have brought $13.75. On Northern iron the Central Western furnaces are quoting $16.00 a ton. In Southern Ohio some iron has been sold in the past month at $15.50 per ton at the furnace for No. 2 foundry, though it is probable that at present it would be difficult to obtain it for less than $15.75. The pipe interests have been buying since our last report.

Reports are coming in from all parts of the country showing that there are orders for larger tonnages of castings on the foundrymen's books than there have been for a long time, and the general outlook in this direction is very encouraging. The increase of orders on the books of the foundrymen has caused many of them to place orders for foundry iron.

The malleable interests have received a considerable tonnage from the agricultural trade, but orders for malleable iron for railroad and car work have not been equally conspicuous. This is probably due in part to the fact that cast steel has been replacing malleable iron to some extent in connection with these lines of manufacture. On the other hand malleable foundries have gained, perhaps, at the expense of gray iron foundries.

The steel foundries report a great increase in the number of orders received and most of them are running with practically a full force of men; some, in fact, are working over time.

The price of foundry coke has increased somewhat, and there are indications that it may go still higher. Ordinary foundry coke is now quoted at $3 per ton at the oven in the Connellsville region and $3.25 is asked for special grade. It is probable that steady or slightly increasing prices will rule in foundry lines for some time, on account of the fact that the prices of the blast furnace raw materials that is iron ore and coke are both increasing and that the railroads are showing a tendency to put freight rates back where they were before the slack times of 1904.

All this means that if the foundryman is to conduct his work at a profit he must obtain a somewhat higher price for his castings, and such re-adjustments as this always take time.

MANUFACTURE OF BY-PRODUCT COKE.

In another part of this issue we publish an article on By-Product Coke, telling of its manufacture and also of the manufacture and use of some of the by-products. As by-product coke is becoming more common and is being used by foundrymen in many centers, it is but natural that all foundrymen should be interested in the subject and in the matter of its production, and we are glad to be able to present such a good article on the subject. The paper was read before the Philadelphia Foundrymen's Association.

NEW BOOKS.

"High Temperature Measurements," by H. Le Chatelier and O. Boudouard. Authorized translation by G. K. Burgess. Published by John Wiley & Sons; second edition. Price $3.

This book contains 341 pages of very interesting matter descriptive of pyrometers and high temperature measurements. Formerly such a work would have been of interest only to the scientific investigator in connection with laboratory work, but now that pyrometers are used so extensively for the control of temperatures in all classes of metallurgical work, the subject has become one of vital interest to all connected with the different branches of the metal industry in which the metal undergoes heat treatment. In this work the authors in the preface give a short review of the history of high temperature measurements and then follow with an extensive treatment of the subject of high temperature measurements, describing the many different devices which have been invented for this purpose and showing the relative advantages of each.

Considerable mathematics has been used in some portions of the work, though one not familiar with higher mathematics would gain a great deal of information by reading the other portions of the book.

A CASTING DIFFICULTY.

BY O. B. CECIL.

In answer to the matter entitled "A Casting Difficulty," by A. L. B. in a recent number of *The Foundry*, I may give the following experience with this kind of work. Some years ago, I had to cast some rolls of the nature described, and after spoiling several, I tried the following method with success. I had a pattern made with the prints one-half inch out of center, and molded them with the print nearest the bottom and in a horizontal position. In preparing the mold, I placed 2½ inch shrinking heads along the pattern every eight inches and dried the mold thoroughly, using a sand mixture that would bake very hard. I heated the shaft red hot and placed it in the mold a few minutes before pouring. The iron was melted to a white heat and in pouring I allowed the metal to flow through the feeding heads until the iron lay perfectly quiet and then used a churning rod until the metal was congealed. Castings made in this way turned up nice and clean. Very little stock is required on the bottom or under side of the casting and by allowing all the stock on the top it enabled me to be sure that the work would turn up clean. I wish to lay great stress on the fact that the shaft must be as hot as possible and the cast iron must also be very hot or good results will not follow.

I also had a great deal of success in casting brass bearings in driving wheel boxes made of cast iron. This saves a great deal of expense in a machine shop, which is quite an item in a big railroad system. In doing this it is necessary to have the iron boxes hot before pouring the brass.

*CHEMISTRY IN FOUNDRY PRACTICE.

BY N. W. SHED.

The last fifteen years has brought a great change in the making of cast iron. Before 1890 little attention was given to the different grades of cast iron, but since that time machinery manufacturers have demanded a hard, wear resisting metal and also a soft metal which may be easily machined. The control of this metal is governed by its chemical composition and for this reason chemists have come from the blast furnace and steel making plants to the foundry. Before 1890 the chemist was looked upon as an ornament or a fad, and most foundry men wondered why they were allowed to exist, and to some foundrymen today the chemist is looked upon as a close ally of the devil and his suggestions are regarded as rank heresy to the orthodox teachings of the old practice. The feeling was much the same among the old blast furnace men twenty odd years ago.

In the old days a man that made soft iron did not dare to make hard iron. Only four years ago I met a foundryman who would not make a pully for his own shafting. He would

*Read at meeting of Buffalo Foundrymen's Association, Feb. 21.

have to make them of harder iron than his regular mixture, so he went outside and bought his pulleys. He said, "Nobody shall ever accuse me of making anything but dead soft iron," and he keeps his word, for all his iron simply crumbles as the tool steel strikes it. The hard iron was usually a question of luck and scrap. When the scrap was hard, the iron would be hard; if the scrap happened to be soft the iron was soft, but was called hard. The method of mixing irons was a curious mixture of good judgment and superstition. A great many pigs were broken and the fractures examined. It took a good observer and a good guesser to judge iron by fracture and in case there was doubt it was considered the thing to put in a good dose of Scotch. Scotch iron was a panacea for all iron ills and was supposed to be a softener. Then there were some special strong irons, which were spoken of with a certain reverence and were supposed to have virtues handed down from the remote past. These were known to gain strength from the hills whence they were made. These were mixed with the Scotch, and scrap added with fear and trembling. Occasionally white iron was seen, but this was regarded as the black beast of iron founding and any one charging white iron into a cupola was looked upon as insane or a tempter of providence.

The grading of iron by fracture was one of the difficulties in the old method of mixing. At one time there were nineteen different No. 1 irons. They varied from ½ percent silicon to 4 percent and were all No. 1. No. 3 in one brand would match No. 1 in another. No. 1 and No. 2 were usually confused, and often No. 2 was supplied for No. 1 and the founder paid the No. 1 price. When we know that two or three grades of iron can be distinguished on a single pig, when we know that a No. 3 grade can be transformed into a No. 2 grade by slower cooling, when we know that iron cast in a dry pig bed is a lower number than iron cast in a wet pig bed, we can form some idea of the difficulty of grading by fracture.

It would be interesting to know how many foundrymen still cling to this method of grading iron. No doubt many think that the iron is graded by fracture, but, if the truth were known, every ton they receive is graded by analysis. But this handling of iron by number and by tradition is unknown to the mixer by analysis. The chemist ruthlessly cuts into the iron with two acids, separates the graphite, silicon, sulphur, phosphorus and manganese and marshals them into columns, and now the mixing is simply a pairing off of these substances:

A high silicon with a high phosphorus; a low silicon with a low phosphorus; a low manganese with low sulphur; a high manganese to carry off sulphur; low silicon and low phosphorus for strength; high silicon and high phosphorus for softness; a low silicon and high manganese for close grain.

Nothing is left for guess. A formula is decided upon and the various irons are figured to so mix that the result shall not vary over one-tenth of one percent. The old method was more picturesque, but the modern method is more sure. There are foundrymen here who will admit that mixing can be done better by analysis, but they say the blast furnace people make the analysis of every carload of pig, and that is good enough for them. This may do in making the softer grades of iron, but when it comes to making hard iron the furnace analysis is seldom reliable. The fact is the analysis given of the carload is not an analysis of the pig in that car, it is simply an analysis of the cast from which that carload was loaded. As one cast of iron may vary from 10 to 60 in silicon it is easy to see that a man may get a carload of iron of which the furnace analysis is 1.50 silicon, but the actual analysis is 1.00 silicon. If he goes on the supposition that the furnace analysis is right, he will get white iron if he uses any hard scrap, and he will probably get all his light castings white if he uses nothing but pig. These cases are happening right along. Castings that should be 1.25 to 1.60 percent silicon, have finished below .70 silicon because the furnace analysis did not represent the car. The blast furnace sample is taken from the liquid metal as it runs from the notch at the furnace, and though the analysis of that sample doubtless is correct, yet that sample is very different from one obtained from the car itself. Another disadvantage of relying on the blast furnace is that the furnace people will claim that the only satisfactory iron is supplied by them. The claim is often made that the ores, limestone and even air used by them have a marvellous power to give both strength and softness to the iron, while ores and air of a rival furnace have no such power. If this claim is admitted by the foundryman, he is at the mercy of the pig iron maker, and the blast furnace fairly owns the foundry. This shuts out the foundry from the open market when prices are much lower. If the foundryman is free to buy, he can often pick up lots of off malleable or off basic iron which he can use to advantage. In the same way, many lots of scrap, two or four dollars below the price of pig may be picked up and the right pig bought to go with it.

But the great value of the chemist to the foundry is in the making of special irons.

Some castings must be very strong, some must resist corrosion by acid or alkalies, some must expand and contract with sudden change of temperature. This requires a careful balancing of the different elements in the irons, and in many cases the correct amount of manganese will solve the problem. A special iron much heard of lately is semi-steel. The name is a poor one, but like many other poor names, it seems to stick. It is practically not steel at all. It is simply a cast iron strengthened by melting steel with it. It generally gives a foundryman a creepy feeling to melt steel with pig iron, but when he gets up his courage, he finds the metal clean, close-grained and strong and not a bad imitation of air furnace iron. Semi-steel should have a definite composition and its real value is in the low graphite. The plates of graphite scattered through cast iron tend to weaken it, and if the amount of graphite is lessened the iron becomes stronger. Even in running a cupola a chemist may be of value. Cupolas are slagged with limestone or fluorspar as a flux. The amount of limestone is generally given by the chemist. The coke ash should be fluxed as well as the sand on the pig. The old way was to add a shovelful of limestone to every charge of iron, but now from 100 to 200 lb. of limestone are added to a charge, the amount depending on the coke ash and upon the amount of scale and sand on the pig iron and scrap. Lime, if properly used, will absorb some sulphur from the coke and will also save iron from going into the cinder. This may be considered a small point, but it means saving many tons of iron in the course of a year.

But the coke sampling is the most important. Many cokes are sold with 1½ to 2 percent sulphur, which means a moderately low silicon, white iron castings. Sulphur should not go above 75 percent in coke, and many foundrymen find out that the coke is poor after they have made two heats of white castings, then they test the coke. This is much like locking the door after the horse is stolen.

The chemist is often of value to the purchasing agent in keeping up the standard of quality in blackings, flours, core compounds and oils that are often supplied heavily adulterated. Many alloys, fluxes, dopes and physics are constantly pushed on the foundry with a high sounding name. It is usually some familiar compound that is thrust upon him at double the price. Numerous revivors, restorers, are often proposed to make the poorest iron good. Most of these inflated schemes can be punctured by a test in the right place. A careful watching of every part of the work is essential to success and a great deal of this watching may be done by the chemist who tests the supplies and tests the product.

SHOT IRON.

BY P. M. WOODEN.

I have just read in the March issue of *The Foundry* the article on shot iron. My experience with the same began in February, 1904, when I induced my people to put in a "Sly" mill and was able to obtain from my daily drop from 1,200 to 1,800 pounds of shot iron. I used this in each charge during the heat in sufficient quantities to use up each day's shot iron just as it was ground or washed, and then watched and waited to hear from our machine shop, but never heard a word. So the first of last May I induced my people to get another Sly mill and an electric motor and put it to work on my dump, which was one year old.

On the 29th of September I had the dump cleaned up and a little over 118 tons of shot iron to the good and used up into castings. During this time I had also used all of the regular quota from the daily drop. I send all of my gangway riddlings through the Sly mill, and have melted as high as 5,500 pounds of shot iron per day with no evil results, aside from a little extra slag. The cupola is 64 inches and the charge consists of 6,000 pounds of iron on the bed and 3,000 pounds on each charge. I enclose a few shavings planed from one of our saw mill knees, which I picked up as I was coming through the machine shop.

Note by the Editor.—The shavings referred to were evidently from the finishing cut on a planer, with a tool taking a cut about an inch wide. The shavings were rolled up into neat, compact rolls, showing an exceedingly good soft gray iron. From this it is evident that Mr. Wooden has solved the shot iron problem so far as his foundry is concerned.

The Marinette Iron Works, Marinette, Wis., has been purchased by W. O. Carpenter, of Menominee, A. C. Merryman, of Marinette and T. C. Miller, of Chicago.

MAKING OF BY-PRODUCT COKE.*

BY EDWIN A. MOORE.

INTRODUCTORY REMARKS.

By way of introduction Mr. Moore said:

Mr. President, Secretary and Gentlemen: I want to say in prefacing the paper that the president very wisely referred to it as the paper which will be read. When the arrangement was made with me in regard to talking to you about by-product coke plants, etc., I was ill and since recovering have been obliged to get over the country through snow storms and otherwise, and I feel greatly indebted to Mr. D. T. McLeod for preparing most of the detail information (or, in fact, all of it) in connection with this paper.

The opening portion, however, does not make any reference to the introduction into this country of what is properly known as by-product coke ovens, and I know that it would be a matter of interest to all of us Philadelphians who are assembled here—I say us because it was my privilege to be identified with the machine shop and foundry business many years ago, consequently I feel more at home with you than I would otherwise.

So far as my personal knowledge is concerned, the by-product coke oven was introduced into this country about ten years ago through the efforts of Dr. F. Schniewind, of the United Coke & Gas Co., of New York City. He was at that time instrumental in the formation of the Otto Coke & Chemical Co., of Pittsburg, Pa., and is now vice president of the United Coke & Gas Co., of New York City. He induced Mr. William L. Elkins Jr. to become interested in the by-product coke oven and to take up the matter. At about the same time the Solvay Process Co., of Syracuse, N. Y., became interested in the same question and installed a small plant of Semet-Solvay ovens in Syracuse in connection with its soda ash works. By the combined efforts of Dr. Schniewind and Mr. Elkins arrangements were made to build a plant of Otto-Hoffman ovens at the works of the Cambria Steel Co., who had become interested in this question and had sent experts abroad to investigate the matter with a view to making coke at its steel works from coal obtained from its mines nearby. Now the United Coke & Gas Co. and the American Coke & Gas Construction Co., with which I have the honor to be connected, are affiliated with a corporation known as the American Coal Products Co., of which Mr. George W. Elkins (son of the late Mr. Willim L. Elkins) is president. You will see as the paper is read how the by-products are utilized by the American Coal Products Co., particularly as regards tar and ammonia, which result from the carbonization of coal in the by-product ovens. The reason for the introduction of the by-product oven as seen by Mr. William L. Elkins Jr. was largely because of the waste that takes place in carbonizing coal in what are popularly known as the beehive oven, in which the celebrated Connellsville coke is made. As a matter of reality, I guess we get very little of what was originally known as Connellsville coke.

The contrast I wish to bring to your attention is between Connellsville, or beehive, and by-product coke; that which is made in beehive ovens, where all waste products from the coal go into the atmosphere, of which about 30,000,000 tons of coal are carbonized every year. About 20,000,000 tons are carbonized into coke for blast furnace use and the balance for sundry other manufacturing purposes. In this conection we would like to impress upon your mind the fact that there goes off as waste products from this 30,000,000 tons from 80c to $1 per ton. Consequently you can see the advantage of saving these waste products because it is not American-like to see so much waste go into the air. Our friends, the financiers, are usually after the mighty dollar, and they don't like to have it get into the air where they can't get it.

By-product ovens have been in use throughout Germany and other parts of the continent and largely through England, during the past 25 years. There is not anything in the way of a beehive oven in operation in Germany at the present time. Those of you who have been abroad know (I have seen pictures of it) that the by-product coke oven produces all the coke that is used abroad, through Germany particularly, but not so much as yet in England. The introduction into this country was comparatively slow at the first, but the field has greatly increased during the past three or four years. There have been built, or are in course of construction at the present time in the United States and Canada about 3,950 by-product ovens, about 2,605 of these being of the Otto-Hoffman and United-Otto systems, carbonizing approximately 15,000 tons of coal per day and about 1,345 Semet-Solvay, carbonizing approximately 8,000 tons of coal per day,

*Paper read before the Philadelphia Foundrymen's Association, Feb. 1, 1905.

amounting in a year to a total carbonization of approximately 8,400,000 tons. It will thus be seen that, although the number of by-product coke ovens apparently does not approach the number of beehive ovens installed, on account of the difference in the size of the charge and the shorter coking time, the coke made in by-product ovens will be much nearer the total coke tonnage of beehive ovens than would at first be supposed.

Mr. Moore's Paper.

The paper, which was profusely illustrated, was then read by Mr. Moore as follows:

It is not the writer's purpose to discuss the relative merits of the different types of oven, but to describe the method of manufacturing coke and the recovery of the by-products from the coal by means of the Otto-Hoffman system. Let us first discuss the objects of a few of the typical plants which have been built, and the writer will then describe a specific plant.

The first plant built in this country was two batteries of 30 ovens each for the Cambria Steel Co., at Johnstown, Pa., which was mentioned before. In these ovens was coked a low volatile coal from the company's own mines, to produce a coke satisfactory for blast furnace use, and incidentally the recovery of tar and ammonia. On account of the low percentage of volatile matter in this coal, the gas produced was only a little more than sufficient for heating the oven batteries. This plant has been in operation now for approximately ten years and two additions of 100 ovens each have been made at different times. Another plant is that of the New England Gas & Coke Co., at Everett, Mass., consisting of 400 ovens, built for the purpose of manufacturing from Cape Breton coal a coke satisfactory for foundry, locomotive and domestic purposes, but the principal object of the plant was to supply illuminating gas to the City of Boston and the surrounding suburbs; also the recovery of the ammonia in the form of sulphate of ammonia and the tar which is distilled by a coal tar company in the near vicinity of the plant. Another plant is that of the Dominion Iron & Steel Co., Ltd., at Sydney, Cape Breton. This was built for the purpose of manufacturing from Cape Breton coal a coke satisfactory for blast furnace use, the surplus gas to be used in open-hearth furnaces, and the recovery of tar and ammonia. The plant of the Maryland Steel Co., at Sparrows Point, Md., consisting of 200 ovens of the long type, has for its object the manufacture of blast furnace coke, illuminating gas for use in the city of Baltimore, and the recovery of tar and ammonia in the form of either concentrated liquor or sulphate of ammonia.

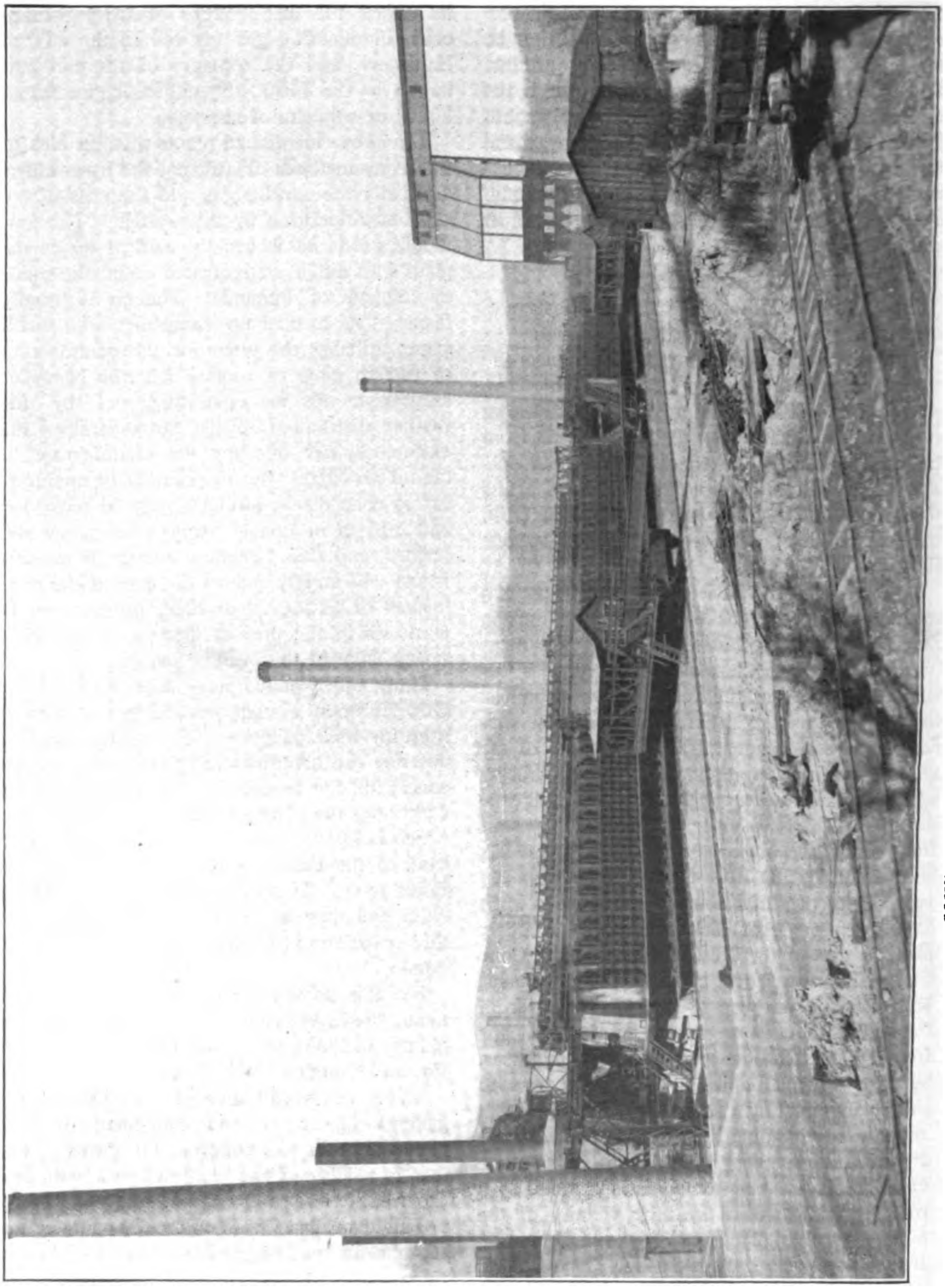
The above mentioned plants give an idea of the many methods of utilizing the by-products especially the surplus gas and the uses of the coke manufactured by this system. The ammonia produced is usually worked up at the plant into either concentrated ammonia liquor or sulphate of ammonia. The tar is usually disposed of to coal tar companies who distill same, utilizing the pitch for the manufacture of roofing pitch or roofing felt, the heavy or anthracene oils for creosoting, and by the further distillation of the tar separating the various lighter oils for the manufacture of tar oil products. By this method of manufacturing coke the by-products may be recovered and utilized in various ways, as above described, and thus become a source of revenue which will largely reduce the cost of the coke instead of letting all of these products go to waste as in the present manner of manufacturing coke in the beehive ovens.

Many other plants have been built of the Otto-Hoffman system, having many various uses for their products. The writer can best describe the manufacture of coke and the recovery of the by-products by this system by describing the plant of the Camden Coke Co., which is located in Camden, N. J., on the East bank of the Delaware River, near the Kaighn Point ferry. This is a plant which is near at hand and may be visited by the members of this association if they are especially interested.

[At this point the speaker, with a stereopticon, displayed views of a number of coke plants, including those of the Cambria Steel Co. and Camden Coke Co.]

These views will give you an idea of the general appearance and equipment of coke plants both in this country and abroad. The last is a view of the plant which I will now describe.

This plant has for its object the manufacture of coke for metallurgical, foundry and domestic purposes, the use of the surplus gas for illuminating purposes, and the recovery of the ammonia in the form of concentrated ammonia liquor, the tar being disposed of to other parties who distill same for the recovery of its different products. The coke made at this plant during the two years of its operation has been dis-



COKE PLANT OF THE CAMBRIA STEEL CO. AT JOHNSTOWN, PA.

posed of to blast furnaces, foundries, and also very largely for domestic purposes. For the latter purpose, when the coke is discharged from the ovens, it is crushed to various sizes, and at the present time the greater portion of the coke produced is sold to supply the demand for this purpose. The illuminating gas which is made is distributed at about 10 lb. pressure to Trenton, 38 miles away, supplying the intermediate towns between Camden and Trenton, and is used at Camden under ordinary pressure. Entirely satisfactory results have been obtained by this plant, both in the coke produced and the large quantity of illuminating gas made, which very much exceeds the production of most plants of this size on account of the installation of Benzole enrichment, this being a special feature of this plant which will be described later.

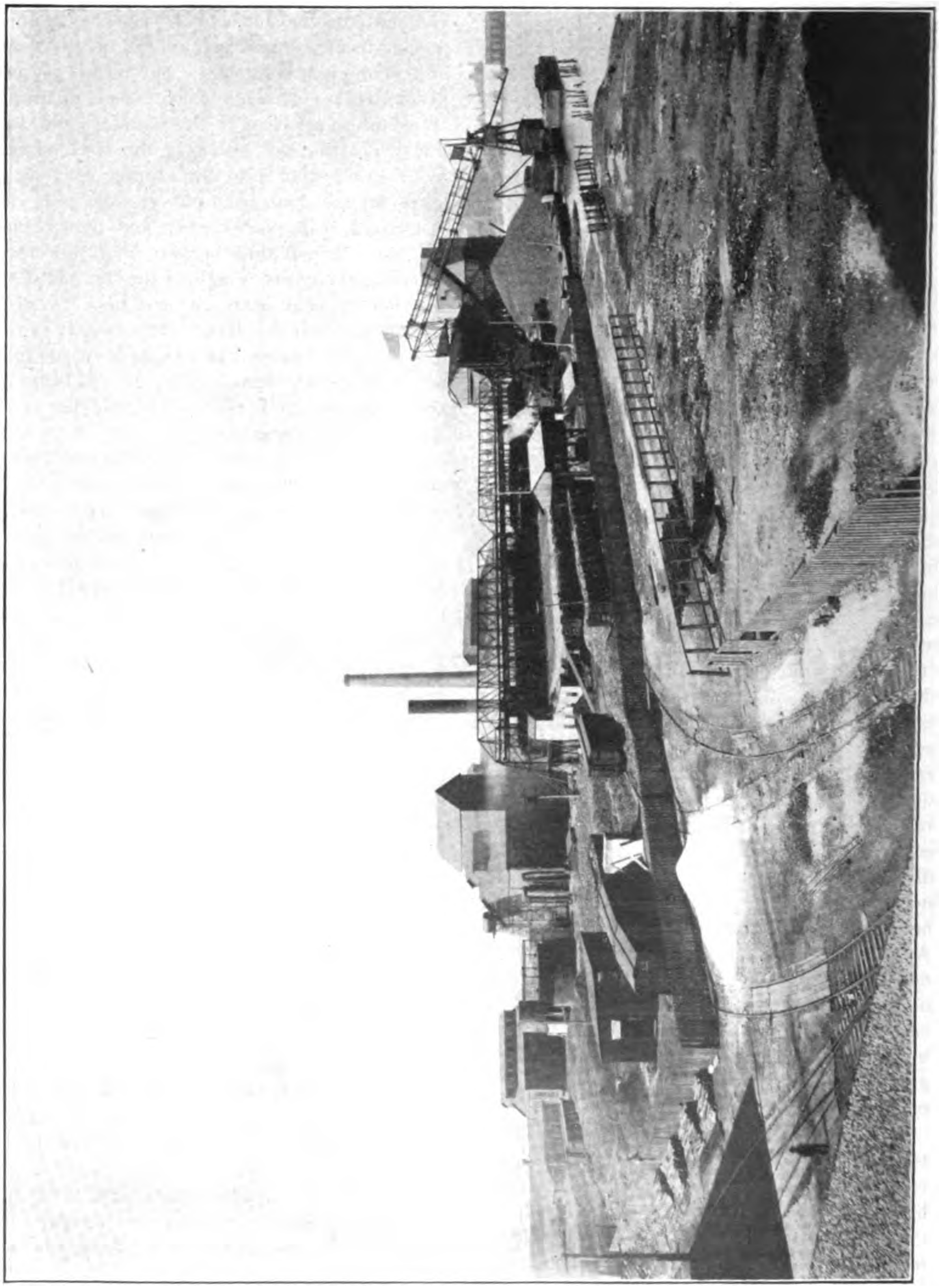
The Quality of Coal.

One of the most important things to be determined in connection with a new plant is the coal to be used. This should be a good grade of bituminous coal of from 25 to 32 percent volatile matter and about 68 to 75 percent of carbon. In selecting the coal, the purpose of the coke should be considered in order to get a coal which will make a coke best adapted for the purpose intended, whether for metallurgical, foundry or domestic purposes. The coal should be low in sulphur—not over 1¼ percent for metallurgical purposes—but the lower the better for all purposes, so that washing will not be necessary at the coke plant. If obtained in the form of "run of mine," it must be crushed at the plant to sizes which will pass through a 1½-in. mesh; the finer the better, especially if the coke is for metallurgical purposes, because the fine coal will make a stronger and more uniform structure in the coke, which is better adapted to carry the burden in blast furnaces, and if there is any slate in the coal it is well broken up and more uniformly distributed throughout the mass. The by-product oven permits various grades of coal to be used and also various mixtures to be used. At this plant two or three grades of coal are used to get certain grades of coke and also to obtain a large quantity of illuminating gas. A coal of this class should yield per ton about 70 to 75 percent of coke, 9,000 to 10,000 cu. ft. of gas, 10 gallons of tar, and 5 pounds of ammonia.

The coal for this plant is brought by barge to the docks on which travels an unloading crane which picks up the coal from the barges by means of a clam shell bucket and discharges it, either into the coal storage bin or to the storage pile. The crane has an inclined frame supported on upright frames at either end and travels on a double track on the wharf end and on a single track on a girder at the coal bin end. The crane travels the length of the coal bin and wharf, and both traveling gear and the carriage for the bucket are operated by means of steam engines and boiler mounted on the frame or carriage at the wharf end. At the coal bin end is suspended a steel hopper feeding into a pair of roll crushers operated by electric motors. The bucket is suspended from a carriage which travels up an inclined track attached to the main trusses, and discharges the coal either in the steel hopper to be crushed or into the storage pile, or it takes up the coal from the storage pile and discharges it in the crusher and thence into the bin. It will thus be seen that the crane traveling the entire length of the bin and dock can pick up coal from any part of a barge or storage pile and discharge into any part of the coal bin. This crane has a capacity of 100 tons per hour and the storage pile has a capacity of approximately 8,600 tons. The coal bin is of the Berquist suspension type, carried on two outside rows of columns at a sufficient height above the oven batteries to allow a clear space between same for the charging larry to travel under the bin to be filled from same by spouts connected to the bottom, these being placed at intervals of 12 ft. throughout the length. The bin is constructed of steel and is lined throughout with concrete and expanded metal. It has a capacity of 1,800 tons of coal, which is sufficient for about 3½ days supply for the 100 ovens, which carbonize approximately 500 net tons of coal per day, giving as a result approximately 375 tons of coke, 1,850,000 cu. ft. of 18-candlepower gas, 2,500 pounds of ammonia, and 5,000 gallons of tar. Over the oven batteries are steel trusses extending the entire length; on the lower portion of these a track is placed on which travels the larry for charging the ovens. These trusses have a clear span from the coal bin to supports between the two batteries, and from this point to the further end of the next battery. They are made of steel and are of the usual form of bridge truss. The larry consists of a steel frame mounted on wheels, and from this frame are suspended six steel hoppers with spouts and grates at the bottom of same. The larry is operated by a 15-h. p. motor and travels the entire length of the two batteries and discharges about 6¼ tons of coal into each oven in its regular turn by means of holes in the top of the ovens corresponding to the spouts.

The Oven Batteries.

Let us now describe the oven batteries. These consist of a mass of brickwork supported on a concrete and brick sub-structure. This sub-structure consists of concrete walls on which are built brick arches forming a floor



THE CAMDEN COKE CO.'S PLANT AT CAMDEN, N. J.

or support for the ovens proper. There are 50 ovens in each battery, these being 17 in. wide, 6 ft. 6 in. high and 33 ft. long and are placed 2 ft. 10½ in. on centers. Between each oven is a set of vertical heating flues, directly below same combustion chambers and above same a horizontal flue. Below each oven is an air chamber and below each battery under two of the supporting arches are regenerators running the entire length and connecting at one end into a common flue to the stack. The openings or ports serve as a passage for the supply of the preheated air from the regenerators to the heating flues, and for the exit of the off-gases from the heating flues to the regenerators. One of these openings is placed directly below each oven. The burners are placed on either side of the battery at the end of the combustion chambers. The gas and air supply for heating the flues is alternated on either side of the battery every half hour, the well-known Siemens regenerative principle being used for the reversal of the gas and air supply.

Let us now follow the manner of heating the ovens, supposing that the gas is burning on the right hand side at the present time. The air supply for the burner is discharged by a fan at the end of the battery into the lower flue of the regenerator on the right hand side, passes up through the openings in the lower arches, through the heated checker brick, through the openings into the air chamber. A damper is placed over each opening which allows the regulation of the air supply to each set of flues. The air passes through the ports in the wall between the air and combustion chambers into the combustion chamber, where it mixes with the burning gas and passes up into the vertical flues (which are divided into two sets midway the length of the oven by a wall extending from the bottom of the chambers to the top of the flues). The burning gases pass from the vertical flues through the upper horizontal flues over the partition wall into and down through the vertical flues on the left hand side into the combustion chamber, through the openings in the wall into the air chamber and down through the opening into the regenerator, giving up a large amount of the heat in passing through the checker work to the lower flue, and thence into the stack. The arrangement of gas burning and the air supply is reversed each half hour by means of valves at the end of each wharf. In this manner the air is always preheated from about 800 degrees Fahr., the temperature of the supply from the fan, to about 1,500 to 1,800 degrees Fahr. when entering the combustion chambers, and the temperature of the off-gases to the stack is reduced to about 600 degrees Fahr. The gas is supplied to the burners from the mains which connect with the regulating gas holder. The heat value of the fuel gas is approximately 550 B. t. u. per cu. ft., and about 6,000 cu. ft. of gas are required per ton of coal carbonized, giving a temperature in the ovens of about 2,500 degrees to 2,800 degrees Fahr. The air supplied by the fan is preheated before entering the regenerators in the following manner:

The air is drawn by the fan through the middle arches of the substructure the entire length of the battery, through openings in the top of each arch into an end chamber from which it passes through the small flues under the chambers the entire length of the battery into a corresponding chamber at the other end, and from this is drawn by means of a pipe into the fan and passed into the regenerator on either side. In this manner the air is heated from the temperature of the atmosphere to about 800 degrees Fahr. before entering the regenerators. By means of preheating the air and the system of regeneration, the maximum efficiency is obtained from the gas burned and higher heats maintained in the ovens than would otherwise be possible.

The Principle Involved.

It might be well at this point to state the principle utilized in the manufacture of coke in by-product ovens. The oven chambers constitute a closed air tight and gas tight chamber heated externally, the heat transmitted from the heating flues to the coal through the brick walls, thereby giving a dry distillation as in a closed retort. By this means the volatile matters in the coal are driven off as the heat further penetrates the charge in the retort, leaving as a residue the coke consisting of 80 to 85 percent of fixed carbon. By means of connections made to each oven the volatile portion of the coal in the form of gas, aqueous vapors, tar oils, and other condensable products are taken off into circular steel pipes, and by passing the same through various apparatus this volatile portion is cooled and the gas washed, obtaining thereby a clean commercial gas, and the condensable portions are recovered in the form of tarry oils, aqueous ammonial liquor, and benzole and its homologues. The principal portions of the oven brickwork, especially those having to withstand the higher heats, are constructed of the higher grades of refractoy clays, the principle of construction being the outgrowth of many years of experience in this line, as a result of which the structures as built at the present time are able to withstand the effects of expansion and contraction due to heating and cooling, and due to varying temperatures in the regenerators and the cooling effect of placing a charge of moist coal suddenly in contact with the highly heated oven walls. We have not as yet been able to obtain as good a grade of brick in this country for this construction as are obtained in Germany. This is largely due to the fact that we have not as good clays for their manufacture.

The oven chambers proper, as above stated, are 33 ft. long, 17 in. wide and 6 ft. 6 in. high. They are closed at either end by cast iron, brick-lined doors, which in some cases are luted with clay and in other cases are especially constructed to give a metal joint or seal, thereby doing away with the necessity of clay luting and thus reducing the cost of labor for this work. In any case the ends are air-tight and the coal is charged into these ovens at six points in the length of same and the coal leveled off to a uniform height by means of bars or rods passed through small openings in the doors at the ends. By later improvements in the method the leveling is done by means of an electrically driven ram or bar which travels in and out, thereby cutting down the labor expenses in this connection and giving much more uniform charge.

The entire battery is heated uniformly throughout, means being provided for regulating the amount of gas to each set of flues. The gas driven off from the coal during the first portion of the heating is rich in illuminants and has an average heat value of about 650 B. t. u. This gas, for the first ten to fourtween hours, is taken off into the collecting main through the standpipe, neck and drop valve indicated. At the end of this period the drop valve on this side is closed and the gas for the remainder of the coking period is taken off through the standpipe, neck and drop valve into the main on the opposite side. The gas for this last period is lower in illuminants and has an average heating value of about 525 B. t. u. Its illuminating value will vary with different coals from about 3 to 8 candle power. The illuminating value of the rich gas given off during the first period will vary from 13 to 19 candle power. One set of standpipes and valves are provided for connecting each oven to the gas mains on either side. After the coal has been in one of the ovens for a period varying from 24 to 30 hours, all the volatile matter has been driven off and the charge is ready to be pushed from the oven. At this time the doors are raised on both ends by means of electric hoists which travel on a track directly over the doors on either side, and the charge of coke is pushed from the ovens by means of a ram or bar with a large head. This ram is mounted on a steel frame of the pusher machine and is propelled by means of an electric motor connected through intermediate gearing to a driving pinion which meshes with the rack on the under side of the ram. The ram is driven by a 50-h. p. motor and the machine is traversed lengthwise on a track extending the length of the two batteries by means of a 25-h. p. motor connected by intermediate gearing to the driving shaft of the wheels on each side. After the charge has been pushed out on the coke wharf on the opposite side of the battery, the ram is withdrawn, the doors on both ends are dropped into place by means of the hoist and set hard up against the brickwork by bars and wedges and luted with clay, or in the later improved type of self-sealing doors by means of eccentric bars, and the oven is then ready to receive another charge.

Method of Charging.

It is so arranged that the ovens are charged at regular intervals in the following manner: 1st, No. 1 oven is charged; next, No. 10, No. 20, No. 30, No. 40 and No. 50; then beginning at the other end of the battery with No. 5, No. 15, No. 25, etc. By this manner of charging a more even and uniform heat is maintained throughout the batteries, thus giving a more uniform coking time for each oven. Each oven is pushed in its regular sequence in the manner above mentioned. The coke wharf upon which the coke is pushed consists of a concrete and expanded metal wharf or floor supported on concrete columns and is covered with red brick. After the coke is pushed from the ovens on to this wharf, it is quenched by means of water from a hose, using as little water as possible in order to thoroughly drive out the heat and prevent the coke from burning after discharged into the cars or on to the conveyors.

When quenched it is loaded into steel barrows and discharged into cars from the edge of the wharf, or through holes in the wharf on to the belt conveyor which travels the entire length of both wharves and discharges into the crusher at the ends of the batteries. If the coke is for foundry or metallurgical purposes it is loaded directly into the cars as "run of oven" coke, or it may be divided; the ends and top portion of the charge being discharged on to the conveyor and delivered to the crusher, and the middle portion of the charge being loaded into the cars for foundry use.

The coke to be crushed is conveyed to the end of the battery, and by means of a cross conveyor, it is conveyed to a roll crusher located at one end of the coal bin. It is run from this crusher up an inclined belt conveyor to the storage bin. At the top of this bin is placed a motor-driven rotary screen 8 ft. diam. x 40 ft. long. The crushed coke is passed by means of a chute into this screen and discharged from the same into five different compartments in the bin, these compartments each having a capacity of 250 tons of coke. By this means the coke is sized and the various sizes, viz.: 2½ in., 2 in., 1½ in., ⅞ in., and breeze, can be loaded from either side of the bin into wagons, cars or barges. It will be noticed that this bin is located on a dock, which allows a barge to come up on either side of the same. In discharging from the bin the coke passes over screens in the chutes, which takes out the dust or breeze; this breeze being used in the boiler house for generating power. Certain sizes, principally nut, are put up in 20-lb. bags which retail at 10 cents. A very extensive trade has been established for this bagged coke, and there is also a large demand for the other sizes for domestic use, the stove and egg size being utilized in furnaces and heaters, and the breeze being used for generating steam in boilers and also for filtration purposes. At the present time nearly the entire output of 375 tons of coke is being disposed of for various domestic purposes; most of this coke is distributed by teams. No doubt most of you are familiar with the ever present advertisements setting forth the manifold advantages of Otto coke and have come to realize that this must indeed be the long-looked-for panacea of all household ills.

We will now return to the volatile portion of the coal, which has been driven off from the ovens and passed through the standpipes and valves into the collecting mains. A certain portion of the heavier condensable products are collected in these collecting mains, the mains being provided with clean-outs where these products, such as heavy pitch form, so that they may be removed; a portion of these products are also taken off by the constant stream of tar which is flushed through the mains in order to keep them clear at all times. These mains run the entire length of the battery and at the ends two pipes, one for the rich gas and one for the poor or lean gas, are run to the condensing plant. During the passage of the gas to the condensing plant a still large portion of the condensable products are recovered, in some cases as high as 50 percent; these consist principally of the heavy tars and oils and some water vapor due to moisture in the coal. On reaching the condensing plant the gas from each main passes through two entirely separate systems of apparatus in being cooled and treated for the further recovery of the products.

Treatment of Gas.

The apparatus on each side is of the same design, and the gas is treated in both sets at this plant in the following manner:

It first passes through the air and water coolers, consisting of a system of rectangular pipes one above the other, connected at the ends by return bends. The gas passes in at the bottom, passes back and forth through each section in a contra direction until it reaches the top and then passes down through a vertical pipe into the common main. These pipes act as air coolers ordinarily, but in warm weather water is sprayed over them from the top and is collected in a cistern below to be cooled and used over again if desired. The gas then passes through circular water coolers, which are 8 ft. in diameter, with 4-in. tubes expanded into heads at either end. The gas passes around the tubes in a downward direction and the water through the tubes in an upward direction, so that the coldest gas is brought in contact with the coldest water, thus obtaining the most efficient cooling results. The cooling in this apparatus should be done gradually and with special care so as to prevent the formation of naphthalene due to a sudden cooling of the gas at any point. The temperature of the gas is reduced in these coolers to about 80 degrees Fahr. and a large portion of the remaining heavier tar oils and the water vapor are recovered; these are led off from the apparatus by drain pipes into a compartment tank where the ammonia liquor, which is mixed with the same, and is separated by gravity to be treated separately. The gas next passes through a tar scrubber which consists of a square tank with a diaphragm plate forming an upper compartment, and the gas entering this compartment passes down through tubes which are set in the diaphragm plate, these tubes sealing at the bottom in a mixture of ammonia liquor and tar. The gas passing down through the tubes has to break through a liquor seal, thereby passing around the bottom serrated edges of the dip pipes, which gives a cleaning or scrubbing effect for removing the tar. After passing into the chamber around the tubes it is taken off through a connection to the main which connects with the exhausters. Ammonia liquor is fed into the tar scrubbers and the mixture of ammonia liquor and tar obtained in the same is led off to a compartment tank where the liquor and tar are separated by gravity so that they may be treated separately. The gas up to this point has been drawn through the apparatus by a slight pressure in the ovens and by a vacuum created by the exhausters. It now passes through the exhausters which are of the usual type direct connected to horizontal steam engines, and is forced by them under a pressure equal to about 16 or 18 in. of water, through the P. & A. tar extractors which remove the finely divided particles of tar and the lighter oils by passing the gas through circular drums constructed of perforated plates placed closely together; the perforations of the various plates are staggered so that the small streams of gas passing through the perforations impinges on the plates beyond, thereby dropping out the tars and oils. In this machine the gas enters the lower chamber, passes up into the drum of perforated plates, through the same into the upper chamber and out into a connecting main. These drums seal in a mixture of ammonia liquor and tar and a greater or lesser amount of perforated surface is exposed, depending on that required to remove the tar and oils. This apparatus can be set for a certain differential pressure necessary to remove the tar, and is self-regulated at this pressure by means of counter-weights.

Removal of Ammonia.

The next step of treating the gas is the removal of the ammonia. The ammonia is removed from the gas to the best advantage at a temperature ranging between 60 degrees and 75 degrees Fahr. It is, therefore, the object to have the gas at about this temperature when entering the ammonia washers. This enables the ammonia to be removed with the least amount of water or weak liquor which is used for the washing purposes, thereby making a stronger liquor to be treated later on in the ammonia house for the conversion of this liquor into a finished product. The ammonia washers consist of circular shells, 8 in. in diameter, with a bottom and top compartment, and intervening spaces between the same filled with perforated plates or with wooden slats set at right angles to each other, attaining by both of these means the breaking up of the gas into small streams and forming a large area of wetted surface for contact with the gas, whereby the ammonia can be most readily removed. Two of these apparatuses are used on each side, the gas passing through them in series. In the washer furthest from the exhausters a large portion of the ammonia being already extracted from the gas in the first washer, it is washed by clean cold water, this water being fed into the washers by means of a number of sprays set in the top of same. The gas passes up through the washer and the water down through the same removing the last traces of ammonia from the gas and resulting in a weak ammonia liquor which is drained to a compartment tank and pumped from there to the overhead feed tank, from where it is fed into the first washer. Here it washes the gas which contains a greater amount of ammonia, and by washing with this weak liquor a large percentage of the ammonia is removed and the liquor greatly increased in strength. This liquor constitutes what is called the strong liquor which is about 1 percent to 2 percent in strength, and the manner in which this liquor is treated will be described later on in connection with the ammonia house.

As the poor gas is used only for heating purposes, the illuminants in same (which are principally benzole and its homologues), are practically of no value, and in order to utilize these illuminants to the greatest advantage the poor gas is now passed through three washers of a type similar to the ammonia washer, and in passing through these in series the gas is washed by tar oil which has a strong affinity for benzole and removes from this gas the greater percentage of same. This tar oil, after passing in series through the three different washers, thereby increasing the amount of benzole in the same, is then pumped to the benzole house where it is treated in a manner to be described later on. The poor gas after leaving the benzole washers passes to the regulating gas holder maintaining about 7 in. water pressure, and from there to the batteries where it is used for heating purposes.

The rich gas after being washed in the ammonia washers passes out of the condensing house and to the storage holder. In order, however, to increase the illuminating value of this gas by utilizing the benzole removed from the poor gas, a small portion of the rich gas is taken at a point beyond the ammonia washers by means of a pipe, through a gas compressor, passed to the benzole house and through one of the benzole stills, in which the tar oil previously mentioned is being treated. The tar oil from the benzole washers, in passing down through these stills which are heated with steam gives up the benzole (which is evaporated by means of heat) and the rich gas in passing upward through this still takes up these benzole vapors. The current of rich gas is then passed back into the rich system in front of the exhausters in the condensing house, is mixed with the larger volume of gas in these mains and thereby increases the candle power of the whole quantity. In this manner a much greater illuminating value is obtained from the coal, and the high candle power rich gas when later on mixed with water gas from an auxiliary plant requires less enrichment in order to get a mixed water and coal gas of a high candle power. Water gas is only made at times when more gas is required than can be supplied from the coke plant. This gas is made in a standard Lowe apparatus. This is one of the first instances where this method of benzole enrichment has been used in this country, it being done here, we believe, on a larger scale than has ever before been attempted, and it has demonstrated its value in this plant to the thorough satisfaction of all parties concerned.

Condensable Products Removed.

The condensable products in the gas are finally removed from the various apparatus and piping in the condensing house by drains to separate compartment tanks. The strongest ammonia liquor, which will vary from 1 percent to 2 percent, is pumped to a feed tank in the ammonia house, and the lighter tars obtained in this apparatus are pumped to the tar storage tanks. The heavier tars which are condensed in the gas mains between the ovens and the condensing house are drained into large tanks or pits and a portion of this tar is pumped over and over through the collecting mains on the battery. The balance of the tar is pumped to the tar storage tanks and is loaded from this tank into barges for treatment at the works of the coal tar products people. The picture before you is that of a large condensing plant with apparatus similar to that described. It forms a part of the coke plant of the Lackawanna Steel Co., Buffalo, N. Y., and is designed to treat 33,000,000 cu. ft. of gas per 24 hours. It is undoubtedly one of the largest single plants of its kind in the world. The ammonia liquor is fed from the overhead feed tank in the ammonia house into circular stills. These stills consist of three parts, a volatile still and a lime mixing chamber, which parts comprise one unit, and the fixed ammonia still, which comprises a separate unit. The liquor passing in at the top of the volatile still is preheated and as it passes down through the upper portion of the volatile still the volatile ammonia is freed by contact with steam and hot ammonia vapors from below and the liquor flowing into the chamber below is mixed with milk of lime and agitated by compressed air to give a thorough mixture. The liquor and lime passing from this chamber into the lime still, comes into further contact with steam, thereby setting free the fixed ammonia. The waste liquor passes out of the bottom of the lime still into the drain. These stills handle approximately 30,000 gallons of 1¼ percent liquor per day, reducing the strength of the ammonia in the waste to a minimum. The vapor which is given off from the still passes into a circular apparatus 4 ft. in diameter, consisting of alternating absorbing and water-cooled sections. In this apparatus the gas passes down through the ammonia liquor in the various sections, this liquor constantly overflowing and increasing in strength as it reaches the bottom. It is also brought in contact with water-cooled surfaces, thereby reducing the temperature and increasing the strength to a greater degree. In this apparatus the strength of the liquor is increased to about 16 percent to 20 percent, which is a commercial product used for various purposes.

In some plants the ammonia gas from the stills is brought in contact with sulphuric acid in large lead-lined boxes, thereby forming a precipitate or salt, which is called sulphate of ammonia. This salt is then drained from the boxes and passed through a centrifugal drying machine whereby the moisture is removed and the salt sold for use as a fertilizer. The farmers are being educated to its use at the present time through the Department of Agriculture and, as the country grows and people become more educated in scientific farming, sulphate of ammonia will be used more and more as a fertilizer.

How Power is Supplied.

The power required for the different apparatus and machinery throughout the plant is supplied by electric power generated in the power house, using for the purpose coke breeze in the boilers and a portion of the poor gas in gas engines. The power plant consists of three sets of water tube boilers, 256 h. p. each, these boilers being equipped with a forced draft system and special grates for burning coke breeze. The boiler fronts are also provided with connections so that gas may be used for fuel if desired. Especially efficient results have been obtained by the use of the forced draft system in burning coke breeze, the boilers showing by a test conducted under ordinary working conditions that they were developing 389 h. p. each, or more than 50 percent above the rated capacity without showing especially deteriorating results. These boilers are connected by a breeching to a stack which is common both to the boiler house and the ovens. This stack is of special perforated brick, and is 7 ft. in diameter by 150 ft. high. The boiler is provided with the necessary feed pumps, injectors and other customary fittings. The bulk of the steam generated here is used for a Green engine of about 150 h. p., for the exhauster engines in the condensing house and for the stills in the ammonia house. In the engine room are placed the Green engine which is used under ordinary conditions for developing electric power required, this engine being belted to a 180-k. w., 220-volt, alternating current generator, which is placed on a line shaft. This generator furnishes ordinarily sufficient power for the entire plant and is seldom used up to its capacity except momentarily. There is also a 280-k. w., 220-volt, alternating current generator direct connected to a Westinghouse gas engine. This gas engine is used ordinarily as a reserve, but at intervals, when sufficient fuel gas is available, it has been operated by this gas with entirely satisfactory results. Notwithstanding the fact that this gas is unpurified, it is only necessary at intervals to place clean igniters, which is the only difficulty experienced with the use of same. It was the original intention to use this engine for the regular supply of power, but owing to the fact that the amount of fuel gas has been reduced in order to increase the quantity of illuminating gas, it has been unable to carry out the original intentions, except at intervals. On account of the benzole obtained from the poor gas, it has been found desirable to run the ovens longer on the rich gas side, thus getting a greater quantity of illuminating gas, but at a lower average candle power. This candle power, however, has been increased to that desired by the use of the benzole enrichment. This plant is, we believe, one of the few in this vicinity which is using alternating current for power purposes, especially on apparatus where any variation in speed of the motors is desired; it has, however, proven very satisfactory. The power plant is provided with the necessary generator and feed panels complete with the customary fittings for this purpose. The lighting for the plant is supplied by an outside circuit, incandescent lights being used throughout, these being enclosed incandescents in certain portions of the plant, particularly in the benzole house.

In regard to the benzole plant, we believe it unnecessary to further describe this, as it would take the writer into considerable amount of detail, which would not be particularly interesting to you, and the principal object of the benzole plant was described earlier in connection with enriching the rich gas.

The Water Supply.

This plant has its own water supply consisting of a steel standpipe, 10 ft. in diameter by 100 ft. high, and two horizontal duplex steam pumps with a capacity of 1,200,000 gals. per day. The pumps draw the water by a suction line from the Delaware river, the foot-valves and strainer being placed in a cribbing in the dock on which the coke storage bin is situated. The water is distributed at approximately 40 lbs. pressure throughout a system which supplies the fire service lines, water for cooling apparatus, coke quenching, ammonia washing and various other purposes. This makes the plant entirely independent of the city service except for drinking water, and greatly reduces the cost of the supply. The office is placed near the entrance to the plant for the superintendent and necessary clerical force. All tests and analyses in connection with coal, coke, gas, tar, and ammonia products are made by a chemist, in a laboratory situated adjacent to the power plant. The duties of the chemist in these plants are important, as it is only by chemical analyses of the gas and liquors that wastes due to careless operation are detected. It is also his duty to analyze the coal, coke and tar and watch the operation of the condensing, ammonia and benzole plants. The heating and operation of the ovens also materially influence the quantity of the by-products produced.

The above description of this plant covers the principal and most salient features in connection with same, and the writer will be pleased to go into any further detail questions if information is desired by any of the members, or an opportunity will be given to any of the members of this association to visit this plant if they desire, especially to examine the coke, which is, I believe, the product most interesting to you.

Many improvements have been made in the design and construction of later plants, some of the principal features being as follows:

In connection with the oven construction, several plants have been built in which the length of the ovens has been increased from 33 ft. to 43 ft., thus increasing the capacity of the ovens to nine tons or approximately 30 percent at a very small cost, the principal increase in cost being ten additional feet of brickwork with the necessary increased foundations, and a slightly larger pusher machine on account of the longer bar required, and a larger coal larry, thus obtaining a much larger output at a slight increase in investment. While the average charge of the ovens at Camden is 6¼ tons, this charge has been increased in later ovens of the same length to 7 net tons. This has been done by increasing the height of the ovens 6 in., and by the introduction of a leveling machine which enables coal to be leveled more uniformly than is done at this plant by hand.

The oven proper is at present built on steel beams supported on three concrete walls running the entire length of the battery. The regenerators are built underneath and are made entirely separate from the oven proper, a connection between the regenerators and the ovens being made by a connecting brick flue at each three ovens. This construction prevents the possibility of cracks developing in the ends of the ovens due to the contraction and expansion of the regenerator brickwork. One of the principal objects of this construction is, however, to reduce the cost and to enable the introduction of auxiliary burners at different points in the combustion chambers, whereas in the type of oven at Camden only one burner is used at the end of the battery. The multiple burner system enables a little more uniform heat being maintained through the length of the oven so that the charge will be more evenly coked. The coke wharf at this plant has been replaced in later plants by a coke quenching machine. This machine consists of a water-cooled chamber approximately the size of the ovens, mounted on a steel frame. This chamber is made up with hollow side castings and circular top and bottom castings. The water is introduced into the bottom section, passes up through the sides and overflows at the top of the side sections, thereby coming in contact with the coke and quenching same with a minimum quantity of water. The steam evolved acts as a dryer and the surplus steam at the beginning of the operation passes out through stacks or pipes on top of the chamber. A heavy chain forms the bottom of the chamber, and this chain travels through same, passing under the bottom of the machine in its travel.

Method of Operation.

The method of operation is as follows: When the oven is ready to push, the machine is moved opposite the oven, the pusher ram pushes the charge of coke into the chamber, the doors on either end of the chamber are closed, and the water which is drawn from a trench running the entire length of the quencher track is discharged by a motor-driven centrifugal pump into the bottom portion of the machine, quenching in the manner above mentioned. After the coke is quenched the doors on either end are raised and the motor operating the chain is started. The chain carries the coke charge out of the chamber into cars at the end of same. By this method of discharge, the machine can travel along a series of cars throwing the ends of the charge in one car and the middle portion into another, or in case of an under-coked charge the entire charge may be distributed over a series of cars. In this manner a selection of coke may be made and the coke handled with a minimum amount of labor. On account of the steam acting as a dryer, if the quenching is properly done, the moisture will run from 3 to 7 percent when discharged into the cars. As the coke is not broken until discharged into the cars, the amount of breeze is also greatly reduced from 5 percent to practically nothing. This method of quenching gives the coke the grey metallic lustre which is to many foundrymen the indication of a first-class coke, but which is really no indication as far as actual results are concerned.

The above improvements are only a few of the many which have been made during the past few years with a view of simplifying the construction, reducing the cost of same, and particularly reducing the cost of labor by using machinery wherever advantageous. This all tends to reduce the cost per ton of coke made, which, of course, is one of the principal points to be attained. We feel very much encouraged by the many uses to which this coke is applied and especially at the accounts received from the foundrymen and furnace men using same, and at the increasing interest they are manifesting in it. We feel sure that if you will all give it a trial you will be amply justified by the results.

During the past few years the installation of these plants have received a great impetus over the preceding years since its introduction in this country. We, who firmly believe in the field open for these plants for the various objects, believe that in the next few years the number of beehive ovens built will be materially reduced and that the by-product oven will eventually replace the beehive oven. We feel justified in this belief because it will sooner or later be necessary, as competition becomes more severe, for manufacturers in this country to reduce to a minimum all waste products, as has already been largely done abroad, thereby reducing the cost of manufactures in every line.

The writer feels that he has not done full justice to this subject, owing to the fact that business demands have made it impossible, in the brief time allowed for preparation, to treat the subject in a more than a superficial manner, and he feels certain that further investigation on your part will convert you into advocates of this method of making coke rather than by the other method, whereby only about 63 percent of coke is obtained from the original coal, as in beehive ovens, instead of 70 percent to 75 percent coke and the by-products, as are obtained in the by-product ovens. I hope to have the opportunity at some future time to present to you more detailed and interesting data on this subject, and wish to thank you all for your kind attention to what must have seemed to many of you a lengthy and uninteresting discussion, as the subject must have been entirely new to some of you.

CORE ROOM RECORDS.

By R. W. MacDowell.

Many foundries do not pay sufficient attention to the running of accurate cost records for their core rooms. No exact records are at-

Report of Material used in Core Room

Date________ Rept. No.____

I have today used the following material in core dept.

___Sand________ lbs.____

___Sand________ lbs.____

___Linseed Oil________ gals.____

___Core Compound________ gals.____

Form 1 Foreman.

The Foundry

tempted, and it is not known just how many cores are made, nor how many are lost through poor work in the making or through carelessness. The result as that they have little or no idea as to whether this department is cost-

Requisition For Supplies. No.____

To________ Date________

Storekeeper

Please furnish________ Dept. with the following material.

Form 2 Foreman

The Foundry

ing too much, or how to make it cost less. Carelessness in this respect also breeds indifference on the part of the coremakers, who know that there is no record of their work that can be depended upon. A good cost system in this department will go far toward showing where the leaks are, and will give something definite to proceed on in the effort to stop them. No matter how big or how little a foundry may be, a system of this kind should be carefully kept, for if the cost of the cores be not known, it stands to reason that the cost of the castings cannot be determined with any accuracy. Naturally, the make-up of the system must be determined by the kind of a foundry it is intended for, and what style of castings are to be manufactured, some kinds of work requiring many cores, while other kinds require but few, but in any case, the cost of the cores, by the month or by the job, should be at hand at all times.

It is not really a difficult matter to operate a system of this kind. The principal items in any cost system are material and labor, and there should be no trouble experienced in keeping track of these, as no complications are likely to arise in accounting for either, the material being simple and easily weighed or measured, and the labor being principally piece work. A little care and attention in reporting the amount of material used and the number of cores produced by each man will be all that is required. The core room should be treated as a separate department and charged with the material and labor expended in producing the cores as well as its proportion of general expense, and should be credited with the good cores which it produces. Let a ledger account be run with this department, and the charges and credits be entered monthly.

The core department of a radiator plant forms a good illustration on which to base a system of this kind, for this is all cored work, the core room being a very important part of the foundry, and all the large radiator plants are extremely careful to get exact figures as to the cost of operation of their core rooms. We will therefore describe a method of keeping records for a plant of this kind which makes single, two and three column radiators.

Material.

All material used in the making of cores is charged to the core department account once or twice per month, as preferred, or may, if it is so desired, be charged direct at the time the invoice comes in, the former method being probably the better. Sand, linseed oil, core compound and other materials used in large quantities, are kept either in the core room itself, or in close proximity to it. Other supplies which are used in smaller quantities, such as carbon oil, rosin, flour, molasses, etc., are kept in the store room and given out on requisitions issued by the foreman of the core room as he requires supplies of this character from time to time. As the material kept in the core room is used, it is reported to the storekeeper, or whoever has charge of the store records, by means of blanks like Form 1. This is a simple form, giving the quantities of the different kinds of sand, linseed oil, core compound, etc., and the number of batches of sand mixed.

There is no trouble in determining the exact quantity of linseed oil and core compound used, as a gallon or two gallon bucket can be used to get the oil out of the barrel. A blackboard is kept in the core room, on which the record can be kept until the report is made up for the day. The quantity of sand used may be ascertained in various ways. Certain sizes of wheelbarrows may be used, by which the quantity may be readily approximated, or each load may be weighed. This latter method is not recommended as it is slow, and frequently the sand mixer will forget to note the weight of

COREMAKERS TIME CARD

Name ______________ No. ______

Mark ______________

Kind of Core	Made	Disct	Good
Single Column			
20" Steam			
26" "			
32" "			
20" Water			
26" "			
32" "			
Two Column			
20" Steam			
26" "			
32" "			
38"			
45"			
20" Water			
26" "			
32" "			
38" "			
45" "			
Three Column			
20" Steam			
26" "			
32" "			
38" "			
45" "			
20" Water			
26" "			
32" "			
38" "			
45" "			
Special			

O.K. ______________

Form 3

The Foundry

Report of Cores Made During________________________190______

	Steam						Water				
	20"	26"	32"	38"	45"	No. Col.	20"	26"	32"	38"	45"
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
29											
30											
31											
Form 4											

The Foundry

one or more loads. One of the best methods the writer has ever seen employed was in a plant having tracks run from the core room to the sand sheds, over the scales, and using a sheet iron lined box in which to mix the sand. This box was mounted on wheels, so when a batch of sand was required, the whole box was taken to the sand sheds, filled with sand, and weighed on the return trip. The weight was noted on the board as soon as the sand came in, so at the end of the day the board will show just how much sand has been used. If the sand is mixed by means of one or more of the machines now in common use, the same plan may be employed, by using large boxes in which to bring in the sand and weighing each load in the same way. This method will probably give better results than almost any other way.

Cores Discounted on________________190______

Thrown out				
Number	Size	No. Col.	Kind	Cause
Broken				
Number	Size	No. Col.	Kind	Cause

____
Foreman

Form 5

The Foundry

Core Room Records.

Requisitions, Form 2, are made out in duplicate, one copy going to the storekeeper while the other copy is retained by the core room foreman for checking purposes. The requisitions from the core room should be of a different color from those of the other departments, for convenience in making up the monthly reports. A card will answer very well for the foreman's copy, as in this shape it is convenient for filing. There will not be any very large number of these requisitions issued in the present instance, as radiator cores are nearly always made of sand and linseed oil instead of sand and flour or sand and molasses, and the

REPORT OF MATERIAL USED IN CORE ROOM FOR MONTH OF ____________ 190__

Material	Price	Cost	Remarks
______ lbs. Sand			
______ lbs. Sand			
______ gals. Linseed Oil			
______ gals. Linseed Oil			
______ gals. Core Compound			
______ gals. Core Compound			
______ gals. Molasses			
______ lbs. Rosin			
______ lbs. Flour			
______ qts. Carbon Oil			
______ ft. gas for ovens			
______ batches Sand mixed.			
Cost of Material			

Form 7

The Foundry

linseed oil is kept in the core room itself and reported on the daily report.

In this way the material used is accurately reported, and there is no reason whatever why this item need ever get wrong. The next feature to be considered is,

Labor and Production.

Labor in the core room is an extremely simple matter to take care of, cores being paid for at a certain rate each, which gives a fixed price on productive labor, all non-productive labor being paid for by the day. Time is registered by means of a clock, every workman being provided with a card on which he registers his time of beginning and quitting work, whether he works by the day or by the piece. The cards of the men in the core department are of a different color from those of the other departments which makes it easier to enter up the time in the proper place.

In addition to these cards, the coremakers each make out a card like Form 3 after their work is finished for the day. These cards are turned in to the office after the foreman has O. K.'d them, and from these cards the monthly core sheet, Form 4, is made up. This sheet is ruled so as to provide spaces for the various kinds of cores used, and is a very useful record to have about a radiator works, as it can easily be seen from month to month just what has been done and what has been received in return for the outlay as shown by the monthly recapitulation. In many foundries, a record of this kind would not be necessary, but in a radiator plant it is well to have this information at hand at all times.

A discount sheet, Form 5, is also kept, on which the number of cores thrown out each day is recorded. A core may be broken through carelessness on the part of the coremaker, it may have imperfect vents and cause a "blow" or the knobs upon it may be defective. In any of these cases, the coremaker receives no pay for it. If, however, as is sometimes the case, the core is broken by the molder through no fault of the coremaker, the latter is paid for it, the discount coming off the molder. After this system has been worked for a little while, it is surprising to note the effect it has on both coremakers and molders,

LOCATION

MINIMUM	UNIT	FLOOR	
NORMAL	ROOM	SECTION	BIN OR SHELF
REMARKS			NO.

Received			Delivered						Balance		
DATE	ORDER NO.	QUANTITY	DATE	ORDER NO.	QUANTITY	DATE	ORDER NO.	QUANTITY	DATE	QUANTITY	COST

Form 6

The Foundry

Core Room Report for Month of ______________ 190____

Cost of Material						
Cost of Fuel						
Cost of Labor (Productive)						
Cost of Labor (Non-Productive)						
Total						
% Genl. Expense						
Whole Cost						
No. Cores Made						
No. Discounted						
Total Good Cores						
Average Cost						

Form 8

The Foundry

making them far more careful in the manufacture of the cores and the handling of them after they are made, and it will be found that a very small percentage will be either carelessly made or broken. The discount sheet shows what kind of core was thrown out, who made it, why it was rejected, and where the fault lay, which is all the information the management needs. The time cards have a space given on them for rejected cores, so the number of good cores produced by each coremaker is easy to figure, and this is all that is necessary to enter in the time book, radiator cores being paid for at a certain rate, each according to their size, this rate varying from ½c to 1½c each. If one man works on two or more different kinds of cores during the period, ample space will be found in the "total" column to note the number made of each kind.

A certain section of the pay roll book is allowed for the core department and the productive and non-productive labor is usually run on different pages, so there is no difficulty in getting each of these amounts for the month, pays being twice per month. The non-productive labor consists principally of the men who look after the oven, take out the cores and put them in, the sand mixers, and the boys who grease corepans, go after wires and help the coremakers in various ways.

The Monthly Report.

The monthly core room report is simply a recapitulation of the other forms. The cost of the material is first given, followed by the cost of fuel, productive and non-productive labor, and the percentage of general expense. The cost of the material is obtained by taking the amounts used from the stock records and the requisitions and extending the value at the price per pound or gallon. The stock record has been previously described in this magazine so description will not be necessary. A form, (No. 6) is, however, shown for the purpose of illustration. The total material issued on requisitions is figured up and entered in the same way, thus giving the entire cost of the material for the month.

The productive and non-productive labor is then gotten from the time book, by adding these items as shown on their respective pages for the two preceding pays. The number of cores made is then gotten from the core sheet, and if desired, the average cost each can be figured. This will not, of course, be strictly accurate, owing to the difference in the sizes of the cores, but it will not be far out of the way, and if the difference in the prices paid is added or deducted as required, the variation will be very trifling.

These reports are then filed and form a permanent record. It is thus possible to make monthly comparisons, and if the core room is costing more this month than it was last month, or if the work is not coming fast enough, it will be seen at once, and there will be something to proceed on toward finding out the reason; if there is a leak anywhere the reports will show it and aid in finding where it is. Without such a system of records it is the easiest thing in the world for unnecessary cost and leaks to go on for months unchecked, and even after they are discovered it is one of the hardest things to find just where they are and check them if there is no such data at hand as these reports provide. Of course the system will not attend to such matters itself alone, but if common sense is used in connection with them, they will be found to be of the greatest assistance. The core room of every foundry is not, of course, as important a department as it is in a radiator plant, but it is important nevertheless, and it is well to bear in mind at all times in regard to foundry work of any description that "What is worth doing is worth making a record of."

SOME MELTING FURNACE PRACTICE.

The Steele-Harvey melting furnace which was described in our issue of August, 1904, has been installed in a good many different plants, and we have received the following information concerning some tests made in one of these furnaces. It will be remembered that this is a furnace in which a crucible is surrounded by a tilting furnace and heated by gas or oil, the result being that the metal is not brought in contact with the products of combustion to such a great extent as it is in many melting furnaces. The makers claim that this results in much less loss and in a better quality of metal. The results given also show that it is possible to melt very refractory material in the furnace. This furnace is made by the Monarch Engineering and Mfg. Co., Baltimore, Md.

In a test made at a prominent foundry near Baltimore, the following results were obtained in one of the large No. 275 furnaces, the composition being of heavy copper and red metal.

First day's run 2,895 lb.; loss 1.04 percent; number of heats, 4.

Second day's run 2,252 lb.; loss 1.19 percent; number of heats, 3.

Third day's run 2,579 lb.; loss 0.96 percent; number of heats, 4.

Fourth day's run 2.534 lb.; loss 1.03 percent; number of heats, 3.

Average use of oil 1½ gallons per 100 lb. of metal, and castings were run into a fine grade of marine work.

At the same plant the following test was made in the same furnace:

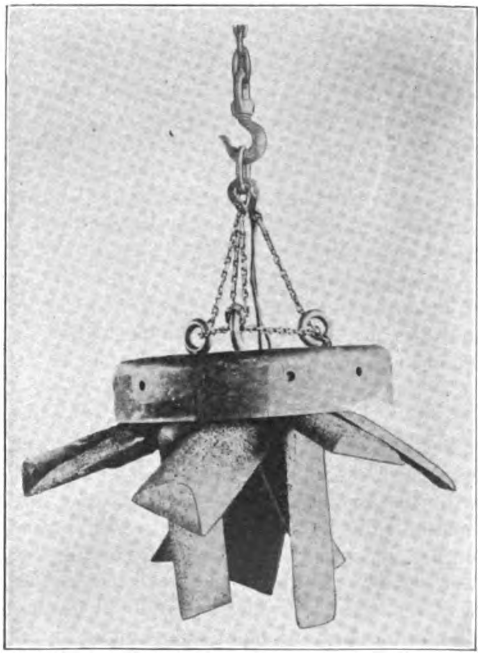
175 lb. low carbon billet steel.
24 lb. ferro manganese.
4½ lb. ferro silicon.

The above was run into a fine grade gear wheel, and time of melting was three hours, oil consumed two gallons per 100 lb. of metal.

The following test of foundry iron was made: 590 lb. No. 2 put in received 571 lb., loss in slag and dross 19 lb., oil consumed three gallons per 100 lb. metal.

LIFTING MAGNETS.

With the increased tonnage of many of our larger plants and the increased competition, it becomes necessary to practice every possible economy in the handling of material. This has led to the adoption of many devices for handling material in bulk. One of the most interesting applications in this line is the use



A LIFTING MAGNET.

of electrically operated lifting magnets, for handling such material as pig iron, scrap, castings, etc. These have for some time been successfully used for handling plates, bars and billets, but they are equally advantageous in the handling of material in bulk.

The accompanying illustration shows one of these magnets lifting a quantity of sandless pig. It can be used equally well for handling many classes of castings, scrap, etc.

One point that has been discovered in the application of these magnets, however, is that a single design of magnet is not adapted for handling all classes of material. Each magnet must be designed for the work it has to do. For instance, it requires a very different magnete for the handling of thin plates from that which would be required for the handling of steel billets. The manufacturers have taken great pains to design each magnet so that it would be especially suited for the class of work which it has to perform.

The magnets are controlled by the crane operator, so that in handling pig iron and other similar material, the man in the crane can do all of the work without any help from some one on the ground. Pig iron can be loaded into or taken from cars, or handled in a number of other ways by this device. The manufacturers state that while one might think at first that there was great danger of accidents in this method of handling, that they have a large number of magnets in use at different places throughout the country, and they have yet to learn of a single accident that has occurred through their use. In fact, the records for the magnets are very much above those for ordinary sling chains used for handling certain classes of material. The magnets when built are tested with from four to five times the specified load.

These magnets are made by the Electric Controller & Supply Co., of Cleveland, O., and are protected by the Wellman, Clark and Peik patents.

FOAMING SLAG.

Seeing an article in *The Foundry* on foaming slag, I thought I would give my experience with the enemy of the casting. I had been melting 12 to 15 tons a day; all was going well until I got a new car of coke. Our first heat was small, eight tons, the next day 14 tons was our heat. The slag began about the middle of the heat to foam and stopped up the slag hole. I went up to the charging floor and found the melter charging on iron which disappeared through the slag which was now up to the charging door. I stopped the charging and as I found I was having trouble with my motor driving the wind through the cupola as my heat was near off and the slag began to get into the tweers and wind drum; I told the melter to pull the bottom but before he could my motor stopped with a fuse blown. Now that slag which was up to the charging door found its way into the tuyeres and wind drum of the cupola in along the wind pipe for 20 ft. I had a solid mass of slag that looks like a black glass. It was very heavy and could not be broken easy.

We lost a day getting the cupola ready for the next heat. I changed my coke, which, to all appearances, looked no different, yet results proved it was in the coke, as the iron was the same for a month. The cupola lining was a month old and our next heat was all right and has been ever since.

Can some one tell me if this slag was from the coke which I believe it was. Why is it so heavy and so solid?

MATTHEW ELLIOTT.

FOAMING SLAG.

BY EDW. HANDLEY.

An analysis of your foaming slag will show it to be principally a basic silicate of iron.

When the bed in the cupola becomes too low, caused either by economy in coke or by using a soft coke with excessive blast, which will allow melting to take place too close to the tuyers and thus allow the blast to play directly upon the melting iron, oxidation of iron, to a certain extent, will invariably take place. It is a well known fact that atmospheric oxygen unites with iron at a white heat, and when oxygen and iron unite under these conditions there is a decided raise in temperature, which of course has a tendency to promote further oxidation.

The oxide of iron being a strong base, readily attacks the acid lining of the cupola, which creates the excess of slag, and also accounts for the burning out of the melting zone.

The melting of the iron frame extending out at the charging door does not mean anything, as that can happen when the cupola is running all right by leaving the blast on too long after the last charge has been melted down.

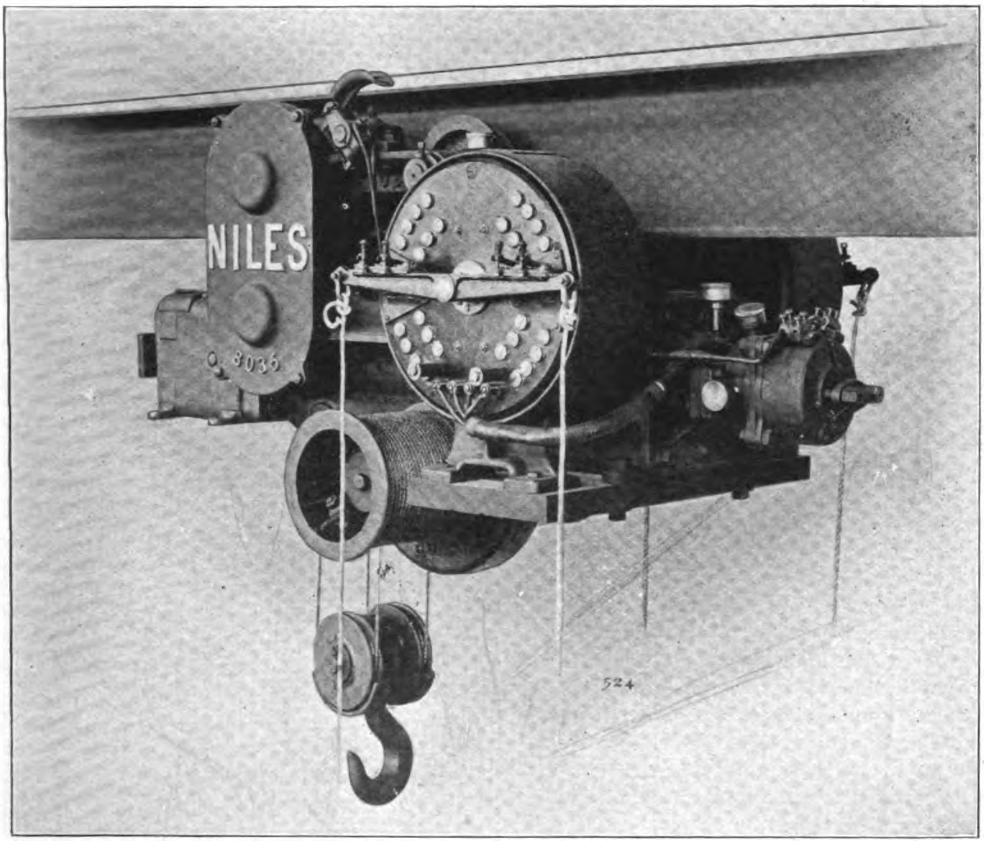
In conclusion, let me say, keep your bed high, don't use too much blast, watch soft coke carefully and you will have no trouble with foaming slag.

A NEW TRAVELING ELECTRIC HOIST.

Electric traveling hoists have many advantages for different classes of work and especially for foundry work. By arranging suitable switches and passing points, it is possible to reach any point on the floor, and for instance, in pouring operations, to have a steady procession of ladles moving from the cupola to various parts of the floor and back again without interfering with one another, while when ordinary traveling cranes are used they are constantly getting in each other's way.

A new electric hoist suitable for foundry use is shown in the accompanying illustration. It is arranged to run on the lower flange of an I beam, and is built in capacities from ¾ up to 6 tons. For broad spans such traveling crane hoists are arranged to run between two I beams. The controllers are attached to the hoist and operate it by cords reaching to the floor. These hoists will run on either curved or straight tracks and are usually provided with separate motors, one for traversing and the other for hoisting, though when desired a hand traverse can be supplied. The hoist is self-contained and arranged so that it is balanced when in use.

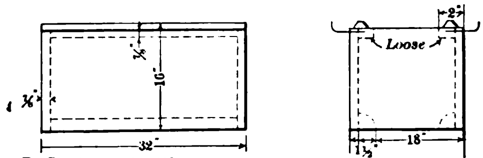
These hoists are manufactured by the Niles-Bement-Pond Co., Liberty street, New York, N. Y.



A NEW TRAVELING ELECTRIC HOIST.

TROUBLE WITH THE FOUNDRYMAN.

I enclose two views of a pattern which I made and the foundryman claims he could not mold it. It will be seen by the views that it is a simple square pattern with two strips top and bottom. The top strips are left loose and



The Foundry Side View End View

are held in place with wires. The foundryman sent back word that he could not mold it, that it would have to be cored out inside, and I can't see why that foundryman couldn't have molded the pattern in a three part flask. There was a great rush for the casting and the trouble made a great delay as there was only one casting wanted from the pattern. I would like to hear from some of the readers in regard to this pattern. C. E. W.

J. P. Raymond, of Oswego, N. Y., is planning to build a new foundry at Red Creek, N. Y.

METALS IN FOUNDRY PRACTICE.

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Steel, Brass and Bronze.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.

J. B. Nau, Metallurgy of Steel and Steel Castings.

Dr. Richard Moldenke, Malleable Castings.

C. Vickers, Brass Castings.

We have also made arrangements with several others to act as special contributors upon Brass, Bronze and other subjects. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

Silicon and Carbon.

Question.—In mixing iron I understand that the silicon is used for the purpose of controlling the carbon; what should be the ratio between the graphitic and the combined carbon?

Answer.—Silicon is used to vary the ratio between graphite and combined carbon, and it is the only practical way to do this, but there are many other ratios between the other elements that influence the quality of castings, therefore no definite percentage of silicon, graphite or of combined carbon can be depended upon to produce a definite quality of casting. Two castings with absolutely the same chemical composition, so far as the six ordinary elements are concerned, may have quite different physical qualities.

However, the only way that we have to vary physical quality is to vary silicon, and then we measure the shrinkage and strength to see if more or less silicon should be used with that mixture.

Ordinarily the less combined and the more graphitic carbon the softer the castings, and it is not at all sure that such castings will not also be the stronger.

Practically the silicon should be varied until the quality suits, irrespective of the ratio between the carbons.

Again the size of the casting changes the percentage of silicon necessary, as slow cooling of large castings allow a smaller percentage of silicon to produce like results.

Mixture for Automobile Cylinders:—Silicon about 2.25 per cent P. about 1 per cent S. .075 Mn .5. The silicon should be as low as possible and machine easily. Purchase the irons that your market offers, which will produce such a mixture. You will find that some irons will give you cleaner castings than others and will in time find the most desirable mixture.

Mixture for Corliss Engine Cylinders of 1,800 to 3,500 lbs. weight.—Metal about 1¼ to 1½ in. thick? Silicon 1.20 to 1.60 per cent, sulphur less than .095, phosphorus below 0.70, Mn below .70 percent. See remarks on automobile cylinders.

Blow Holes or Drawing.—Where arms join the rim in heavy blank castings for machine cut gears? The ordinary way to prevent such shrunk spots is to reduce silicon as low as possible and allow of machining. The use of scrap with low sulphur will help. Low phosphorus allows the iron to set quick, but the best way is to use cast iron borings, 100 lbs. to the ton of iron melted. Pack clean borings in pine boxes holding 100 lbs. and nail the cover on tight. Charge the box on the coke before charging the pig iron.

Spongy Spots on Cylinders.—See remarks on Blowholes or drawing. The trouble in that and in your case comes from shrinkage after the surfaces of the casting has become set.

The reason that such spongy spots are located near the gate is that they are at the place that cools last. Have all parts of a casting of as even a thickness as possible. Founders are using chill pieces more and more each year, and will in the end place a chill on any surface when they are troubled with an open grain. This sets the iron quickly and so deep that the tooling will not cut into a soft spot. You should not use irons that will chill hard.

Molding in a Stove Foundry.

Question.—Is it good foundry practice in a stove foundry to mold up work and let it freeze up over a shut-down of a couple of weeks.

Would it affect the castings in any way?

Answer.—Very few castings can be saved if a mold is allowed to stand over until next day, even if it does not freeze. Freezing would dry the molds so that when thawed they would not be fit to pour. To pour iron into a frozen mold would chill the iron.

At a meeting of the stockholders of the Chas. Creighton Foundry Co., of New York City, the following officers were elected: John H. Allen, president and treasurer; Jas. H. Norris, vice-president and secretary; Chas. H. Thomas, manager.

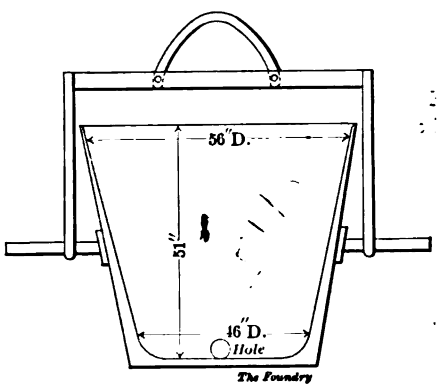
MALLEABLE CAST IRON NOTES.

BY DR. RICHARD MOLDENKE.

Time For Heat.

J. P. L. asks what time a fire should be started for a 20-ton heat in the air furnace, so that it can be tapped at 4:00 P. M. This naturally depends upon a number of things. First, whether the furnace is an up-to-date one which will turn out a properly mixed charge of this size in four and one-half to five hours. Some furnaces would not do this in six hours, and others might, with heavy fuel expense, cut the time down a little from the first mentioned figure. The second consideration is whether you charge on a cold bottom or not. If so, you can charge early enough in the morning, so that you can light up at 11:00 A. M. Should you notice that the heat will be ready before you really want it, you can throw in some extra pig iron to retard the heat, and then tap. Next day you can start up the fire a little later.

The second consideration is the mixture. The modern tendency is to get away from the



refining of the metal as much as possible. The additional strength gained from the burning out of the silicon and lowering of the total carbon is better attained by the direct addition of steel scrap to the mixture. Hence it is only necessary to melt the charge, and then heat it up to the proper pouring temperature, before tapping. The first test plug taken should show proper casting metal, though it may be necessary to hold the heat for ten of fifteen minutes to get it hotter. Adding steel for strength and quality means that about 30 points in silicon should be added to the composition of the castings wanted, for the silicon of the charge. This should prevent holding the heat in the furnace to refine it down to the proper point as in the old way of melting.

Tapping Hole for Reservoir.

J. P. L. further wants to know how large to make a tapping hole in a reservoir ladle as per sketch, and how long it would take to empty the ladle. The idea being to tap as in the cupola. We confess that once upon a time, during our university days, we were familiar enough with the calculus to work out this problem, granted that we could get the proper coefficients for melted iron, in place of water, in the calculation of the flow of water from given orifices, or to get the size of the orifice itself, when the quantity of water is given. Life is too short to go all over this mathematical matter long since on the shelves of our memory, and very dusty. We fear that the only way to get this information is to try it, and by repeated trials with small tapping holes at first, and enlarging them until the desired time of full discharge is found, the problem will be solved at least as fast as by calculation.

Incidentally, if the reservoir ladle is to be used for "malleable" for transportation, care should be taken to have the metal extra hot, as it loses fluidity every time it is repoured. In our own interests, we take away metal five tons at a time, but pour from the lip, and get excellent results, so that it is possible to carry hot metal for malleable casting purposes, if proper care is taken. This statement is liable to be doubted by several large works where carrying of the metal had to be abandoned because it got too cold to pour; but it is so just the same.

BRASS FOUNDRY NOTES.

BY C. VICKERS.

Manganese Bronze.

Inquiry.—Will you please give me a recipe for making manganese bronze, also state just how it should be compounded or mixed.

Answer.—"Manganese bronze" is made by simply adding manganese to any bronze or brass alloy, and the best manner of adding it is in the form of manganese copper.

An alloy for manganese with bronze is known as red manganese bronze and is used for bearings and other bronze parts of machinery. It may be either hard or soft according to the amount of tin. A soft alloy is:

Copper	64 pounds.
Tin	4 pounds.
Zinc	5 pounds.
Manganese Copper	5 pounds.

For a hard alloy use:

Copper	64 pounds.
Tin	8 pounds.
Manganese Copper	10 pounds.
Zinc	4 pounds.

When manganese is added to yellow brass it is called yellow manganese bronze, properly speaking it is a brass, not a bronze.

Such alloys are noted for their tensile strength. Any yellow brass can be converted into manganese bronze by the addition of from 5 to 10 per cent of manganese copper. From ½ to 1 per cent of aluminum should also be added. A good example of this class of alloys is:

1.

Copper	64 pounds.
Zinc	42 pounds.
Manganese Copper	8 pounds.
Aluminum	1 pound.

2.

Copper	64 pounds.
Zinc	30 pounds.
Manganese Copper	6 pounds.
Aluminum	4 ounces.

In melting manganese bronze keep the surface covered with charcoal, and do not "hold" the metal in the fire after it has become sufficiently hot, pour the yellow variety with the same precautions as with yellow brass. Manganese bronze shrinks almost twice as much as ordinary brass, such shrinkage must be overcome by the use of large risers, on the heavy portions of large castings, and the use of shrinkage balls on lighter castings.

Car Wheel Casting Difficulties.

Your subscriber's troubles are caused as he surmises both in the mixture and method of treatment. I see nothing particularly wrong in the designs of wheels, although curved spokes in mine car wheels and curved plates and ribs in ordinary car wheels are preferable to straight ones.

The ordinary method for making mine car wheels in Pennsylvania is to use a strong enough mixture to slightly chill the wheel and stand the shrinkage strains without annealing. Such as your subscriber was doing with No. 3 Southern iron.

To chill the rims of mine car wheels to obtain ⅛-in. or more depth of chill is a difficult thing for an ordinary jobbing shop to do successfully without the necessary annealing pit to counteract shrinkage strains.

Re-solid plate car wheels, nothing short of an ordinary good car wheel mix with annealing will make these wheels successfully as a mixture hard enough to give depth of chill will surely crack without the annealing process.

The fact of the wheels breaking under moderate pressure in mounting on axles or after mounting, indicates a poor mixture of iron as I have proved repeatedly by experience. Only a short time ago I replaced twenty pairs of 24-in. wheels having cracked hubs which had been in service but a short time under lumber cars. These wheels were made in an ordinary foundry.

To illustrate the strain there is on car wheels made of good mixture by the regular car wheel makers if the wheels are left to cool the same as an ordinary casting they always crack across the plate.

It may be possible to obtain a mixture of iron to give sufficient depth of chill and not crack without annealing but I have never come across it yet.

Chills should not be made less than 2½ in. to 3 in. thick and thicker as the wheels increase in diameter.

Standard 33-in. car wheel chills are seldom made less than 3½ in. thick.

Half silica sand and half loam sand will make a clean core.

J. C. WARNE.

REVIEWS.

Centrifugal Castings.

Eisenzeitung, Jan. 26. The Huth method of centrifugal casting seems to be meeting with much success in Germany. In this process the molds are given a centrifugal motion, while the metal is being poured in. Several kinds of steel or gray iron can thus be cast into the same mold, and give the desired results. Thus for a wheel, a hard steel is poured into the mold, immediately flying outward into the rim, then the soft steel is poured in, filling the mold. The result is a wheel with a hard rim and soft centre. Other castings can be made similarly. The advantages claimed are greater density, no shrinkage spots, which is saying much for steel castings; slag is kept from the outer surfaces, and the strains are not as prominent as would be the case with the ordinary molding methods.

The centrifugal method of casting is especially recommended for bulky castings whether of one class of metal or more, on account of the greater freedom from openness and shrinkage.

Modes of Testing Cast Iron.

The Mechanical World. Feb. 10. Mr. W. T. MacCall, in a paper read before the British Foundrymen's Association, describes the various methods of testing cast iron. The ordinary cross-breaking test is the most common. One test piece is the one inch square and over three feet long, (broken on supports 36" apart). The other bar is as long and 2" vertical by 1" horizontal in cross section. The former should stand 2,000 lbs. before breaking, and the latter has a load of 3,000 lb. specified.

In the tensile test, the bar is turned down to 0.798" in diameter, and the heads are shouldered off to fit the machine. A breaking strain of 26,750 lbs. per sq. in. is specified, while the highest recorded strength in England is 40,320 lbs.

For the crushing test the sample should be about two to three times as long as the diameter, in order to get a fair test. In England bars for tensile or compressive tests are usually cast on and cut off the casting for subsequent turning up, while for transverse tests the bars are always cast separately. In America we are taking up standards a little nearer the ideal conditions under which cast iron should be tested, and the bars are shorter and heavier than the above sizes.

Economic Value of Cast Iron.

A paper was recently read before the Manchester Association of Engineers, by Mr. W. H. Pretty, in which he discusses the production of machine castings of maximum strength, uniformity and satisfactory machining qualities A very interesting editorial in the *Engineering Magazine* comments freely on the points raised. While everything points to the steel casting for machinery purposes, yet it must not be forgotten that cast iron offers advantages still better in given places, and therefore its study should be encouraged in order to locate these places and provide the best grade of material for them.

In the engineering field cast iron is especially useful for some parts of structural work, for bridges, tunnel linings, and water pipe. Then for castings in engine and machine construction, and finally for the malleable casting. In England the recently introduced segment castings for tunnel linings are going to the blast furnaces. Here the large foundries get them. The steel casting is bound to crowd the gray iron one, but the malleable casting will probably hold its own for a long while to come, if not for always.

Today we consider cast iron a compound of iron and carbon, manganese, silicon, sulphur, and phosphorus. Later on, Mr. Pretty predicts, such elements as chromium, arsenic, titanium, etc., will be looked after carefully in the pig irons we use. The melting methods will then be so improved that great strength should result, and the comparatively rarer ingredients thus become more important.

The study of cast iron from the chemical as well as physical standpoint has disclosed the reasons why certain results are obtained in the way of strength and other characteristics. We can now manipulate our material so that required standards can be met, and thus the value of the foundry product is greatly enhanced in the arts. The introduction of high speed steels has rather emphasized the necessity for soft castings, yet there is also a tendency not to sacrifice other good qualities simply for ease in machining. Mr. Pretty would like to see a shop test for the machining qualities of a cast iron adopted.

Quite a number of items which it will pay to follow out in the foundry laboratory and on the molding floor are enumerated. Among these are, for the cupola: The behavior of the blast under bad working conditions, and its effect on the quality of the iron. The formation of a cupola slag of standard composition, similar to other metallurgical slags for copper, silver, etc. The addition of proper reducing agents to take away oxidation, such as the alloys of iron with aluminum, magnesium, and silicon. The study of gases in cast iron, and the strains they may leave in the metal.

In the foundry proper, we have the effect of dampness in the molding sand. The characteristics of distribution of impurities, and the effect of frequent remelting. The decay of iron in service. The effect of temperature conditions on the metal and the heat treatment of cast iron. The microscopical study of cast iron. Finally the various classes of melting apparatus which can be used.

Our American Foundrymen's Association is highly commended for what it has done along the above lines, and it is predicted that the newly formed British Foundrymen's Association will also take its place in the front, a sentiment with which we Americans heartily agree.

ASSOCIATIONS AND SOCIETIES.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care J. W. Paxson Co.

The 145th meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club, 1409 Walnut street, on Wednesday evening, March 1, with Vice President Alex. E. Outerbridge Jr. in the chair. There were about forty members and visitors in attendance. The treasurer's report showed a balance of $2,197.74 in the treasury, all bills to date being paid.

The secretary read a letter which had been received from the Associated Foundry Foremen of Philadelphia and vicinity, extending an invitation to the members of the Foundrymen's Association to become associate members of their organization and attend their meetings. This association was formed recently, one of the principal objects being the improvement of the working department of the foundry. Mr. Evans also announced that the subject to be presented before the Foundrymen's Association at the meeting in April would be "Foundry Costs," and the probable subject for May would be "Cores and Core Making."

The paper of the evening was read by Thorsten Y. Olsen, of the firm of Tinius Olsen, of Philadelphia, Pa., the paper being entitled "The Fremond Method of Testing the Fragility of Iron and Steel." The paper was illustrated with stereopticon views and was very interesting indeed. It provoked considerable discussion and the author was tendered a vote of thanks.

New England Foundrymen's Association.

Fred F. Stockwell. Secretary. care of Barbour-Stockwell Co., Cambridgeport, Mass.

The regular monthly meeting of the New England Foundrymen's Association was held at the Exchange Club, Boston, on March 8, at 4:30 P. M. Vice President W. B. Snow presided. The secretary reported the illness of President John Magee and stated that flowers had been sent him on behalf of the association.

Reports were received from the committees on securing new meeting quarters and on the pig iron storage warrant system. These were accepted and filed. The quiz questions arranged by the committee were then discussed as follows:

Ques. What is the best sand to use for making medium brass and bronze castings?

Ans. In the hardware business we find that No. 0 Albany sand for brass castings and No. 1 Albany sand for plain castings is the best that can be used in making up hardware. The Albany sand is strong sand to start with and it is also a stronger sand after being worked.

Ques. Do you use salt in tempering the sand?

Ans. Salt is just as necessary to sand as lime is to sand in order to make it strong. There is no molder that can produce a casting without any salt in the sand. We can produce just as good a casting in green sand in high brass, but we cannot do it without salt. Salt gives the sand strength and without it a molder would be helpless. He could not produce the fine work which we produce today.

Ques. How much salt do you use?

Ans. In proportion we use about ¼ lb. salt to a bucketful of water.

Ans. There seems to be a vast difference of opinion on that point. We use No. 1 Albany sand and we find we can get as good results with No. 1 Albany as with No. 0 sand. If you get in too much French sand, it gets too strong. In regard to French sand, we call it sand, but it is more of a clay than sand and the clay, by ramming up the mold, will make it quite air tight. The question of today is how will the foundryman go to work to make all his gas escape. If he can do that then he is sure of a good sound casting.

Ques. What has been your experience in the use of old or burnt core sand in mixture?

Ans. We use old core sand because it is absolutely necessary in making up good castings. The old core sand is more porous and allows the gas to escape more readily than new core sand.

Ans. We have started recently to use old core sand on certain mixtures. We are today using about 20 percent on medium sized cores and about 30 percent on larger cores. We use a dry compound and that is the only thing that will hold core and sand successfully. We can handle more old sand with the dry compound.

Ques. What success have you had with core compounds or core oils?

Ans. The smallest core we make is about ⅛ in. diameter and I find that the core compound is the best binder. It is far better for the cores than core oil.

Ans. Going back to the old methods of core making, you can make a core of glue, or a core of flour, or a core of core oil, or any other compound which is in the market today, but the main point is this. Sometimes the foundryman condemns a good article, he never goes far enough to investigate what the reason is that his cores blow. In all probability he does not vent the core properly. If the core is 3½ in. long it should be vented 2½ in. and the coremaker has vented it only 1 in. When the molder puts that core in the casting there is a blow there. The main point in making a core is the venting of the same.

We have tried core oils and compounds but are now using burnt sand with glue. We found with core compounds and core oils it took us so long to get the core out of the top of a small hole that we had to go back to the old method of core making.

After a short intermission the meeting adjourned to dinner. At the evening session the president introduced as the speaker Mr. Geo. H. Hull, of New York, president of American Pig Iron Storage Warrant Co., whose remarks were on the use of the warrant and certificate system by foundrymen in supplying themselves with pig iron. He said that the warrants were simply a receipt for 100 tons of pig iron. They designate on the face the brand, grade and weight, and upon the return of the warrant the 100 tons as described on the face of the same would be put on the cars free of charge. Iron bought on these warrants are purchased on both analysis and fracture grading. At the conclusion of the speaker's remarks there was some discussion, after which a unanimous vote of thanks was extended to Mr. Hull. The meeting adjourned at 9:50.

Indianapolis Foundry Foremen.

W. H. Holmes, Dist. Vice Pres., care American Foundry Co.

At the March meeting of the Indianapolis Foundry Foremen, Mr. Keller read a paper on "Core Making." The Indianapolis Club has gotten out a postal card which they send out to each member previous to the meeting, stating the date on which the meeting will be held, the subject of the paper to be read, and requesting that the members come prepared to discuss the same.

Hamilton, Ont. Foundry Foremen's Association.

A. Chase, care Sawyer & Massey Co,, Secretary and Treasurer.

During the winter the foundrymen about Hamilton have met a number of times to discuss the subject of forming a local branch of the Associated Foundry Foremen. On Saturday night, March 11, a meeting was held at which the final organization was perfected, the charter having been received from New York. The following officers were elected: David Reid, of the Canadian Westinghouse Co., Ltd., president; Frank Reid, of D. Moore & Co., vice president; A. Chase, of Sawyer & Massey Co., secretary and treasurer. The president appointed the following executive committee: Thos. Simpson, Canadian Iron Foundry Co., city; John Dale, Sawyer Massey Co., city; George Manning, with John Bertram & Co., Dundas; Jas. Dowling, city; Samuel Brown, Canadian Westinghouse Co., city.

The foundry foremen of Brantford, Dundas and St. Catherines were also invited to be present at the meeting. The principal paper of the evening was by Dr. Richard Moldenke, of Watchung, N. J., but as the doctor could not be present the paper was read by Mr. Reid, and provoked considerable discussion.

On account of the fact that the election of officers and other routine business had taken up a great deal of time, it was impossible to discuss the paper as extensively as it was desired, and hence it was voted to continue the discussion at the next meeting. Before adjournment the members passed to an adjoining room, where an elaborate luncheon had been prepared. A hearty vote of thanks was extended to Dr. Moldenke for the paper presented.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.
F. H. Zimmers, Secretary, care Union Foundry and Machine Co.

THE ASSOCIATED FOUNDRY FOREMEN.
Frank C. Everitt, Secretary, 2413 Third Ave., New York, N. Y., care The J. L. Mott Iron Works.

CLEVELAND FOUNDRY FOREMEN.
W. H. Nicholls, 608 Gordon Avenue, District Vice President.

PHILADELPHIA FOUNDRY FOREMEN.
W. P. Cunningham, Secretary, Pencoyd, Pa.

ERIE FOUNDRY FOREMEN.
W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

NEW YORK FOUNDRY FOREMEN'S ASSOCIATION.
S. M. Williams, Dist. Vice Pres., 221 Third Street, Elizabeth, N. J.

CHICAGO FOUNDRY FOREMEN.
David Spence, Dist. Vice Pres. 142 Bunker St.

MILWAUKEE FOUNDRY FOREMEN.
Thomas Glasscock, Dist. Vice Pres., care Pawling & Harnischfeger Co., Milwaukee, Wis.

CONTINUOUS PROCESS FOR CAR WHEEL MANUFACTURE.

No branch of the iron and steel industry offers wider possibilities for the production of duplicate parts than the foundry trade, and in the past few years many continuous processes have been tried with more or less success. No steel plant is considered modern today without a continuous mill and it can be safely predicted that in the very near future every specialty foundry will operate on some continuous semi-automatic system. Labor troubles in foundries have fostered the molding machine, and the further replacement of skilled labor by the unskilled and cheapening of labor costs will bring about continuous processes. At Pittsburg a continuous steel belt was tried in one of the largest malleable shops for conveying molds to the casting floor, and practically all continuous processes tried have been designed to prevent the shaking down of molds when taken from one floor to another. The steel belt was discarded as it was impossible to prevent the vibration which resulted in the destruction of an unduly large percentage of molds. At another specialty shop the molds were placed on floats in a large water tank, but the tipping of floats with the consequent destruction of the molds soon resulted in the system being discarded. Outside of the car wheel line, no attempt has been made at operating continuously with a process that combines molding, casting and stripping.

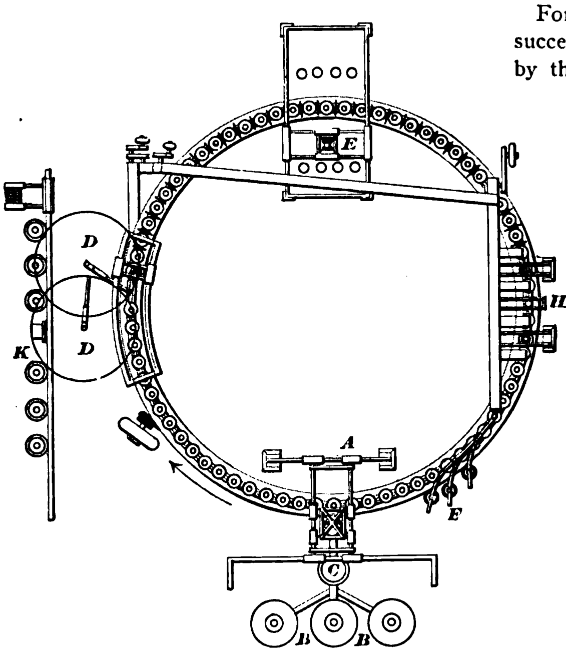


Fig. 1

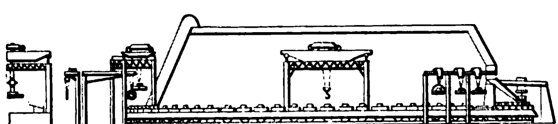
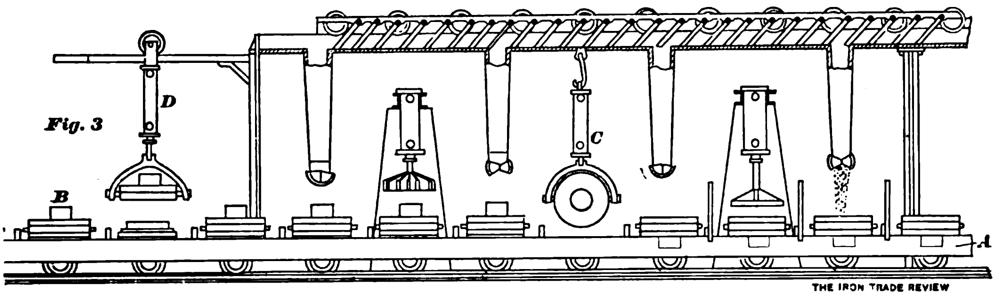


Fig. 2 THE IRON TRADE REVIEW

PLAN AND ELEVATION OF CONTINUOUS CAR WHEEL MOLDING AND CASTING PLANT.

For nearly two years car wheels have been successfully made at a plant near Pittsburg by the Sherman process, the invention of C. W. Sherman, of Bellevue, Allegheny county, Pa. Mr. Sherman's wide experience as a car wheel manufacturer led him to the conclusion that by the installation of a continuous process and a division of the work on each wheel would facilitate the manufacture, better the product, and effect a saving in the labor.

As shown in Fig. 1, the plant consists of an endless track and mold conveyor 100 ft. in diameter with space for 72 car wheel flasks. Each flask is allowed approximately 52 in. of space on the ring. The movement of the conveyor is intermittent and the distance moved is equal to the space occupied by one flask. The molding is accomplished by the use of ten patterns and each pattern is placed in a flask at A shown in Fig. 3, which is an enlarged elevation of the molding section. As the flask moves from point to point sand is fed from overhead spouts at point H in Fig. 1, and each man does that portion of the work assigned to him and this labor is the same on every wheel. When the flask leaves point B, Fig. 3, with the pattern withdrawn the mold is ready to be poured. The coping device is shown at F, Fig. 1. The sand ramming devices shown in Fig. 3 have not yet been used, this work now being done by hand. The pouring is accomplished by the use of a bottom pouring ladle as the mold passes the pouring crane A, Fig. 1, the iron being supplied in the usual manner from cupolas B and ladles C in Fig. 1. The stripping of the wheels is done at a cherry red temperature near the annealing pits, the pits being indicated by K, Fig. 1, the scope of the pouring and stripping

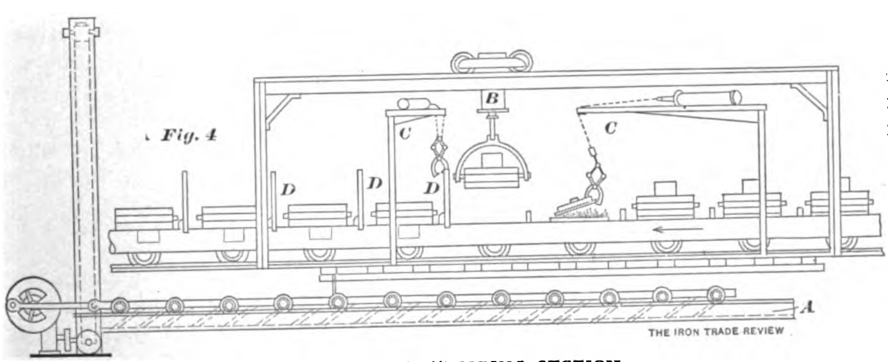


ELEVATION OF MOLDING SECTION.

cranes being such as to allow the proper time between pouring and stripping each wheel regardless of the speed of molding and melting. The wheel casting is removed with crane D, Fig. 1, from the conveyor car and placed in position for the pit, in one operation. The pitting crane is at G. Fig. 1. As the sand is removed from the wheel it drops into conveyor A, Fig. 4, and is automatically screened, mixed and tempered as shown in Figs. 8 and 9, while being conveyed to the molding section and the empty flask is replaced on the conveyor and passes under crane E, Fig. 1, where it is removed and a cold one placed in position ready for use. About one hour and 45 minutes is required for a flask to make a round of the entire operation and in operating 10 hours a day the same flask can be used twice, thus effecting a saving in a foundry's flask equipment of about one-half.

The track construction on which the conveyor moves consists of 70-lb. T rails curved to the proper radius and resting on ordinary cross ties. Figs. 5 and 6 show an endless conveyor, but the present installation consists of a system of cars, each holding two flasks and made of upright plates A, Fig. 6, and aprons B, of bent plates, forming a protection for the wheels which operate loose on the axles and also the rails at the stripping and molding sections to prevent any loose sand from blocking the track.

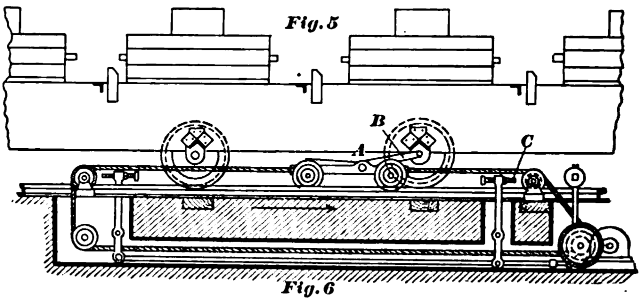
The radial axles have the distance from the axle of one car to the axle of the next, the same as between the axles on the same car, and the cars are coupled by a universal device, which will be simplified by the use of a continuous conveyor. Figs. 5 and 6 show a side view and cross section of the conveyor at the operating point. Trolley A, Fig. 5, is so applied to the conveyor as to allow the return movement without engaging the axles. Dog B works against the axle on its forward movement only, and the trippers CC act on the clutch A, Fig. 7, and reverse the movement of the trolley from either direction while the motor runs steadily forward making the movement automatic. The trolley track inside the conveyor track in Fig. 6, extends only the distance of the operating mechanism. The propeller is connected to drums B and C, Fig. 7, by a wire cable shown in Fig. 5, and by referring to Fig. 7 it will be seen that one drum is loose on the shaft while the other is in operation and vice versa. The drums shown are of different sizes to proportion the periods of travel and rest for the main conveyor and allow the proper time between movements for doing the work at various points on the circle. It has been found that a 15-h. p. motor is sufficiently large to move the whole train.

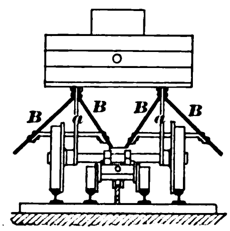


ELEVATION OF STRIPPING SECTION.

Fig. 3 shows the reciprocating sand conveyor and down spouts for feeding the sand to cope and drag sections of the molds. The gates on the sand spouts operate by a lever. The roll-over hoist C in Fig. 3 is at a convenient point to roll the flask over immediately after the bottom board has been fastened and the coping device D travels in line with the center of the conveyor and leads off the center line in Fig. 1 at F. Fig. 4 shows a pneumatic crane B, which travels in line of the conveyor and the wheel removing cranes C and C. The stripping operation is carried out as follows: Crane B removes the cope, chill and drag from the casting and replaces the flasks on the conveyor in a vacant space ahead, and the wheel is taken from the concveyor by ordinary wheel tongs operated by pneumatic jib crane C and deposited in position for the pitting crane G, Fig 1. The bottom board is then placed in an upright position as at D, and all the remaining sand drops through the cars and open track into conveyor A. The car and grating construction around the stripping section prevents any chunks of iron or scrap from falling through which cannot be easily handled by the conveyor A and removed from the sand by screen A in Figs. 8 and 9. The sand passes along conveyor A, Fig. 4, into screens A, Figs. 8 and 9. This mixer has a system of paddles attached to a shaft for thoroughly mixing the sand while it is being cooled and tempered. The sand is discharged at the opposite end into elevators and conveyors for delivery to the molding section ready for use.

The advantages of the system are many, resulting in uniform molding with comparatively unskilled labor, each man confining himself to one molding operation and an intelligent laborer can be taught his portion of the work very quickly. It has been found by actual operation and in the production of 400 wheels daily the average molding loss is about 2½ percent. All the pouring is done at one point near the mixing ladle, which avoids variations in temperature of the iron poured owing to its conveyance to a distant portion of the shop or near the cupola in an old system shop. The time of stripping all wheels is under the control of the man in charge which insures the pitting being done at the proper temperature and the wheels follow each other uniformly, exactly the same time elapsing between the pouring and pitting of every wheel. This is impossible under the old floor system where the wheels are conveyed variable distances before pitting. By this continuous system the heat from the pouring and stripping is entirely removed from the molding section and all wheels are stripped and pitted in the shortest time possible, reduces the loss of heat by radiation, bottles it up in the pit for annealing and avoids roasting the men at the work. A trial of this system through two summers has proved the pouring





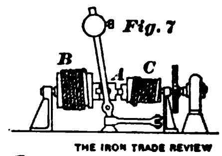
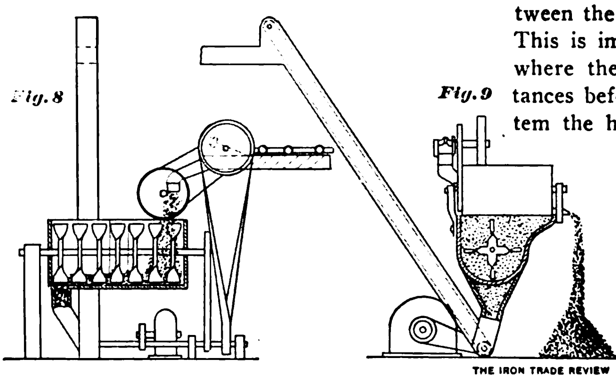


FIG. 5.—MOLD CONVEYOR SHOWING AUTOMATIC STARTING AND STRIPPING DEVICE. FIG. 6—CROSS SECTION OF MOLD CONVEYOR AND PROPELLING DEVICE FIG. 7.—DETAIL OF DRIVE AND CLUTCH.



CROSS SECTION OF SAND SCREEN AND MIXER.

and stripping to be much easier than under the old floor system and is due to the fact that only one ladle of iron and not more than two wheels are radiating heat in the shop at the same time. Under the old system each molder and helper handles 4½ tons of sand three or four times a day, which is done mechanically by this improved method, the whole operation of handling the sand, molten iron, hot wheels and flasks is reduced to a minimum and Mr. Sherman is now perfecting a molding device to complete the cycle of mechanical operations necessary to the manufacture of machine molded car wheels.

The number of men required to operate a plant equipped as shown in the drawings is as follows:

No. of Men.	Occupation.	Wage Per day.	Total.
1	Painting Chills	$1.25	$ 1.25
12	Sand Rammers	2.50	30.00
4	Finishers	4.50	18.00
1	Clamp Up	2.00	2.00
1	Pourer	3.00	3.00
1	Ladle Attendant	1.50	1.50
6	Shaking Out	1.75	10.50
2	Changing Flasks	1.50	3.00
1	Tempering Sand	2.50	2.50
2	Pitting	2.00	4.00
1	Cupola tender	3.25	3.25
1	Cupola tender helper	2.00	2.00
2	Laborers	1.50	3.00
	Total		$84.00

The above number of men will produce 350 good wheels in 10 hours which makes a total cost of 24 cents per wheel from molding to pitting inclusive and is a saving of 21 cents per wheel from molding with 35 cents for molding and 10 cents additional for foundry labor under the old system. With the application of the molding device for which a patent has been asked, there will be a further saving making the total aggregate 25 cents a wheel.

MENDING A CASTING WITH THERMIT.

In the February number of *The Foundry* I notice you gave considerable space to Aluminothermics. Having had some experience with this metal I thought I would offer it to your valuable paper and if you deem it worth space it may be the means of assisting someone who may have occasion to use thermit for mending. The W. H. Mullins Sheet Metal & Structural Works, of Salem, O., had a large 8-ton anvil for a drop hammer break at the point where one of the guides bolted on, and as the anvil was worth about $600, they thought it would pay them to weld it with thermit.

Not caring to undertake making the molds they requested the Silver M. F. G. Co., of Salem, O., to do that part of the work. Mr. Homer Silver, the superintendent of the foundry department, assigned the writer to do the work. I will now describe as close as I can the way the work was done. Owing to large brace ribs on the anvil it was impossible to take the molds from the broken anvil and we requested them to take plaster casts from the broken anvil and make a duplicate of the broken end of the anvil out of plaster. We then made a box which we nailed loosely together, made a cast core arbor and made the cores from the plaster duplicate. After the cores were rammed up and taken away from the plaster duplicate we pulled the box apart and took it away from the cores, thus saving the trouble of making iron boxes as was recommended by the circulars sent us by the thermit company, and I believe that the cores will dry better and a better opportunity is given the vent to escape. Also a better opportunity to guard against leak or runout by dispensing with the iron box.

The mixture we used for the core where it came in contact with the thermit metal was 40 percent china clay and 60 percent sharp sand; this we used as a facing, filling the rest of the space with common core sand. After the cores were dry we mixed a clay wash with the china clay about as thick as milk, and into a quart of this clay wash we put one pound of a good quality of graphite facing and painted the parts of the core exposed to the metal with this wash.

The core stood the metal and showed no scabs or blows. The cores were too large to handle by hand which made our job fitting them to the anvil a little more difficult. The lower core we left remain on the core plate placing it beneath the anvil,, we raised it into position and secured it there. We then fitted the top core in place temporarily, then taking it away we cleaned out the molds and heated the anvil to about a red heat. The top core was then put in place permanently and clamped from the plate beneath the bottom core to the cast iron arbor in the top half of core. We then rammed sand above the joint to prevent a runout. The basin for the surplus metal was in the top half of core, the slag basin we made by taking an old drag and lining it with common molding sand as one would do in makng a runner.

The crucible was put in place and 350 lb. of thermit metal and 50 lb. of steel punchings placed in it as directed by the Thermit Co. The igniting fuse was lighted and the metal let stand one minute before tapping. Notwithstanding the short time it required the metal to run out of the crucible the heavy walls and metal jacket of the crucible were white hot on the outside by the time the metal was all out. To the naked eye it looked much brighter than an arc light. As for the violence of the reaction any one who has ever seen a mold blow up, and I think we all have, has seen more violence than the writer saw from the thermit reaction.

The weld was successful but I would advise anyone contemplating using thermit to weld cast iron to multiply by three instead of two as directed by the Thermit Co. That is, find how many pounds of metal it will take to fill the fracture thermit collar gates and multiply this by three and that will give the amount of thermit required if you wish to be sure of success.

The Thermit Co. says to run as much metal through as is required to fill the fracture and thermit collar, but from what I saw of Thermit I don't believe that in welding cast iron that amount is enough.

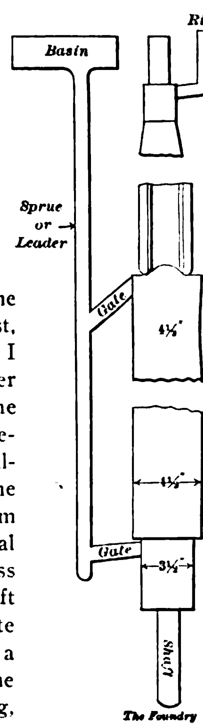
When I was making these cores I bared one of the spurs of the cast iron arbor and placed a wrought iron rod in the core beside the cast spur with the end exposed in a like manner to see which metal it would adhere to the best. When we stripped the molds off the wrought iron rod was welded to the thermit steel and in trying to get it away it broke off above the weld, but the cast iron spur did not even take hold which led me to believe that more thermit is required to weld cast iron than it would require to weld wrought iron or steel.

As far as the foundry is concerned I do not believe that that thermit at its present price will be of much value. Unless the casting was a very valuable one it would not pay to attempt to mend it, and if a customer was paying a large sum for a casting he would hardly take one that was patched. Owing to the enormous shrinkage of thermit it is useless for filling holes in castings, and if a light or delicate casting were operated on with thermit it would surely weaken or break it. The only way in which I can see that thermit might be of use to the foundry would be in the blending of iron and steel. The iron could be drawn from the cupola and thermit melted in the crucible and mixed without the steel coming in contact with the impurities of the cupola which are so injurious to steel. But to the machine shop where the breaking of some part might cause the shutting down of the shop or a machine the value of thermit as a mending agent can be estimated only by value of the time which it would require to get a new part, which in some cases would be very great. The little experience I had with thermit was very interesting to me and I think there are many uses to which this metal will be put and by the exchange of our experience with thermit we will all learn its real merit.

PATRICK REDINGTON.

CASTING IRON ON STEEL.

In answer to G. L. B.'s casting difficulty, I would suggest to him that on this particular job he ram the mold in the vertical position, taking the precaution to gate the mold where the drawing shows diameter of casting to be 3½ in. This, in my opinion, should be the bottom end, as the shaft protrudes more and has a better hold where the strain would be greatest, in addition to this gate I would still cut another slightly smaller at the top of the 4½ in. diameter with the idea of filling the mold up to the height from the bottom gate, then as the metal rises to a more or less dull degree than it left the ladle the upper gate will help to enthuse a new life to it with the result of a better casting, an extra inch of pattern to be turned off the upper end of casting would also be of benefit, but if this is not practicable place a riser thereon. After securing by clamping, cast on end, as I do not know what kind of a flask you are using, great care will be necessary to overcome extra strain if tackle is weak.



WM. LEARY.

TRADE PUBLICATIONS.

The Ingersoll Sergeant Co. have issued another small catalogue 4½ x 3¼ in., entitled "Air Compressors." In this, one machine of each type which they build is illustrated, and a short statement given as to its distinctive features and the work for which it is adapted.

Warren-Webster & Co., of Camden, N. J., are sending out a reprint of a paper entitled "Circulation of Steam for Heating Purposes, at or below the Pressure of the Atmosphere." This paper was read by request before the American Society of Heating and Ventilating Engineers, by Reginald Pelham Bolton. In this paper the author treats very interestingly the subject of low pressure circulation for heating purposes.

The Rockwell Engineering Co., of New York City, have issued a new catalogue describing the Rockwell double chamber melting furnace. The catalogue is gotten up in very neat style and fully illustrates the use of this furnace, showing the method of operation in detail, also the method of lining. In addition to this, a comparative statement is given, showing the cost of operating this furnace and the ordinary style of crucible furnace.

The Ingersoll-Sergeant Co. have started a set of bulletins which are being sent out from their pneumatic department. The first one is entitled Bulletin No. 2,000, and deals with the McDonald rivet forge. This forge would be a very handy device for use in a foundry where a limited amount of smith work was required.

PERSONALS.

James S. Stirling, who was recently elected president of the Crescent Shipyard Corporation and of the S. L. Moore & Sons Corporation, subsidiary companies of the Bethlehem Steel Corporation, has risen rapidly during his business career. Mr. Stirling, who is not yet 34 years old, entered the cost department of Harlan & Hollingsworth Co. in 1891, and in 1892 was made superintendent of the foundry department. In January, 1903, he became vice-commissioner of the National Founders' Association. He continued in that position until he resigned to become associated with the S. L. Moore & Sons Corporation. Mr. Stirling was vice-president for three years of the Philadelphia Foundrymen's Association and was a member of the third district committee of the National Founder's Association during 1901 and 1902.

Mr. Benj. J. Downs has bought an interest in and taken charge of the Harry A. Spears brass foundry, 130 Oliver street, Boston, Mass. Mr. Downs has had years of experience as foreman and is a progressive foundryman.

Mr. Hugh McPhee, foreman of Eaton, Cole & Burnham Co.'s brass foundry at Bridgeport, Conn., gave a very interesting talk on molding before the Mechanical Club of the Y. M. C. A. of that city. He illustrated the talk by making a mold and pouring it with white metal.

On March 2nd, Mr. E. H. Mumford, of the Tabor Mfg. Co., Philadelphia, Pa., read a paper on foundry molding machines before the Franklin Institute.

Wesley R. Mason has been promoted to the position of district manager at the Detroit shops of the American Car & Foundry Co., as successor to George Hargreaves, resigned. Mr. Mason, although a young man, has been connected with the company 17 years. D. W. Hawksworth, who has been mechanical engineer for the company at Detroit, will be assistant to Manager Mason.

Mr. C. B. Murray, for may years chief chemist of the Carnegie Steel Co., at its Edgar Thomson Works, has associated himself with Mr. G. P. Maury in the active management of the Metallurgical Laboratory, 611 Bailey-Farrell Building, Pittsburg, Pa.

FIRES.

The foundry plant of the Rogers Machine Foundry Co., of Riverside, Cal., was damaged by fire to the extent of $3,000 on March 6th, with $2,000 insurance.

The foundry plant of the Hardie-Tynes Foundry & Machine Co., of Birmingham, Ala., was damaged by fire on March 12th to the extent of $20,000, which is covered by insurance. The fire evidently originated in the core ovens.

The foundry of I. Droege & Sons, of Covington, Ky., was visited by a serious fire on March 6th. The molding department was entirely destroyed, together with some new tools and a large amount of stock. The loss is estimated at $35,000, which is fully covered by insurance. The engine room, pattern and pattern storage departments and some other departments were saved.

A fire which started in the molding shop of J. Fleury's Sons, Aurora, Ontario, Feb. 28, destroyed core boxes in use and did considerable damage to the roof. Loss $2,000.

The Crawford-Speer Foundry & Machine Co.'s plant at Bridgewater, Pa., was destroyed by fire on Feb. 15, entailing a loss of about $9,000, which is offset by $4,000 insurance.

The foundry of Engelman & Sons, of Benton Harbor, Mich., was slightly damaged by fire on Feb. 16th.

The foundry plant of the Bovee Furnace and Grinder Works, of Waterloo, Ia., was destroyed by fire on March 3rd, with a loss amounting to $15,000, which was partially covered by insurance. The work of the foundry will be done in other foundries in the city until the company can rebuild the burned structure.

The plant of the Davis Foundry and Machine Works, in West Rome, Ga., was destroyed by fire on March 3rd. The loss was about $9,000, partially covered by insurance.

The foundry of the Flint-Lomax plant at Denver, Colo., was damaged by fire to the extent of $2,500 on Feb. 23. The loss was fully covered by insurance.

A fire in the plant of the Jones & Bruce Foundry, Cincinnati, Feb. 25, partially destroyed the plant, causing a damage of $2,500.

The Lakeside Malleable Iron Works, Lakeside, Wis., three miles south of Milwaukee, was burned March 1. The plant was valued at $125,000, and is a total loss. The Bruce Engine Co.'s plant and the Racine Iron & Steel Works were damaged.

The Fort Payne Stove Foundry, of Fort Payne, Ala., was visited by fire on Feb. 23rd, and a large portion of the plant destroyed. The office, stables and pattern department were about all that were saved.

McCormick & Co.'s foundry at Pittsburg, Pa., was slightly damaged by fire on Feb. 21.

The plant of the Missouri Malleable Iron Co., of East St. Louis, Ill., was visited by a fire on March 7th, with a loss of $100,000. A considerable portion of the plant, however, was saved.

The foundry of the Cedar Falls Iron and Brass Works, of Cedar Falls, Ia., was destroyed by fire on Feb. 15th. The loss was $20,000, against which there is only a small amount of insurance.

A portion of the foundry and the pattern department of Pascal Amesse, Montreal, Canada, was damaged by fire on Feb. 24th. The damage is estimated at 1,500, being largely due to the destruction of valuable patterns.

The foundry connected with the plants of the Barcus Horse Stock Co. and the Wabash Stove Co., of Wabash, Ind., was burned on March 5th, with a loss of several thousand dollars, upon which there was a small amount of insurance. The most important loss was the patterns, among which there was a full set for automobile engines.

NEW CONSTRUCTION.

Abendroth Bros., New York, will build a new molding shop 90 x 175 ft. at the plant in Newburgh, N. Y. They will also erect a machine shop 50 x 140 ft., six stories high.

Plans are being perfected by Stanley G. Flagg & Co., Pottstown, Pa., for the erection of a building on the site of the foundry recently destroyed by fire. The new building will probably be larger than the old structure.

The Central Foundry Co., of Vincennes, Ind., are planning to build an addition to their plant which will give them from 15 to 20 more molding floors.

The Butler Foundry & Iron Co., of Chicago, Ill., has taken out a building permit for a one-story addition to its plant, to cost $8,000.

The Missouri Malleable Iron Works, East St. Louis, Ill., will rebuild the annealing building which was destroyed by fire March 7. The new structure will be 110 ft. wide by 150 ft. long, and will cost about $45,000.

The Joy Stove Works, of Chicago, Ill., are to construct a new plant at a cost of about $25,000.

M. A. A. Guilbert is making plans for a new foundry for the Lakeside Malleable Casting Co., of Racine, Wis., to take the place of the buildings recently destroyed by fire. The buildings are to be constructed of steel and concrete.

Plans have been completed for a new factory, including a foundry, for the Aldine Grate & Mantel Co., at Grand Rapids, Mich. They expect to build their plant in the near future and to have it in operation by August.

The I. Droege Foundry Co., of Covington, Ky., expect to replace their plant, which was recently destroyed by fire, with a steel structure. Temporary quarters for carrying on the work will be erected in the meantime.

J. H. Newbury, of Middletown, N. Y., is planning to erect an addition to his foundry at Goshen, N. Y. The addition will be 40 x 100 ft. and will be occupied for offices, while present offices will be fitted up for a machine shop.

A building permit has been granted to the Central Iron Works, of Syracuse, N. Y., for the construction of several buildings including a foundry.

Work at the Kerbaugh plant, near Bellwood, Pa., is progressing rapidly. Several of the buildings are practically completed and it is expected that the plant will be in operation

May 1st. The machine shop will be 120 x 230 ft. and the foundry 50 x 50 ft.

The work of rebuilding the foundry of Theodore F. Conner, of Bloomsburg, Pa., has been begun and will be pushed as rapidly as possible.

The J. B. Morris Foundry Co. will erect a large concrete addition to their foundry at Cincinnati, O.

The Carroll Foundry & Machine Co., of Bucyrus, O., will erect a new steel foundry building 130 x 300 ft. during the coming summer.

Work on the new Day-Ward foundry at Warren, O., is progressing rapidly.

Jas. H. Rhodes, architect, 429 Broadway, Logansport, Ind., has plans for a four-story machine shop, 50 x 150 ft., and a one-story foundry building 60 x 100 ft.

McCarthy & Malinski, of Cairo, Ill., have commenced the erection of their new foundry and machine shops at Cairo, Ill.

The Prescott Co., at Menominee, Mich., contemplates erecting a foundry for the manufacture of steel castings.

The Kalamazoo Stove Co., Kalamazoo, Mich., which recently increased its capital stock from $200,000 to $315,000, will erect a large warehouse 300 x 215 ft., and a power building to enclose a 350 H. P. Buckeye tandem compound engine, Union Steam Pump Co.'s pumps. condenser, Cahall boilers and a Crocker-Wheeler generator direct connected.

The Detroit Steel Casting Co., Detroit, whose plant was recently destroyed by fire, will build on a much larger scale than at first contemplated. There will be a large additional equipment.

The Harlan & Hollingsworth Co., of Wilmington, Del., are making quite extensive changes in their plant, and are preparing for the erection of a new foundry.

The Standard Sanitary Mfg. Co. have awarded a contract for the construction of the additions to their plant at Louisville, Ky., including a foundry and warehouse. The additions will cost about $50,000. The foundry will be 150 x 280 ft., and there will be several other large buildings.

Work has been progressing as rapidly as possible on the plant of the Bacon-Collins Co., of Albany, Ga., but it is probable that their machine shop and foundry will not be completed before May 1st.

Mr. Maddox, of Jacksonville, Fla., is planning to erect a foundry and machine shop, which he expects to have in operation in the near future.

A foundry is being added to the Burns Boiler & Machine Co.'s plant at Jonesboro, Ark. This will enable them to do work which they have formerly had to get from Memphis, Tenn.

The Davenport Locomotive Co., Davenport, Ia., will erect a large addition to its plant, a tract of 12 acres having been purchased recently for that purpose.

The Olbrich & Clay Foundry at Cedar Falls, Ia., which was recently destroyed by fire, will be rebuilt.

Geo. Clare, president of the Clare Mfg. Co., of Preston, Canada, recently visited Winnipeg, Manitoba, and made arrangements for the erection of a foundry plant by his company. They have purchased five acres of ground and will begin work in the near future.

GENERAL INDUSTRIAL NOTES.

We are informed that the new works of Geo. G. Blackwell, Sons & Co., Ltd., Liverpool, England, for the manufacture of ferro-silicon are completed, and will be in operation early in April. They will have the largest output of ferro-silicon of any works in the world and will produce grades as follows: 25 per cent, 50 per cent and a third grade varying between 70 and 75 per cent. They will take great pains to have their alloys low in phosphorus, and also state that their grades containing a high percentage of silicon are made in such a way that they will not crumble into a powder but will remain solid.

Keith Furnace Co., Des Moines, Ia., has just completed the erection of a new building to be used for offices and a pattern room. The space in the main buildings formerly used for this purpose will be given over to the foundry and assembling departments.

The new plant of the Leyner Engineering Co., at Littleton, Col., erected on state land, has been completed. The machine building is 280 ft. long and is planned for lengthwise extension to 400 ft. The forging building is 61 x 161 ft., and the pattern building 41 x 141 ft.

At the recent annual meeting of the American Hardware Corporation, New Britain, Conn., it was decided to increase the capital stock from $5,000,000 to $7,500,000, a part of the new capital to be used in purchasing the Corbin Cabinet Lock Co., which has a capital stock of $200,000. The stockholders chose the following directors: Philip Corbin, Andrew

Corbin, Charles M. Jarvis, A. J. Sloper, Charles H. Parsons, Charles Glover, Howard S. Hart, S. C. Dunham, of Hartford; Frederick P. Wilcox, John H. Whittemore, of Naugatuck; Charles Miller, of Waterbury, and George W. Corbin. The last two named directors were added to the board to represent the Corbin Cabinet Lock interests, and the board otherwise remains the same as last year. The corporation has recently increased its dividend from 2½ per cent yearly to 1 percent. The directors' annual report of the American Hardware Corporation gave the total assets of the subsidiary companies as $7,992,201; the bills and accounts payable amounting to $868,532, leaving the net assets $7,123,668. The net earnings during the year were $548,240, about the same as in 1903.

The Niles-Bement-Pond Co., of New York, have purchased the plant of the Cresswell & Waters Co., Philadelphia, Pa., which includes a machine shop and foundry and some other buildings.

The Johnstown Foundry & Machine Co., of Johnstown, Pa., has applied for a charter. The new plant is to manufacture iron and steel castings, mine cars and other machinery. This is a reorganization of the Cambria Foundry & Machine Co., and the incorporators are Geo. A. Hager, John W. Walters, N. Bruce Griffith, Harry M. Benshoff and John N. Horn. The company is to have a capital of $30,000.

The Globe Foundry Co., of Port Chester, N. Y., has been incorporated with a capital of $40,000. The incorporators ore C. H. Underwood, Henry D. Merchant, and John C. Merchant.

The Davison-Namack Foundry Co., Ballston Spa, N. Y., recently incorporated, has bought out the business of Uline Bros., of that city. The plant, while not large, is in good shape as far as convenience is concerned. The foundry is a modern one, and work can be handled up to six tons. The new owners have been repairing the machine shop and have added a jig saw and buzz planer to the pattern shop. Other machinery and equipment will be installed as the business warrants. The company has land enough to enlarge, which it hopes to do within a year.

The stockholders of the Tacony Iron Co., of Tacony, Pa., will meet in Philadelphia on April 27th to vote on an increase in the capital stock of the company from $50,000 to $200,000, the funds thus provided to be used in increasing the capacity of the plant, which is located at Tacony, Pa., and consists of an iron foundry, brass foundry, machine shop, etc.

Mr. C. H. Urick, of Erie, Pa., is at the head of the project for starting a new jobbing foundry in Erie. His three sons will engage in the business with him. They expect to spend about $25,000 in equipping a new plant and will have it in operation in about two months.

The National Elevator & Machine Works, of Honesdale, Pa., has been sold to H. F. Guerney, New York, N. Y.

The Ohio Brass & Iron Mfg. Co., Cleveland, which recently increased its capital, does not intend to erect any buildings at present, but expects to use the new capital in extending its business. Three traveling salesmen have been added to the outside force.

The American Castings & Register Co., of Akron, O., has been incorporated with a capital of $25,000. The incorporators are Daniel Motz, Geo. N. Dugot, Edward H. Arend, Cloyd R. Quine and William H. Kroeger. The company will take over the business of the American Castings Co., the plant will be enlarged and general line of foundry business carried on in addition to the manufacture of hot air registers.

At the annual meeting of the stockholders of the Portsmouth Stove & Range Co., Portsmouth, O., the following officers were elected for the ensuing year. President, F. V. Knauss; F. M. Knauss, vice-president, and Robt. G. Bryan, secretary and treasurer.

D. E. Dangler and Paul Schneider are interested in the formation of a company to be known as the Best Foundry Co., of Bedford, Ohio.

John E. Angell & Co., East St. Louis, Ill., have been incorporated with a capital of $25,000, to conduct a general foundry and machine manufacturing business. The incorporators are: John E. Angell, James G. McHale and W. T. Summer.

The Tuscaloosa Foundry & Machine Co., of Tuscaloosa, Ala., has been formed to carry on a general machine shop and foundry business. The officers are Ed. W. McDonald, president and manager; F. L. McDonald, vice-president, and J. S. Hanson, secretary and treasurer.

The Birmingham Stove & Foundry Co., of Birmingham, Ala., has been organized with a capital of $25,000. The incorporators are H. D. Maus, James M. Jolly, E. M. Chestnutt, J. B. Gibson, W. G. Ester, C. E. Thomas, T. F. Thomas, and T. F. Wimberly. The company expects to manufacture stoves and ranges.

The Whitman Agricultural Co., St. Louis, Mo., whose pattern building was recently damaged by fire, has not been seriously inconvenienced. The plant is now in operation as formerly.

The Cummings Machine Works has been organized at Boston, Mass., to operate a foundry and machine shop. Henry H. Cummings is president and treasurer, and the capital stock is $25,000.

The Hallcast Foundry Co., Providence, R. I., has been organized recently for the purpose of casting dies by a patent process. Mr. T. Parker Hall, Jr., is the manager.

The Frazer & Jones Co., Syracuse, N. Y., have decided to enlarge their plant by erecting new buildings to be used as foundry and pattern shop. They have also elected the following officers for the coming year: President, R. W. Jones; vice-president, Fred Frazer; treasurer, Chas. R. Jones; secretary, O. P. Letchworth.

G. W. Frazier and brother, of Frankfort, N. Y., have purchased of Wm. Dixon, his machine shop at Adams, Jefferson county, N. Y. They will erect a foundry in the spring and will do general machine business. Mr. Dixon who is 82 years of age, retires after an honorable business career of over 50 years.

John Gilroy and Henry Johnson have formed a partnership for the purpose of carrying on a brass foundry at 252 Whitesboro street, Utica, N. Y.

The plant of the Baldt Steel Casting Co., of New Castle, Pa., is partly completed, the machinery is being installed, and the furnaces gotten ready for operation.

The Marshall Foundry Co., of Pittsburg, Pa., has been incorporated with a capital of $150,000. The directors are W. M. McCulloch, W. D. Marshall, Reid F. Blair, Wm. W. Wishart, of Pittsburg, and Joseph K. Killinghest, Sewickley.

The British steamer Tantalion has arrived in Philadelphia with a cargo of 4,000 tons of pig iron from Middlesborough, England, consigned to a Philadelphia firm to be used in the manufacture of cast iron water pipe and reshipped to England. United States Consul H. Clay Evans, London, reports that 3,150 tons of pig iron were shipped to the United States during December from Middlesborough.

The Mahoning Foundry & Machine Co., of Youngstown, O., have purchased from the executors of the Geo. B. Sennett estate the punch and shear plant. It is announced that the new owners will push the business more energetically than ever before.

The Stark Foundry Co., of Canton, O., has been incorporated with a capital of $5,000. The incorporators are G. P. Bonsky, G. A. Bonsky, G. F. Ebel, P. Bonsky and A. J. Bonsky.

The Canton Malleable Iron Co., Canton, O., is rebuilding its foundry, recently destroyed by fire, as rapidly as possible. The firm is crowded with orders in its foundry department.

The Loveland Foundry Co., Loveland, O., capital $10,000, has been incorporated by Daniel Donnelly, John A. Seymour, Harry Donnelly, George Chambers and Horace B. Jones.

The Aetna Machine & Foundry Co., of Warren, O., has changed hands, Mr. Fred Russell having purchased the interests of Mrs. Lloyd Booth, Chas. H. Booth, H. M. Garlick and Charles W. Bray. This gives him four-fifths of the stock, the remaining one-fifth being owned by his father, J. W. Russell, who is about to retire from active business.

The property of the National Valve Co., Sandusky, O., was sold last week to the bondholders, and a reorganization is to be effected.

The Dennison Foundry Co., of Dennison, O., has been incorporated with a capital of $60,000. The incorporators are: M. Dunn, J. F. Digan, P. F. Smith, Jr., E. D. Moody and W. A. Coldren.

The Ohio Brass and Iron Works Co., of Cleveland, O., has increased its capital stock from $50,000 to $100,000.

The stockholders of the Kelly Foundry & Machine Co., of Goshen, Ind., have elected the following officers for the ensuing year: Frank Kelly, president and treasurer; H. B. Kelly, vice-president and manager of tank department; Charles F. Kelly, secretary and superintendent.

The Wayne Stove Co., of Fort Wayne, Ind., has been organized with a capital of $50,000. The incorporators are Wm. H. F. Moellering, Saml. M. Holtzman, Geo. B. Aldrich, Albert K. Hart and H. W. Dickman.

The old Dorner Truck & Foundry Co.'s plant, Logansport, Ind., is to be reopened and employment furnished to 75 men. The Dorner Mfg. Co., capital stock $100,000, has been incorporated to manufacture car trucks, etc. The directors are: H. A. Dorner, R. D. Buckingham, Oscar Lund, B. H. Walrath and Lloyd J. Smith. Work will begin at once to put the plant in shape for operation. The defunct Dorner Truck & Foundry Co. was organized about four years ago, but through lack of funds and other difficulties was obliged to cease business.

The Mattoon Stove Foundry, of Mattoon, Ill., which has been idle for some time, has started up once more.

The Excelsior Mfg. Co., Chicago, has been incorporated with a capital of $2,500 to manufacture castings and machinery. The incorporators are: L. H. Flint, L. A. Koepfle and Wm. J. Krueger.

The plant of the Fountain City Drill Works, La Crosse, Wis., has been sold to B. E. Edwards, who has leased the plant to the Summit Stove Works, which will use it for the manufacture of stoves. The building will be remodeled and equipped with suitable machinery.

Chas. Walker has started in business in Detroit, Mich., his company being known as the Walker Motor Foundry & Machine Co.

The Oltmer Iron Works, Hoboken, N. J., recently incorporated with a capital stock of $25,000, has taken over the plant and business of Christian Oltmer, of that city, and will manufacture structural and monumental iron.

Sumter Iron Works, Sumter, S. C., which has been conducted by W. E. and John I. Brunson, has been incorporated with a capital stock of $12,000, and the following officers have been elected: John I. Brunson, president; W. E. Brunson, vice-president and general manager; E. W. Moise, secretary and treasurer. The company will be in the market for machinery for installation in its machine shop.

By special act of the county commissioners, the new pipe plant of the Coosa Pipe & Foundry Co., at Gadsden, Ala., has been made exempt from taxation for a period of five years. The city has already exempted the company from city taxation. The new plant will employ 500 men when it is completed.

The Newport Foundry & Machine Co., whose plant at Newport, Ky., was recently sold to the strikers, has changed its name to the Weber Foundry Co., and purchased the foundry plant, contracts and good will of the Wessling Bros., who have operated a foundry at McLean and Sherman avenues, Cincinnati, on the Southern Railroad. The company will continue to make gray iron castings. Henry J. Weber is president.

The Wellsburg Heating, Ventilating & Foundry Co., of Wellsburg, W. Va., expects to make extensive additions to its foundry in future, which will greatly increase its output.

The Davis-Forrest Machine Works, of Savannah, Ga., expects to erect an iron and brass foundry.

The Peacock Iron Works, Selma, Ala., is seeking another location, and may move to Chattanooga, Tenn. The company's specialty is car wheels and cars of all sizes and kinds. The company wishes to triple its capacity.

The Exchange Machine Works, of Birmingham, Ala., has filed a petition in the probate court to change its name to the Vulcan Machine & Foundry Co., and to increase its capital stock from $2,000 to $10,000.

Knoxville Foundry & Machine Co., Knoxville, Tenn., has been incorporated with a capital stock of $25,000. The incorporators are: John P. Staub, Frederick Staub, Charles H. Smith, James H. Weicker and R. H. Sanson.

Nelson Story, Jr., of Bozeman, Montana, is planning to move his foundry from Bozeman to Billings, Montana.

The Great Western Heater Co., of Des Moines, Ia., has been organized by Mr. R. J. Shank. The company will have its headquarters in Des Moines and will manufacture heaters. Mr. Shank has had long experience in this class of work.

The Byron-York Machinery Co., Pueblo, Col., has been incorporated with a capital of $25,000. The company proposes to manufacture gasoline engines chiefly, but has made arrangements for general machine foundry business. The directors are: F. D. Wallaker, O. E. Byron, W. A. Borroughs, H. L. York and A. E. York. The factory is located in Peublo.

The machinery for the new plant of the Grant's Pass Iron & Steel Works, of Grant's Pass, Ore., is being installed and Grant's Pass will soon have the largest foundry in the state south of Portland.

The Tulsa Foundry & Machine Co., of Tulsa, I. T., has been incorporated with a capital of $5,000. The officers are: Ed. C. Reynolds, president; M. B. Baird, vice president; and W. I. Reneau, secretary and treasurer.

The Union Foundry Co., of Seattle, Wash., has been incorporated with a capital stock of $18,000. The incorporators are: Axel Sjostrom, Nels Kartvig and Adolph Swensen.

The Canadian Fairbanks Co., Ltd., has been formed by Henry J. Fuller, of Montreal, Canada. They will take over all the interests of the Fairbanks-Morse Co., including all of their contracts, organization and warehouse stocks, and will establish a plant in Montreal to manufacture the Fairbanks scales and other specialties.

The Ambrose Foundry Co., St. Joseph, Mo., has been incorporated with a capital of $15,000. The board of directors will be composed of S. F. Rowley, S. F. Ambrose and J. M. Johnson.

THE FOUNDRY

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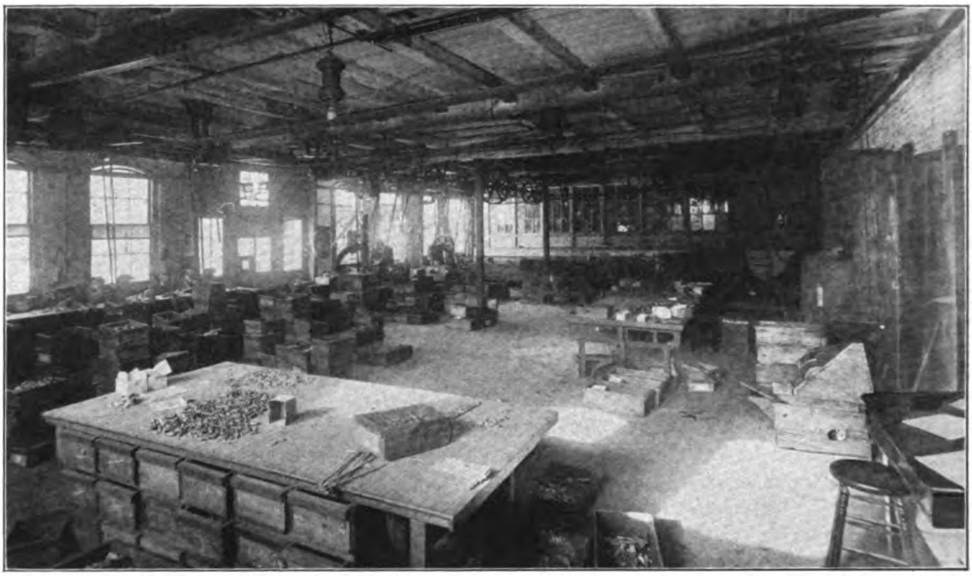
Brass Foundry of the Yale & Towne Mfg. Co., Stamford, Conn.

Like the iron foundry, this department has been very carefully equipped for the production of the special castings required for the line of manufacturing that is carried on by this company. The brass foundry proper is 120 by 129 ft. At one end there are two rooms, each 34 by 78 ft., one of which is used as a core room. The most of the sand for the brass foundry is stored in the shed adjacent to the foundry and the sand mixing department is located in a wing 20 by 24 ft. situated on one side of the building. Great care is taken in the preparation of the sand for the different classes of work, the mixing department being equipped with a magnetic separator for removing any iron from the sand which has been used, and with suitable grinding and sifting machinery for preparing the various facings. The furnaces are situated in the center of the foundry building, being arranged in groups of 16 furnaces each. The pots are drawn from the furnaces and carried to the side floors on suitable trolleys supported from I-beams. They are then taken to the molds with ordinary shanks.

ONE SIDE OF BRASS FOUNDRY.

Practically all the work is bench molding, each man being equipped with a bench, the necessary number of flasks and bottom boards and the required amount of sand. In most cases perforated iron plates are used as bottom boards. As the men prefer to ram their flasks with their feet, a rope is suspended over



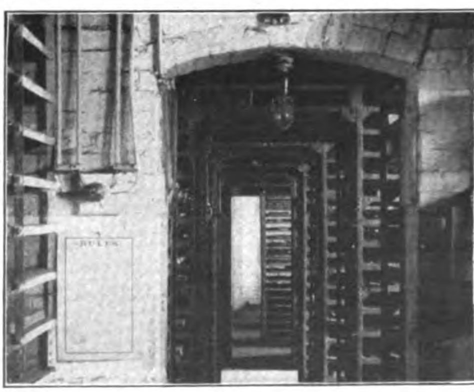
CLEANING DEPARTMENT.

each tub to assist the man in jumping up on to the mold and as a support while using his feet for ramming. The flasks are very carefully designed to receive the work being done. For all the more delicate work the molds are skin dried by placing them around stoves which are situated in the center of the building near the melting furnaces. The molds are smoked by placing them upon suitable racks and passing a pot of burning resin under them. The fine carbon from the resin smoke serves as a blacking or facing.

The slag and waste material from the furnaces is ground and cleaned in the department located at one end of the brass foundry, and the metal so recovered either used in the mixtures, or sold to dealers in this class of material.

The castings are cleaned and trimmed in the department under the metal pattern shop, which is situated at one end of the brass foundry. This department is equipped with metal band saws, trimming presses, grinding machinery, pickling vats, sorting tables, etc.

The vault for the storage of patterns and matches is also located at one end of the brass foundry and underneath the metal pattern shop. This vault is so situated that it can receive light from outside windows without incurring fire risk. The matches and patterns



1. PATTERN VAULT SHOWING PASSAGE AND RACKS.
2. RECEIVING AND INSPECTING ROOM OF PATTERN VAULT.

are supported on iron shelves carried on iron racks. The only timber work in the room which could burn is the 7/8-in. floor, the ladders and the receiving table and desk of the man in charge of the pattern vault. The general construction of the vault is shown by the accompanying illustrations.

METALLOGRAPHY APPLIED TO FOUNDRY WORK.

BY ALBERT SAUVEUR.

In this series of short articles, I propose to present as concisely and simply as possible the elements of Metallography with special reference to the application of this testing method to foundry work I shall avoid dealing with hypothesis or with theories, which are still to a great extent of a speculative character, as well as with scientific considerations of no immediate practical application. In short it will be my aim to convey such a knowledge of metallography as will be of value to those engaged in the production of castings.

The Fracture Of Cast Iron vs. Its Micro-Structure.—As is well known, foundrymen from time immemorial have been in the habit of judging of the grade of pig iron by the appearance of its fracture. In recent years moderately successful efforts have been made to replace this relatively rough and uncertain test by the more accurate and scientific method of chemical analysis. Many foundrymen, however, are still guided by the appearance of the fracture in selecting pig iron for their mixture. With all its shortcomings and limitations, the fracture test undoubtedly furnishes to the trained eye much reliable information regarding the chemical composition of the iron. The reason for this is to be found in the close relation which exists between the aspect of the fracture of a metal and its physical and chemical characteristics. Indeed it may be confidently asserted that any treatment which affects the chemical or physical properties of a metal will also affect the appearance of its fracture. If this be so, it only remains for us to learn how to read and interpret these changes in the aspect of the fracture in order to obtain the needed information regarding the properties of the metal. As might well be expected this will demand considerable experience on the part of the observer. The fracture of a metal is not an open book in which any one may read. A long preliminary schooling is generally required and even to the proficient student, the book yields, undoubtedly, but a very small part of the secrets which it encloses. The little which it does yield, however, is generally of sufficient value to warrant the effort of acquiring the necessary training. Many instances of notable proficiency in fracture reading are on record, such, for instance, as the remarkable accuracy with which skilful and experienced smiths are able to determine the refining heat (recalescence point) of steel by the appearance of the fracture, and the close estimate made by crucible steel makers of the carbon content of their steel based solely upon fracture inspection. If it be considered that in this study of fracture reading we have hardly passed the spelling stage, we may confidently expect fruitful returns as a reward for further endeavor.

Seeing the closeness of the writing and the jealous care with which the metal seeks to hide its secrets, it was quite natural that metallurgists should have called to their assistance those instruments of modern research which in other fields had been used with such wonderful results, namely the magnifying glass and the compound microscope. In examining the fracture of metals by means of a magnifying glass we are occasionally able to obtain information which the naked eye could not secure, but it is, on the whole, of but slight assistance. The examination of the structure of metals, on the contrary, by means of a compound microscope opens up almost unlimited possibilities. A wonderful light is thrown on the page which we were reading so laboriously; new words—new sentences—appear, and we have taken a step forward in our knowledge of metals which mark an epoch in their study.

The compound microscope, however, cannot be applied to the examination of fractures, the magnification which it yields being so great that only perfectly plane surfaces can be observed. The inequalities of a fracture when so highly magnified become as many mountains and valleys: if we focus our eye upon the summit of a mountain the valley will be so far away as to be but dimly visible, while if we bring the valley within visible distance, the mountain tops lie so near our eye as to be quite undistinguishable.

In order to apply the microscope to the study of metals, it is, therefore, necessary to use polished sections, suitably prepared. The micro-structure of the metal is in this way revealed. That a close relation must exist between the fracture and the micro-structure seems likely, if not certain, but the fracture is like a page roughly written with a blunt pen which can be read only imperfectly and with much labor, while the micro-structure may be compared to a beautiful page of calligraphy in which every letter is perfectly formed.

It will be seen that the microscopical examination of metals may be regarded as an extension of fracture study. It is still an inquiry into the properties of metals by an ocular examination of its structural components, but it is an infinitely more searching and effective method than mere fracture study with the naked eye.

The superiority, in some respects, of the microscopical examination over chemical analysis may be shown by the following considerations: The properties of a metal do not depend so much upon its ultimate composition as upon its proximate composition. Somė substances may have exactly the same ultimate composition and still have widely different properties because they differ in proximate composition. The chemical analysis of metals as conducted at the present day furnishes us only with the ultimate composition, that is with the percentage of the ***elements*** the metal contains: it yields no information with regard to the way these elements combined with each other to form the metal; in other words it fails to suggest its proximate analysis. The microscopical examination of a metal, on the contrary, is a step, and a most important one, towards this proximate analysis. It reveals the constituents of the metal such as they exist. It does not tell us that the iron contains so much carbon but so much carbide of iron (Fe^3C), and it shows the way in which this carbide of iron is associated with the balance of the iron; it does not merely give the amount of iron present but the number of grains of iron with their size, shape and distribution.

Again it is well known that slight changes of heat treatment may greatly affect the properties of a metal, while it generally leaves its ultimate chemical composition unaltered. In this connection chemical analysis utterly fails to assist us in detecting and interpreting these changes. The micro-structure of the metal on the contrary is closely related to any change of properties, and the effect of heat treatment may always be detected in the structure.

THE TECHNOLOGY OF METALLOGRAPHY.

Polishing.—As already mentioned in order to examine the structure of cast iron under the microscope it is necessary to prepare a polished section of the metal. As it is, of course, desirable to shorten as much as possible this operation, it is recommended that sections be prepared not exceeding one-half inch square or ¼ square in. in area. After a little practice and with the assistance of a suitable polishing outfit, the time required to prepare a sample of this dimension should not exceed 10 minutes. Larger samples will demand considerably more time.

Samples of cast iron suitable for microscopical examination may readily be cut from test pieces or other castings by means of a hand hack saw, or better still by means of a power hack saw. Samples of white cast iron must, of course, be broken or cut with a thin emery disc.

The polishing should be conducted with care and a surface produced quite, if not altogether, free from even the minutest scratches, because such markings when highly magnified might seriously interfere with the resolution of the structure.

If the sample has a very rough surface some time may be saved by filing it with a smooth file. It is then ready for the polishing operation.

To remove the file or saw marks and obtain a surface free from scratches the sample must now be rubbed successively over several abrasive substances of increasing fineness for it is not possible to obtain such a specular surface in one operation; the transformation must be gradual.

In the following pages it will not be attempted to review the various methods which have been advocated by different workers, but merely to describe briefly those methods which I have found to yield the most satisfactory results.

Hand Polishing.—Roughly speaking the polishing of samples of metals for microscopical examination consist in three treatments: (1) two or more polishings with emery (or carborundum) of increasing fineness, (2) polishing with an intermediate powder such as tripoli, crocus, diamontine, etc., and (3) polishing with jeweler's rouge. Some writers recommend the preparation by each worker of his own powders, but I find no difficulty in obtaining very good surfaces with the best grades of the powders of commerce.

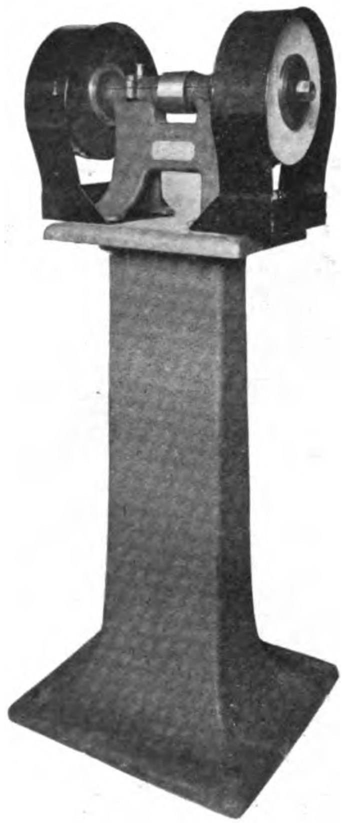
While much time is to be saved by the use of some simple polishing machine, the operation may be conducted entirely by hand, in which case the following procedure is recommended. Four very smooth and perfectly level blocks of wood should be obtained measuring, say, 6 by 12 inches and 1 or 1½ inch thick. Upon two of these blocks a piece of cotton cloth should be tightly stretched and fastened by tacks to the four sides, while upon the other two blocks, pieces of fine broadcloth should be similarly stretched and fastened.

A small amount of emery powder No. 80 should now be poured on one of the polishing blocks covered with cotton cloth, and mixed with sufficient water to form a thick paste. This paste should be spread over the block, conveniently by means of a spatula, and with the addition of a little more water, if necessary.

The sample of metal which should have been previously carefully filed with a smooth file should now be rubbed back and forth over this block at right angle with the file marks, without changing its position until the latter have been removed, and replaced by finer markings due to the action of the emery powder. The sample should be carefully washed—preferably in running water—as well as the fingers of the operator, and then rubbed over the second polishing block, covered with cotton cloth and some flour emery of the best quality, precisely as before. The specimen should be held in such a way that the new marks cross the old ones at right angle, because the complete disappearance of the latter can then be more readily detected. The sample, after being carefully washed, is ready for the next treatment. Some of the tripoli powder should be spread, with the addition of water, over one of the blocks covered with broadcloth, and the specimen rubbed over this block until all the markings left by the fine emery are replaced by finer ones running at right angles. After careful washing the sample should now be rubbed over the last polishing block, covered with fine jeweler's rouge and water, until all the scratches have been removed. In the case of grey cast iron many small irregular cavities can be detected by the naked eye, but these mark the location of the graphitic carbon, and will be readily distinguished from scratches. A magnifying glass is very useful in inspecting polished specimens.

The polished sample should now be carefully washed and dried with a soft cloth—preferably an old piece of linen. Where an air blast is at hand, as is generally the case in chemical laboratories, it is advised to dry the specimen by means of this blast instead of drying it with a cloth, because by so doing we diminish the danger of scratching it. Even after drying by the air blast, however, the sample will generally have to be gently wiped with a cloth.

In conducting the polishing operation, the student is advised to press the specimen lightly over the polishing block, especially when using the fine powders. Great care should be taken not to carry any coarse powder over a



GRINDER FOR PREPARING SPECIMENS.

polishing block upon which a finer powder is used, as the presence of but a few particles of coarser powder will greatly lengthen the operation. It is, therefore, of much importance to keep all the blocks carefully covered when not in use, as well as the bottles containing the powders. Cardboard covers will readily be procured to cover the polishing blocks.

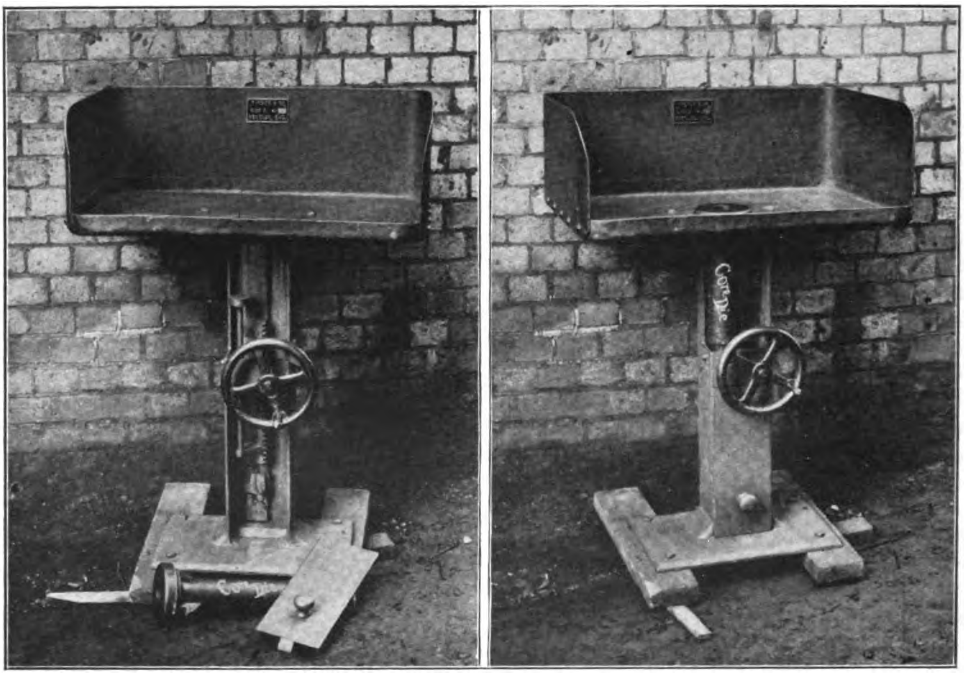
POLISHING MACHINE.

The use of some simple power driven polishing machine naturally suggests itself to hasten the polishing operation. In Fig. 1 is shown a device which has given excellent results and which is widely used. It consists of a grinding machine of the usual style, carrying four discs revolving in a vertical plane: the first disc is an emery wheel of suitable grade, the second a cast iron disc covered with canvas and the next two, wooden or cast iron discs covered with broadcloth. A simple arrangement permits the quick removal of torn cloths whenever necessary. Flour emery, tripoli powder and rouge are respectively applied at the center of the three last discs in the shape of a thick paste, conveniently by means of a brush while the machine is running. Water may be added from time to time as needed in a similar manner. Shields are provided for catching the water thrown off the discs. The sample is pressed in succession over these four surfaces, observing the precautions outlined for hand polishing.

With such an outfit it should not require over ten minutes to polish a sample of cast iron measuring ½-in. square, and frequently a much shorter time will suffice.

A BRITISH CORE MACHINE.

A core making or rather core forming machine, which has several excellent features is shown by the illustrations, Figs. 1 and 2. This machine, while following the lines of some earlier types, is well designed and is also simple and easy to operate. Fig. 1 shows the machine with the working parts exposed, the main portion of the complete machine being in one casting. The top of this is bored and faced to receive the core dies, one of which is shown laid by the foot of the machine; these dies are made interchangeable and are easily removed from the frame, when it is desired to make another size of core. The method of fixing being by means of a bayonet joint, a quarter turn by hand secures the die firmly in its place.



A BRITISH CORE MACHINE.

A crosshead and rack carry a piston or plunger rod fitted to suit various sizes of pistons as required, this rack and piston slide on a guide bar fixed to the frame casting; the hand wheel and gear wheel shown move the plunger when ejecting cores.

On the guide bar a rule is fixed and by setting an adjustable stop to any length desired, cores of that length only can be produced. A vent pin is so fixed that the cores are vented as made, and is removable when not required.

When operating the machine a quantity of sand is placed on top of the table, and after setting the adjustable stop to the desired length of core, the coremaker uses a suitable rammer with one hand and with the other feeds in the sand, until the die is rammed to the top; then by turning the hand wheel the core is forced out. By having dies with several small sizes the makers claim that an exceedingly large output per hour can be obtained, while with a 2-in. die, cores 6 in. long have been turned out at the rate of eighty per hour.

Two sizes of these machines are made, the A size making cores up to 3¼ in. diameter, and 12 in. long, while the B size will deal with cores to 6 in. diameter and 15 in. in length.

Fig. 2 shows the machine ready for work, and illustrates how neatly Messrs. Riches have protected the working parts from the sand, while keeping them accessible. ZELDE.

SHOT IRON.

We have read with interest the article on page 42 of last copy of *The Foundry* on "Shot Iron."

We have not succeeded in solving the difficulty of using the "shot iron," and we are doubtful that it can be made to pay. In other words we fear that it will be as like "spending sevenpence to mend a broken sixpence."

This foundry has been running for over 100 years, but it was not until lately that we (like a great many other similar concerns) set to, to find out exactly the cost of metal as it runs from the cupola.

We were at once struck by the waste of metal, and also by the manner in which this waste fluctuated.

We have not any machinery for dealing with the cupola dump, etc., but we always screened it, and picked by hand out of it, such pieces of metal as could be seen.

We used to charge it at the end of the cast to make firebars, etc., as it was so hard, that it was not suitable for anything else.

It was very expensive to pick this by hand, and inevitably a large amount of the "shot" had to be thrown away as it could not be recognized from slag.

We then tried putting the whole lot of "shot" into the cupola in small charges towards the end of the cast, so that the metal might be melted out, but then a question arose in our minds as to whether we got a result that paid for the coke consumed, so to define this, we charged the cupola with "shot" only. (Of course we used the usual charge of coke.)

We waited, and waited, and blew, and blew, but never an ounce of metal came out at all.

We would be glad to learn from Mr. James Boyle his experience of the waste of metal per ton of metal put into the cupola, previous to the April he mentions, including the 1200 lbs. per day, also what weight of metal does he melt per day, and what is the consumption of coke per ton of metal put into the cupola, also what weight of gits has he per ton of good castings?

RICHARD PERROTT & SONS, LTD.

MAKING SASH WEIGHTS.

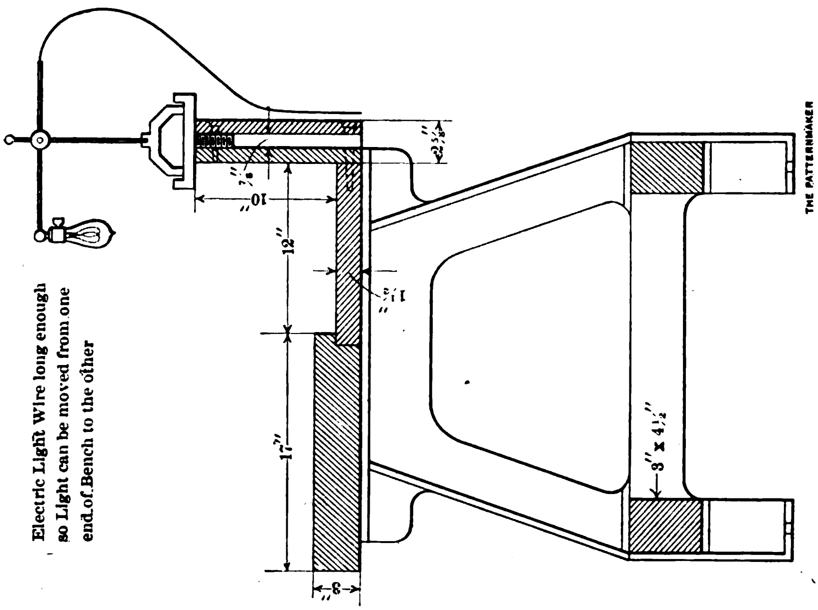
BY HARRY MALONE.

In answer to the inquiry which you forwarded to me concerning the best method of making sash weights, I may say that the best method varies with the conditions. Many founders who have a small amount of hard scrap to dispose of that they cannot work into their regular mixture, dispose of it successfully by installing a molding machine using a card of patterns and having the gates so cut that the molds may be stacked. The machine is so arranged that it forms the cope and drags exactly alike, in other words, each piece has a cope side formed in the lower part of the sand body, and a drag side in the upper part. These are simply stacked up in piles about three feet high without clamps or boxes and are poured.

In other cases, a stripping plate or match board is used and ordinary sand flasks made up. This is the usual case with all of the heavier sizes of sash weights. When fitting up to make the smaller sizes in very large lots, I am told that water cooled cast iron chills are frequently used, the chills being placed on end and one side being arranged so that it can be swung out of the way to remove the work from the chills.

The Ansonia Smelting & Metal Co., Ansonia, Conn., are running a small brass foundry employing four molders, and expect to employ four more in the near future.

The Wheeler Foundry Co., of Worcester, Mass., has been incorporated with a capital of $50,000, to take over the business of Edgar B. Pierce, who operated one of the oldest foundries in New England. The officers are, Edgar B. Pierce, president; Elisha Tolman, clerk and treasurer; general manager, Richard P. Power.



SECTION OF BENCH

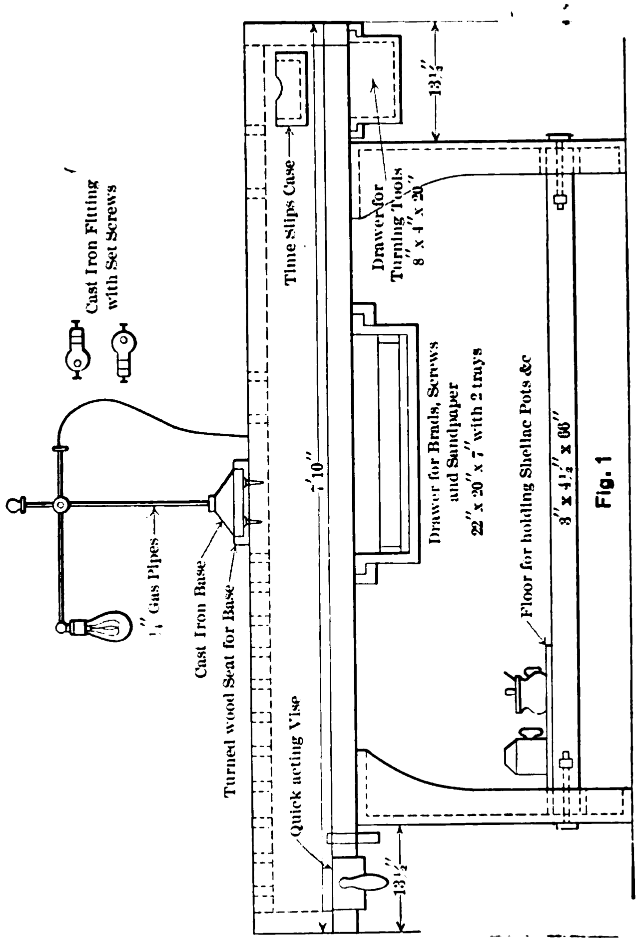


Fig. 1

PATTERN MAKERS BENCH

PATTERNMAKERS' BENCHES AND HORSES.

BY JOHN S. MONROE.

In pattern shops you will find various sizes and designs of benches, drawing boards, etc. I send a few sketches, showing what I think is an up-to-date bench and horse, fitted with cast iron legs. Fig. 1 shows a bench 7 ft. 10 in. long, 31⅝ in. wide and 33 in. high from the floor to the bench top. I have found from experience in a large number of shops that the height given is about right for the majority of men. If a tall man is to use the bench, it can easily be raised and a block put under each leg, so as to give any height required. The bench has two drawers, one at the end for the turning tools, and so arranged that it can be taken out and carried to the lathe while turning. The other drawer is situated near the middle of the bench and is provided with two trays for holding brads, screws, etc., while the bottom of the drawer provides a space for dowels, wax, fillets, etc. This drawer is shown in greater detail in Fig. 2. An electric light holder is arranged upon the tool rack back of each bench, as shown in Fig. 1. This holder is provided with a cast iron base supporting two

DETAILS OF DRAWER FOR HOLDING BRADS, SCREWS, SANDPAPER, FILLETS, DOWEL PINS AND WAX.

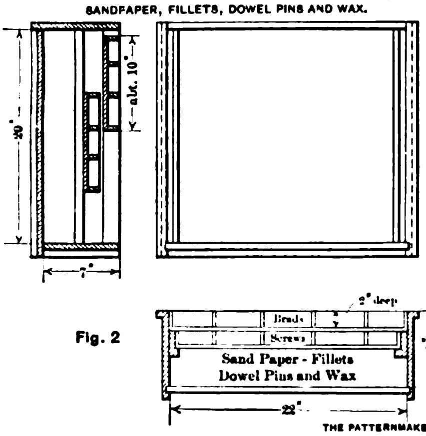
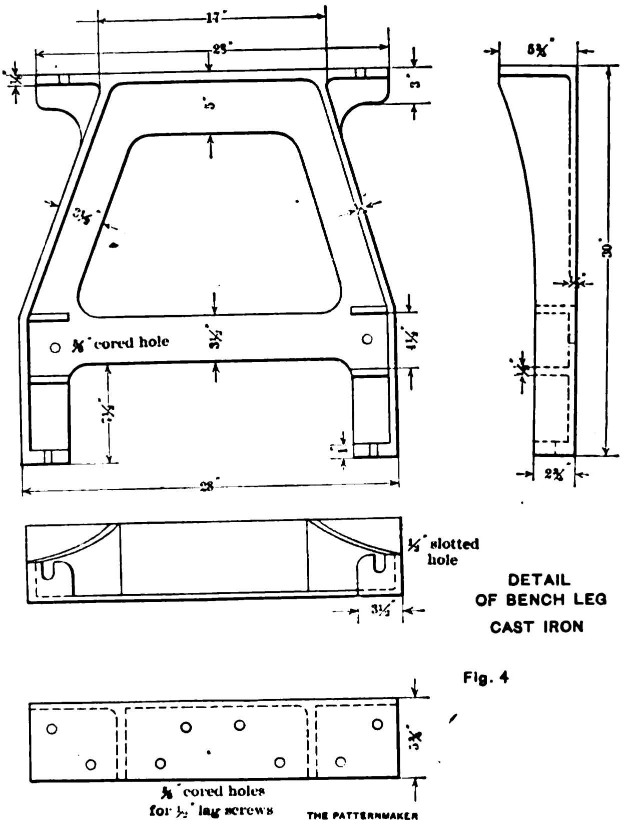


Fig. 2

pieces of gas pipe, so arranged that the light can be adjusted to any required position. It can also be moved from one end of the bench to the other. The tool rack is boxed, leaving an open space in the center. The bottom is open so as to allow dirt to fall out. Such a tool rack protects the cutting edges of the tools.

A horse with cast iron legs is shown in Fig. 3. The bar in the top of the horse can be made of any required length, and if a higher horse is required, a wider bar can be used. The horse can be fastened to the floor with screws if required. The bench leg, with its various dimensions, is shown in greater detail in Fig. 4.

The Wilkes Foundry Co., Toledo, O., has increased its capital stock from $62,500 to $100,000.



DETAIL OF BENCH LEG CAST IRON

Fig. 4

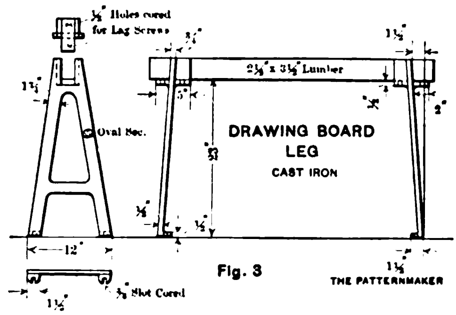


Fig. 3

The open door policy and the free exchange of ideas are responsible for America's supremacy in manufactures. The American Foundrymen's Association stands for mutual helpfulness and better foundry practice. Convention at New York, June 6, 7, and 8.

TEST BARS.

BY B. J. DUNNING.

I am writing this article feeling very much at sea in reference to the question which I have chosen for the title of it, namely: What Does the Test Bar Tell Us?

Now, to begin with, let me ask that I be not put on trial as a heretic, for I have not departed from the faith as taught by the elders concerning the test bar, for I am as orthodox as anyone on the test bar doctrine, but the interpretation thereof is open for discussion, and I am looking for light.

For about five years I have been following the tests to a greater or lesser degree of carefulness, but for the past three years I have been in connection with a company who are striving to excel in quality of iron, and who have been willing to go to considerable expense and trouble to gain that end.

We have a Riehle machine for transverse tests, which also gives deflection. We also have a drop test and a device for taking contraction.

Our tests for each heat are as follows:

We cast three bars 14 in. long to be broken, and also one bar 12 in. long cast in a yoke of that span, micrometer measurement. The 14-in. bars are 1 in. square and are broken on supports 12 in. apart, load applied at center; the shrink bar is also 1 in. square.

I am aware that the square test bar is not held in favor by a great many, but for comparison under like conditions (and the word "like" is not to be taken in its absolute sense) it should answer the purpose. When I began the tests I only took the transverse reading, and by noting the controlling elements in my mixture I got what I thought to be very good results.

Well, being somewhat younger than at present, and very human at that, I followed the way of all flesh and got quite puffed up, and thought that I could regulate things at will, and "predict the things that would come," but as I grew in the business, and began taking tests in deflection, contraction, drop or shock, etc., I found that I yet had some things to learn, and that the sure ground of *my* certainty (?) was slipping from under my feet, and that I was getting into a region of uncertainty, and up against conditions that were not so easily controlled as I had thought. Now, I hear someone say that if we can duplicate conditions each day, that we ought to get like results, but any one who has ever run a foundry knows that it is a mighty hard thing to duplicate conditions only in a relative sense.

Indeed, we do try to keep things uniform, the same percentage of the different irons charged in the same way, and handled from the spout in the same manner each day.

The test bars moulded by the same careful man, gauged and tested in the same manner, care being taken to place bars in devices for testing the same side up, and keeping them that way throughout all the various tests, and after this a difference of 300 to 600 lbs. in transverse strength is found very often.

As we use from 35 percent to 60 percent of scrap it might be thought that the variation may be accounted for in that fact, but when we come to narrow our comparisons down from different heats, to the same heat, or better yet, to two pieces of the same bar, it certainly becomes confusing and hard to explain.

Now, before we rigged up our drop test I thought I could, by comparing transverse breaking point with deflection and contraction. tell whether an iron would stand a shock of a greater or lesser degree before breaking, but I declare to you I have been so surprised at the way the proportions and comparisons jump around that I am brought to a point to feel that "these things are too wonderful for me," and "their ways are past finding out," but of course this feeling comes because I am not well informed as to the causes, and this piece is written in the hope that some good brother will throw out the life line and give me a lift.

Now here are some of the things that come up to trouble the "unwashed."

In the first place if you were to come into our little box stall (OFFICE) you might see great gobs of writing pads covered with figures and calculations something like this:

No. 2 Hubbard Scotch at 1.75 Si. use	30%	=5250
No. 3 Hubbard Scotch at 1.45 Si. use	20	=2900
Scrap (Home) Est, at 1.80 Si. use	50	=90
	100	17,150
Estimated loss in melting		.20
Si. in mix		1.51

And likewise calculations for the other elements, and often checking these over to make sure we are O. K. we think we have something good and we try it.

Now the above mixture ought to give a

strong close iron, just what we want for certain castings.

After charging what we want of the above mixture we figure for a softer mix by using a different proportion and adding enough ferrosilicon to balance it up to where we want it.

The next morning I say to my office man: Ed. you get those test bars ready for testing and I will show you a bar worth seeing.

So Ed. gets the bars and we gauge them and proceed with our testing, starting with the strong (?) one. Now that bar ought to go 2800 or 3000 before breaking as they sometimes do, but behold this one, lets go at about 2300 or 2500, but the deflection is good 19-100 so we predict it will stand a severe test on the drop 12 or 16 blows at least.

Now our bars on being broken on the transverse machine leave two pieces about 7 in. long, which we use for our drop test, so you see we have two trials on the drop to one on the transverse.

Our drop tests are as follows: A weight of a given heft falls a given distance (which distance may be regulated) striking the pieces of test bars placed in position.

Well we place one piece in position and let the weight fall *once, only once,* and bang goes the test bar broken as easily as a moulder's New Year resolution. But we have one more trial, and we put the other end of the same bar in position and it stands thirty-five or forty blows from the same weight, falling the same distance, so our stock goes up a little at this, but what have I learned from my test bars? Chiefly that I am more positive, that I know that I don't know, and perhaps that's a good place to get a start for knowledge.

Of course I am aware of this fact: that when we get under certain limits, we are not getting a satisfactory iron, and as a constant prod to our watchfulness in this direction the test bar is all right as it keeps us dissatisfied, and "dissatisfaction is the main-spring of progress." But as to their being a sure guide in telling us the strength of the iron that we are getting in our castings, I am afraid that they do not always tell the truth, at least they do not within quite a range, I think.

And as to formulating a mixture that will give a test bar, or an iron of a uniform character day after day, in all respects seems to me to be a hard thing to do, for after we have the chemical composition where we want it, there seems to be so many physical conditions that can effect our iron and test bars, that it appears to me that it is only within quite a range that we shall be able to get our results uniform in every day practice, under the conditions which prevail in most shops, and over which we at present have very little control.

Now I expect somebody will come back at me and talk about "molecular structure" "crystaline formation," etc., and other fine haired points; well we recognize all these factors, but how are we going to control them? and do the test bars tell us much about our castings? When a bar only 14 in. long, broken in two pieces, can show such a wide difference in each piece we wonder if we are getting very near the truth after all.

We always take a test bar from the crane ladle just before pouring certain castings, and sometimes when one of these castings is bad, and we have to break it we find that, although the test bar for that particular casting was a weak one in all its tests, that the casting itself is one of the hardest ones to break, the iron will be close and tough and as strong as any grey iron could be expected to be.

And again under the same circumstances the opposite will be true, and again we wonder what the test bar tells us? Now these various tests and observations were not taken in a careless haphazard manner, but with a carefulness which comes of a desire to get at the truth of the matter.

Now I would like to know if there are others who have been troubled in reaching a satisfactory conclusion in this matter, and just what they have decided as to "what the test bar tells us?"

Send your foreman to the American Foundrymen's Association Convention in New York, June 6th, 7th and 8th.

Messrs. E. H. Mumford and C. S. Lovell, who have formerly been connected with the Tabor Mfg. Co., of Philadelphia, Pa., have formed the E. H. Mumford Co., of Philadelphia, Pa., and will manufacture molding machines. They expect to develop a special line of machines which will be very strong and efficient, and will also contain a number of new and valuable features. The latter will be thoroughly covered by patents.

The Central Foundry Co., Vincennes, Ind., will put in operation a second cupola to increase its capacity. The report that the company expected to build an addition to its plant is erroneous.

THE FOUNDRY

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When sending in articles be sure to place your name and address on the article and on the drawings.

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CONTENTS.

TRADE OUTLOOK.

The month of April shows no startling developments in the trade outlook. It has simply been a month of healthy growth in the trade, with very slight changes in prices, either of raw material or finished product. There is evidence in many regions that the general jobbing trade is picking up to quite an extent. Many of the special foundries, especially the pipe foundries, have been exceedingly busy for some time, and the general foundry trade is beginning to feel the same revival. It is natural that the heavy work foundries would be the last to feel the movement, on account of the fact that their work comes as the result of extensive improvements and extensive installation of power plants, etc.

The price of Southern foundry iron is held pretty steadily at $13.50 per ton for No. 2 foundry at the furnace, while Northern furnaces are asking from $16 to $16.50 at the furnace. Foundry coke at the ovens in the Connellsville region brings from $2.65 to $3.

The general indications are that the summer will be a fairly busy one. Many of the blast furnaces are closing contracts for iron to the end of the year, and some few contracts have been placed for the first quarter of next year.

CONVENTION OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION.

The eighth convention of the American Foundrymen's Association will be held in New York City on June 6, 7, 8, and possibly on the 9th also. Arrangements are now being made for headquarters, hotel accommodations, and reduced railroad rates, announcements concerning which will be made later. The indications are that there will be a very large attendance and a large number of interesting papers will be presented, but it is especially urged by the secretary that those interested in the foundry business throughout the country send anything which they have that they think would be of interest, in the shape of papers or subjects for discussion. We believe that the able work of Dr. Moldenke should be appreciated and assisted by the foundrymen throughout the country by sending in such matter for the convention, as only in this way can the greatest amount of valuable information be brought together and the association be made of the greatest benefit to its members and to the foundry business in general. It is stated that special pains will be taken to take care of the ladies at the convention, and it is hoped that there will be a large attendance.

WINONA TECHNICAL INSTITUTE TRADE SCHOOLS.

The Winona Technical Institute, which is located at Indianapolis, Ind., is starting a series of technical courses giving instruction in various trades, the intention being to enable the students to master trades much as they would in the old apprenticeship days. They already have in existence courses in lithography, electrical work, and house, sign and decorative painting. They are now planning to start a course in foundry work.

A number of prominent foundrymen throughout the country are interesting themselves in the subject, and it is hoped that before long there will be a well equipped foundry, capable of turning out both good castings and good molders.

The foundrymen of this country must certainly arrange to support some system of education by which molders, foundry foremen, etc., will be educated. With the increasing specialization of our foundries it becomes more and more necessary that such education should be imparted by some institution in which the education of the workmen is one, if not the prime, object of the institution, and it is to be hoped that the proposed school in connection with the Winona Technical Institute will fill this long felt want.

If these results are to be attained, however, it means that the foundrymen throughout the country must rally to the support of this institution, both with the necessary funds and with the necessary moral support in the way of interest in the school, to see that the instruction is carried on properly and also to see that the shops always have an abundant supply of work.

BACK NUMBERS OF THE FOUNDRY.

One of the prominent engineering libraries in New York City wishes to complete their file of *The Foundry,* and as our files are exhausted for many of the numbers, it is impossible for us to furnish them all of the numbers desired, and we would like to know if some of our many readers who have preserved the paper cannot furnish the numbers required. These include Nos. 1 to 54, which represent a little less than the first five years of *The Foundry*. They also lack Nos. 91 to 98.

The library is willing to pay a reasonable price for them, but their funds are limited, and as the placing of this file in the New York library will place it in a position where any engineer visiting New York can consult it, we hope that some of our readers will be able to send in the desired numbers.

RAILROAD RATES TO THE A. F. A. CONVENTION.

Dr. Richard Moldenke, secretary of the American Foundrymen's Association, notifies us that the Eastern Trunk Line Association has granted a 1 1-3 rate on the certificate plan. In this connection it will be necessary for each delegate to pay full fare to New York and secure a certificate from his local ticket agent at the time he purchases his ticket. When this certificate is countersigned in New York, it will entitle him to purchase a return trip ticket for one-third fare.

We wish to urge upon all who attend the convention the necessity of securing these certificates, as it is necessary to have a certain number of them to secure the rebate, but if members are careful in this point, there should be no difficulty whatever.

Plans are being made for a general excursion of special cars over the Lake Shore Line, which will enable those wishing to attend the convention from Milwaukee, Chicago, Cleveland, Erie, Buffalo, and the territory tributary thereto, to go to the convention in the same train.

Definite announcement concerning this plan will be made later, or any one wishing information can write to the office of *The Foundry* in Cleveland.

FRESH AIR.

With the rapid increase of our manufacturing industries many exceedingly smoky cities are appearing in the United States. Manufacturing cannot be carried on without the making of drawings and the smoke and dirt from the shops is always a big nuisance in the drawing rooms and offices. This department could undoubtedly be carried on much more economically if clean air, free from dust could be furnished to the workmen. That this can be accomplished has been proven by the fact that in building the H. K. Porter building in Pittsburg a system for cleaning and preparing the air has been installed. The equipment was designed and installed by the B. F. Sturtevant Co., Boston, Mass., and consists of fans which draw air in through a regular coke scrubber such as is used for purifying gas. This consists of a frame work containing coke, over which water trickles. The water absorbs the dust and dirt and carries it to the bottom of the structure, where it is removed. After the air has been washed clean it is heated and circulated through the building. The fact that a slight pressure is kept on the building continually by the ventilating fans results in outward leaks at all points and this effectually prevents the introduction of outer air. The same plant can be used for furnishing cool pure air in the summer by simply omitting the heating operation.

HEADQUARTERS FOR THE ASSOCIATED FOUNDRY FOREMEN AT THE A. F. A. CONVENTION.

The Murray Hill Hotel, Forty-first street and Fourth avenue, has been selected as headquarters for the Associated Foundry Foremen during the A. F. A. Convention in New York City, and there are indications now that there will be a large number of foundry foremen in attendance.

MANGANESE BRONZE.

BY PERCY LONGMUIR.

The chief application of manganese in metallurgy is that of a deoxidizer and to some extent as a desulphurizer. In these two respects its application in steel and cast iron is familiar. However, quite apart from cleansing action, the presence of manganese in an alloy confers distinctive properties. With bronzes, such alloys are known as "high tension" and they give in comparison with ordinary bronzes high breaking loads and fair ductility. For instance the following tests were obtained from a sand casting:

Max. Stress Tons per sq. in.	Elongation percent.
28	26

Therefore in view of these high values and of the practical interest possessed by manganese bronze it will not be without interest to examine some of the properties of this alloy.

Manganese bronzes are essentially yellow brasses containing greater or less amounts of manganese, iron and aluminium. The two following are typical analyses of commercial bronzes one containing aluminium and the other iron.

Analyses of Manganese Bronze.

	1.	2.
Copper	53.0	60.0
Zinc	42.0	38.0
Manganese	3.7	0.5
Aluminium	1.3	...
Iron	...	1.5

Evidently in the first case cupro manganese has been used, whilst in the second ferro-manganese has been employed to add the manganese. The low content of manganese in No. 2 will also be noted and it may be remarked in passing that many of the so-called manganese bronzes contain no manganese, although the cleaning action of this metal may have been utilized in making the alloy. Very often when manganese is low or absent, aluminium and iron are present in distinct quantities. Naturally these elements exert some influence on the final properties and it will be well to quote the individual effect of each element first.

As manganese bronzes represent high zinc alloys with additions, such an alloy without additions will form a suitable base for comparison. Thus an alloy containing approximately 60 percent copper and 40 percent zinc will when cast under the best conditions yield the following mechanical properties.

Max. Stress Tons per sq. in.	Elongation percent.
18.0	15.0

If to this alloy 1½ percent of iron is added and zinc reduced by this amount the breaking load will be increased by about four tons per square in., whilst the extensibility will remain the same. The iron must of course be alloyed with the copper and zinc and not held in suspension as mechanically free iron. Aluminium added to a high yellow appears to have a very variable action on the mechanical properties. However, ignoring as far as possible these variations, the presence of aluminium in low quantities appears to raise the mechanical properties. Thus 0.5 percent of aluminium added to an alloy of 60 percent copper and 39.5 percent zinc gave an alloy which in its cast condition yielded a breaking load of 20 tons per square inch and an extension of 25 per cent. When aluminium exceeds 2 percent, the tensile strength of the resulting alloys shows a considerable increase which is, however, associated with a marked decrease in extensibility and some increase in fragility.

Manganese added to a high zinc alloy increases tensile strength and extensibility. Thus

60 percent copper, 38.5 percent zinc and 1.5 percent manganese in the cast condition yielded a breaking load of 22 tons per square inch and an extension of 30 percent.

From the foregoing it is evident that iron, aluminium and manganese, when individually present in amounts not exceeding 1.5 percent considerably increase the mechanical properties of the resultant alloys. That this increase is maintained when the three are collectively present in a copper zinc alloy is shown by the tests already given of a typical manganese bronze. The complexity in composition of manganese bronze is readily shown by the foregoing notes. This very complexity suggests several features of which we will note a few of the more important.

The base of a high tension manganese bronze has been stated as approximately 60 percent copper and 40 percent zinc and the tensile properties of such an alloy have been given. Turning to an alloy of lower zinc content, the following tensile tests are typical of an alloy cast under the best conditions.

Copper percent.	Zinc percent.
73	26

Max. Stress Tons per sq. in.	Elongation percent.
12.5	40

Comparing these figures with the 40 percent zinc alloy it will be noted that the tensile strength is lowered by 5.5 tons per square inch, whilst the elongation is 25 percent higher. Therefore in order to obtain the necessary tensile strength the content of zinc must be comparatively high in the base used for the production of a high tension bronze. A content of 38 to 40 percent zinc gives the requisite rigidity, whilst the additions of aluminium and manganese, partly by their individual action on the alloy, but probably more by their "cleansing" effect, and tendency towards the product of sound and close grained castings, contribute largely to the maintenance of high ductility. Iron as already shown increases the tensile strength. However, this metal is not purposely added, its presence being the natural result of the employment of ferro manganese as a source of manganese.

The usual precautions essential to the production of any alloy are necessary in the case of manganese bronze, it may be well, however, to specially emphasize the three following: 1, loss of zinc; 2, casting temperature; 3, method of casting.

Loss of zinc.—During fusion a considerable loss of zinc occurs, the actual amount lost varying with melting conditions and atmospheres. In any case this loss is seldom below 25 percent, but should be determined for the conditions under which the alloy is melted and allowed for. If large quantities of ready mixed alloy are melted in an air furnace, the best method of allowing for the loss during melting is to add the requisite quantity of zinc to the ladle before tapping.

Casting temperature is of exceptional moment. Reverting to the dual copper zinc alloy the following tests show the influence of varying casting temperature on the tensile properties of castings poured from one crucible within a short interval of each other. Chemically the three castings are identical.

Copper Per Cent.	Zinc Per Cent.	Casting Temperature C.	Max Stress Tons Per Sq In.	Elongation Per Cent
		1038	12.45	6.0
58.6	40.5	943	16 28	9.5
		937	18.88	15.0

The writer has examined many types of alloys and in every case similar temperature variations have a similar effect on the mechanical properties. The following results obtained from manganese bronze were obtained by Guillemin:

Casting Temperature °C	Max Stress. Tons per sq. in.	Elongation percent.
1400	15.2	13
1300	19.7	45
1250	21.6	35
1200	22.9	30

These results sufficiently emphasize the importance of casting at a suitable temperature. In judging a suitable heat the appearance of the alloy in ladle or crucible is at present the only guide. With manganese bronzes this appearance is somewhat confused by the aluminium present, for as is well known this imparts a characteristic skin to the surface of the molten alloy. The practical effect of this is to make the alloy appear colder and less fluid than is really the case. However, careful observation readily overcomes this difficulty.

Casting Manganese Bronze.—Manganese bronzes have a high contraction coefficient, hence if the casting is at all likely to "pull" it should be eased in the mold soon after solidification. In order to obtain castings free from "draws' large gates and rising heads are essential. For large castings "plug heads" should always be used. This type of head is familiar being simply a dry sand head with a plug fitted into the runner. The head is filled with metal and the plug lifted, the ladle keeping a constant level of metal until the mold is filled.

PATTERN SHOP SYSTEM.

BY OSCAR E. PERRIGO, M. E.

There is no department connected with the modern machine shop in which a good system of management, administered by a careful, methodical man, in a quiet and orderly manner, will be of more benefit to the establishment in general than the pattern shop. It is too often the case that this department is looked upon as being non-productive; a source of continual expense; not producing anything which may be sold at a profit; and consequently should be managed as cheaply as possible. Therefore we see the pattern work done in a part of the shop not at all fitted for such work, possibly in one end of a machine room and subject to the iron dust and dirt which is not shut out by even a board partition, and sometimes by one only half the height of the room. We find it poorly equipped with inadequate and often obsolete machinery, supplied with poor lumber and lacking many of the essentials for producing good work. Often men are employed because of the low wages they are willing to work for, rather than those of the requisite ability in their chosen trade.

There is always a vast difference between cheapness and economy, as the terms are generally understood, and these false ideas of economy generally result in the expenditure of more money finally than if such short-sighted ideas gave way to the policy of seeking for the best, being willing to pay for it, and then expecting high efficiency of employes and the production of good work that would stand the test of hard usage, rather than that which must be frequently repaired and strengthened in order to keep it in use.

While these facts should be strenuously adhered to as to the regular work of the pattern shop intended for permanent use, we should not lose sight of the occasional jobs of pattern work intended for only a few castings, and therefore should be made with this end in view, and often at one half the expense of a thoroughly made, permanent pattern.

That there has been a good deal of improvement along these lines within the last few years is undoubtedly true, yet the fact remains that there is still in many shops room for more changes for the better, both in matters of economy of expense and a higher standard of workmanship.

The following plans and systems of handling the work are the result of practical experience as well as years of observation of this and kindred work and it is hoped that they may offer practical suggestions to men having the responsibilities of administering the affairs of such a department.

In arranging the working force of the pattern shop a definite plan should be followed. This plan will depend to a great extent upon the kind of work that is to be done. That is, whether it is to be for large, medium, or small pattern, or perhaps a portion of each. Also, whether it is to be a good deal of new work, or a large proportion of the work is in altering patterns, or changing standard parts of them. In any event the one essential point to be considered is, to employ skilled, or high priced pattern makers only on such work as need such ability, while all work that can be done by apprentices, or less skilled men, shall be done by them. For this reason, getting out dimension lumber, making core prints, bosses, varnishing and marking patterns, and similar work, may be done by men at from half to two-thirds of the pay that the skilled pattern maker receives. Therefore such machines as the planer, jointer, circular saws, etc., may be handled by the men who may be classed as "mill men," who, while they are not conversant with pattern making as a trade, can get out such dimension lumber as the pattern makers require in less time and at much less cost. So it is with the man running the band saw in getting out segment work, and then laying it up. Being employed on this class of work continually, he can, not only do just as good work, but sometimes better, than a man who only does it occasionally, and of course, do more of it and do it more economically. Putting in fillets, puttying, plugging screwhead holes, varnishing and rubbing down patterns, etc., is the work of an apprentice and not that of a skilled workman.

To obtain the most efficient and economical results from this department, assuming that the work will be in the usual proportion of new work, alterations, repairs, etc., its force and the duties of the men should be classified somewhat as follows: A force of 14 employes would consist of say, one foreman, six skilled pattern makers, one lathe man, one planer man, one circular saw man, one band saw and segment man, one finisher and varnisher, one man for keeping pattern records, lettering patterns, etc., and one laborer. For a force of ten employes there should be: one foreman, four skilled pattern makers, one lathe man, one band saw and segment man, one man for keeping pattern records, finishing, varnishing and lettering patterns, etc., and one laborer. For a force of seven men there would be: one foreman, three skilled pattern makers, one lathe, band saw and segment man, one planer, jointer and circular saw man, and one man for keeping pattern records, finishing, varnishing and lettering patterns, etc. A laborer must be called from the yard or some part of the shop when wanted. By finishing a pattern, is meant putting in fillets, plugging screw-head holes, puttying, etc. In a force of ten men the lathe man will do whatever other work the foreman desires when he is not engaged on his special work. The man who keeps the pattern records looks after the issuing of patterns to the foundry and the storing of them when they are returned. An apprentice should be able to put in fillets, putty, varnish, rub down, etc., and where there are only a few men the foreman will keep the pattern records.

It should be understood that when we speak of a skilled pattern maker we mean one who thoroughly understands his business, and this is a matter not always properly understood by men who have not had practical shop experience in this particular line. He must be able to read drawings quickly and thoroughly. He must have a good practical knowledge of molding from the patterns in the foundry, and of the behavior of the various metals in casting, particularly of the different qualities of cast iron, of their liability to distortion, and the varying degrees of shrinkage He must have a practical idea of the effect of distortion of castings from patterns of different forms and proportions. He should know the correct amount of stock to allow for machining a casting when this is not specified on the drawings, and many other things besides the mere mechanical work of building up the pattern. In this part of the work he must know about the behavior of lumber when made into a pattern; how to so build up his pattern as to secure the greatest rigidity; to so dispose of the pieces of wood composing the pattern that its contraction and expansion shall not distort the pattern, or the wood be split from the severe strains produced by wet sand, which is always a severe trial for a pattern. He must have his pattern divided in a proper place to mold easily and without unnecessary time to be spent by the molder. All of these and many minor points relating to his work he must get by study and experience in order that he may be classed as a skilled pattern maker, and to accomplish this he must be a man of considerable ability to begin with, consequently we must not expect him to be a cheap man.

A great deal of care should be exercised in selecting lumber for use in making patterns and it will usually be found difficult to obtain really first class stock of this character. Properly dried and seasoned lumber is not easily found, and even if it is said to have been kiln-dried it may have been left exposed to damp atmosphere afterwards and so absorbed sufficient moisture to make it necessary to keep it stored for quite a time in order to have it fit for use. It is almost impossible to know just the condition of lumber when it is purchased, either in the rough or planed. It is therefore one of the great conveniences, if not a real necessity, to have a dry-room, heated with a steam coil, so that lumber may be thoroughly "dried out" before being taken into the pattern shop for use. Care should be taken that

Fig. 1

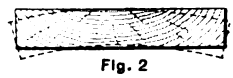


Fig. 2

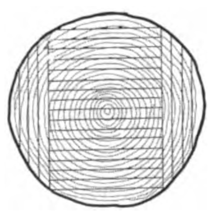
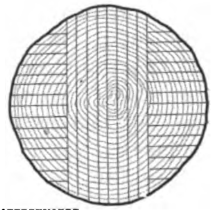


Fig. 3



THE PATTERNMAKER

Fig. 4

this dry-room is not kept at too high a temperature, as such a condition will result in "season checks" in the surface and the ends of the lumber, owing to the too rapid contraction of the surface before the center of the plank, or board, is thoroughly dried. And even after it has been through the dry-room it should not be piled up horizontally, with the flat sides together, but kept on edge, in racks suspended from the overhead timbers of the pattern shop, and in which the lumber is held in position by vertical strips. Previous to being placed in these racks the lumber should be planed to certain regular thickness from a quarter of an inch to one inch by sixteenths, and from one inch to two inches by eighths. Lumber thicker than two inches should ordinarily be left in the rough until wanted for use, unless there are many large and heavy patterns to be made. This lumber may be piled horizontally with strips laid between the planks every six feet or less, and directly over each other.

As to the kind of lumber to be used, white pine is the most common, although much cherry is used for small patterns and should be used for the smaller loose pieces of pine patterns. In the western states the writer has seen butternut used to good advantage for patterns, particularly where the pattern has much hand work with the gouge to be done. It cuts easily and smoothly and is stronger than white pine. Mahogany makes a very nice small pattern, but is unnecessarily expensive for any other patterns.

In selecting lumber for patterns care should be taken to get that which has been properly cut from the log, that is, lumber in which the *edge of the grain shows on the side of the board.* Otherwise it will be very liable to warp, no matter how much care has been taken to dry it, or to keep it well protected. This will be better understood by referring to the engravings. Fig. 1, shows a cross section of a board cut from the log in a proper manner. Fig. 2 shows the result of cutting the board from near the surface of the log, making what is technically known as a "siding." The dotted lines show how it will warp. This is due to the fact that the sap, or outer portion of the log, which is of newer growth is less dense, and will contract more in the process of seasoning.

It is usual to cut up logs in the manner shown in Fig. 3. The boards taken off near the surface of the log are trimmed with an edging saw and should be sold as sidings, for inferior work, but never used as good pattern lumber, unless in a place where they are held and confined so firmly that they cannot warp or distort the pattern. For use as pattern lumber, or for any really good work, the log should be cut up as shown in Fig 4, which preserves the grain in a proper direction as nearly as possible, but is not as economical, as to the value of the lumber, as it makes a number of quite narrow boards. The furniture manufacturers term of "quartered oak" refers to a log cut up as shown in Fig. 5, which is the most nearly correct so far as getting all the good lumber possible out of the log.

Pattern lumber is nearly always expensive, no matter where it may be purchased, and much more care should be used in cutting it up in the shop than is usually the case. If this matter is properly considered and thoroughly understood, very little need be wasted. It is well to have a series of shelves, placed conveniently to the circular saws, upon which such scraps as are likely to be useful may be arranged according to their size or shape, so as to be convenient to find when small pieces are wanted. When a board or plank is cut and a considerable portion of it is left it is customary to stand it up against the wall, or in some convenient corner. This is repeated until a quantity accumulates, the lower ends of the pieces projecting further and further out from the wall, occupying more and more of the floor space, continually "kicked and cussed" until the nuisance becomes unbearable and a cleaning-up process usually results in throwing a good many pieces into the scrap pile. This might easily be avoided by making a rack, consisting of a piece of 3 x 4 in. scantling, in which are fixed hard wood pins one inch in

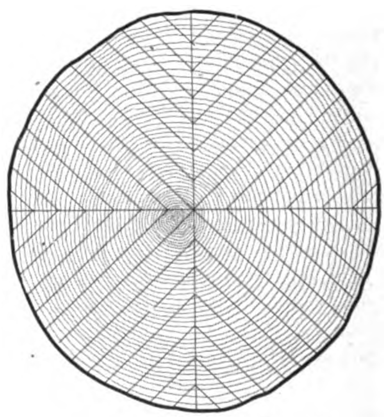


Fig. 5

diameter, placed about six inches apart, and projecting about a foot. This scantling is spiked to the wall in a horizontal position, three to four feet from the floor, with the pins projecting outwardly from it. Pieces of lumber four to eight feet long may be conveniently set up on end between the pins, and any piece wanted may be readily removed without disturbing any of the other pieces. The length of this rack will, of course, depend upon the available space that can be spared for it. One near the circular saws, in addition to the scrap shelves described above, will be found very useful.

One of the best methods of working up the accumulation of small scraps is to have an apprentice make them up into core prints and bosses of all the various sizes in common use, keeping the different sizes in suitable boxes or bins built against the wall. This will, not only use up the scraps, but will save a good deal of the time of the pattern makers, whose time is too valuable to be spent at this common work.

Another point needs attention in most shops, and that is the too frequent disposition to use first-class lumber for such parts of a pattern as cleats, stop-off pieces, core box backs, the inside framing of a boxed-in pattern, etc., when lumber at half the price would be just as good and cost no more to work up. A considerable saving in lumber bills may be made by attention to these matters, and the standard of good work not lowered for any practical purpose.

Fillets and dowel pins can be much cheaper purchased than made in the shop. A good deal of discussion as to the relative merits of wood and leather fillets has been indulged in. The pattern maker's time will no doubt be saved and good pattern work be the result of using wood fillets for straight work and leather fillets for curves. The patented brass dowel pins should be put into all patterns that are to be in continuous use, and the malleable iron rapping and lifting plates, let into the pattern, should be used on all patterns large enough to need them. A stock of these convenient and very necessary articles should always be kept on hand and ready for use.

The system of marking and listing patterns is usually arranged in the drafting room, and the lists furnished to the pattern shop for use and guidance. The plan recommended is to designate each machine built, by a letter of the alphabet, or a combination of two of them, and to indicate the individual patterns of each machine by numbers. Similar parts of machines of the same type take the same numbers. Thus, if the letter of a machine is B, the patterns will be marked B1, B2, B3 and so on. When a change is made in a pattern, a letter X, is added, making the pattern B3, read B3X. If changed a second time it will become B3XX. Further changes would be indicated by one X, followed by a number to indicate the number of changes that had been made. For instance, if it had been changed the fourth time it would be marked B3X4. If the swing of a lathe is to be increased or a planer to be widened, by a special order, the new patterns made necessary by this change would be marked with both of the letters indicating the machines, as for instance, the letter K, indicating a 30-in. planer, to be widened to 36 in., the letter being L, the new patterns necessary would be marked K-L, the hyphen being used to indicate that two machines are meant. Where a machine designation necessitates two letters of the alphabet in consequence of the fact that the letters are exhausted by the variety of machines built, the hyphen is omitted. The letters I O X are omitted as designating letters, as the first two so nearly resemble figures, and the letter X, is used to indicate alterations of the patterns.

Pattern letters and figures should be formed with two sharp points on the back, which may be forced into the wood of the pattern and thus hold them securely. The addition of a little thick shellac varnish will hold them more firmly. These letters and figures may be purchased, or they may be cast in the pattern shop, and as a large number of them are used this will be the more economical way to obtain them. A brass mold in two parts, hinged together, may be made, one part having the letters formed in it, and the other with tapering holes for forming the points on the back of the letters. The metal used is lead, to which is added a small quantity of antimony. A still better alloy is composed of lead 70 parts, antimony and bismuth, each 15 parts. The mold is heated over a gas flame, while the metal is melted over a bunsen burner. Care should be taken not to overheat either of these alloys. They should be just hot enough to burn a pine stick to a rich brown.

These letters and figures should be of the style known as sharp faced gothic, size three-eighths, or half-inch, and are used only for indicating the letter of the machine, the number of pattern and the changes that have been made in it. The letters for the name of the firm, or company, which appear in prominent places on the machine, should be also of the sharp faced gothic style and of a size suitable for the available space They should be purchased and kept in stock in proper boxes or cases. Usually three or four sizes will be sufficient. These pattern letters having flat, smooth backs, are often fastened to the pattern with small wire brads, which hold them very securely, but are likely to show roughly on the casting unless the job is very carefully done. A much neater and quicker job may be done by first putting a coat of light shellac on the backs of the letters, then a rather thick coat on the pattern and placing the letters on this before it is dry. In either case a line should be drawn on the pattern for the tops of the letters, and they should all be laid on and the position of each marked before fastening them to the pattern.

The reason for using the sharp gothic style of letters in preference to roman or fancy styles, is that there is such a large amount of draft to the sides of the letters that they draw very easily from the sand, and also, that for nearly all classes of castings the plainest letters have a much better appearance than the more ornamental or complicated ones.

Pattern letters and figures should be kept in convenient cases or boxes so as to be securely protected and readily found when wanted. The most convenient form of case is that shown in Fig. 6. This case is 20 in. wide and 28 in. long. The strips around the ends and back are five-eighths inch thick and one and a quarter inches wide; the front is the same thickness and one and three quarter inches wide; the bottom being half an inch thick. The partitions are a

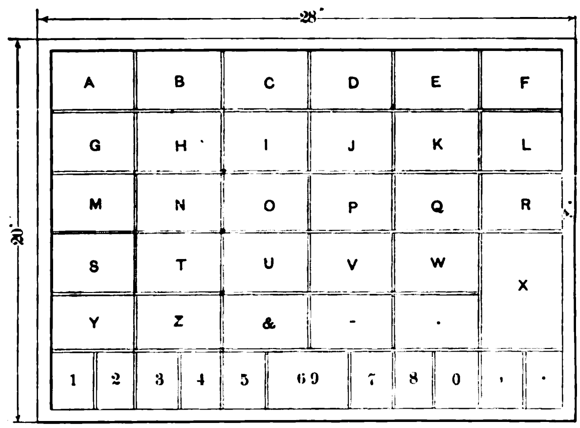


Fig. 6. CASE FOR PATTERN LETTERS AND FIGURES. THE PATTERNMAKER

quarter of an inch thick, and are "notched together" as in a type case. The letter boxes are 3 x 4¼ in., except for the letter X, which is 4¼ x 6¼ in., as many of these are used in marking changes of pattern. The figure boxes are 2 x 3 in., except that of the figure 6, which also answers for the 9, the box being 3 x 4½ in. Each case is furnished with two drawer pulls, and the front should be plainly marked with the size of the letters and figures contained in it.

The care of wood fillets, so as not to injure the feather edges is important, and a safe receptacle should be provided for them. In order to have these articles, as well as leather fillets, brass dowels, wood dowels, rapping plates, etc., properly cared for and arranged in an orderly manner where they can be readily found, the case shown in Fig 7 is designed to meet these requirements. The lower part of this case is 59 in. wide, 20½ in. deep and 26 in. high, and contains six of the cases for pattern letters and figures, as shown in Fig. 6, twelve bins for malleable iron rapping plates, and three drawers properly divided for holding brass dowels. The upper part of the case is 8½ in. deep and contains at the top; six spaces for wood dowels, and beneath these six spaces for wood and leather fillets, both kinds being placed in the same space. The wood fillets being made in four foot lengths there is ample space for them. This case should be made of ⅞ in. pine, with a back ½ in. thick. It will be found a great convenience, as well as a means of saving these articles from waste and injury.

There should be another case with shelves 10 in. wide for holding steel wire brads and wood screws. There should be shelf room enough to show at the front one package of each size that may be used.

Several other packages of the same size may be piled behind the front one as reserve stock. These cases should not be much over five feet high, and arranged against the walls in such a situation as to be most out of the way and yet convenient for the men to get at. They should be built of ⅞ in. boards. The shelves for any articles as heavy as wood screws, brads, or steel wire nails should be supported by uprights about 30 in. apart. These cases should have two coats of light shellac varnish. It is always best to have these and all similar fixtures present a neat and clean, as well as orderly appearance. It will have a good effect on the workmen and they will take more interest in their work and have more respect for the shop and its management to realize that all these matters relating to their wants are foreseen and properly attended to.

All patterns should be so colored in the varnishing as to show the material of which they are to be cast. To effect this all core prints should be *red*. Patterns for grey iron castings should be *black;* for malleable iron castings, *brown;* for steel castings, *blue;* for brass castings, *yellow;* and for bronze castings, *orange*. These colors may be easily made by the addition of vermillion, lampblack, burnt umber, ultramarine blue or chrome yellow to ordinary shellac varnish. The colors should be purchased in a dry state and cut with a little alcohol before being added to the varnish. The brown and blue may need to be made a little lighter in color, which may be effected by adding a little dry white lead, cut with alcohol as before. To make the orange, add a little red to the yellow. This method will save a great deal of needless trouble and annoyance from patterns being cast of the wrong material, as colors will always appeal to the eye and are more easily remembered than any written, printed or oral directions.

The pattern loft should be so arranged that the groups of shelves are located between the windows, projecting out from the walls so as to form alcoves, or passages between them about four feet wide. The best form of shelves will be those supported in the center, near each end by a vertical standard of wrought iron pipe, set in a cast iron base resting on the floor. Fixed at proper heights on these pipes are cross bars of cast iron, upon which the planks composing the shelves are supported. This leaves the edges of the shelves clear of any obstruction, greatly facilitating the handling of patterns. A similar arrangement of shelves may be made with wooden vertical and cross supports, the former being fastened to the floor below and the overhead timbers above. Space should be provided on the floor, or on low supports, or a low platform, for large and heavy patterns, so as to have them in a convenient position for handling. Overhead tracks and trolley hoists may run through the center of the pattern loft for convenience in handling large patterns. They may thus be handled very quickly and economically.

In storing patterns in the pattern loft, those belonging to one machine should be confined to one section, or group of shelves as much as possible, the larger ones on the floor or the lower shelves, and the smaller ones on the upper shelves. The name and letter of the machine should be plainly marked on a strip nailed to the front of a shelf four or five feet from the floor. If different colors are used to designate different machines, or types of machines, these signs may be painted the same colors, for convenience in finding such patterns as may be wanted.

The patterns for machines of the same general type should be grouped in one part of the loft, occupying adjacent groups of shelves, if necessary to use those of more than one group. Patterns for castings of malleable iron, steel, brass and bronze should be kept on one of the shelves in the same group as those for grey iron castings. If special shelves for all the patterns for any one of these materials are kept together there is more liability to mistake in sending the proper ones to the foundry.

The foreman should have a record of the location of all patterns in the pattern loft. The system which will be found to require the least amount of writing and will be the easiest to keep correct from day to day will, no doubt, be the card system. To render this system useful there should be a card for each pattern, and written upon it the letter designating the machine, the number of the pattern, its name, and a list of all loose pieces that should go

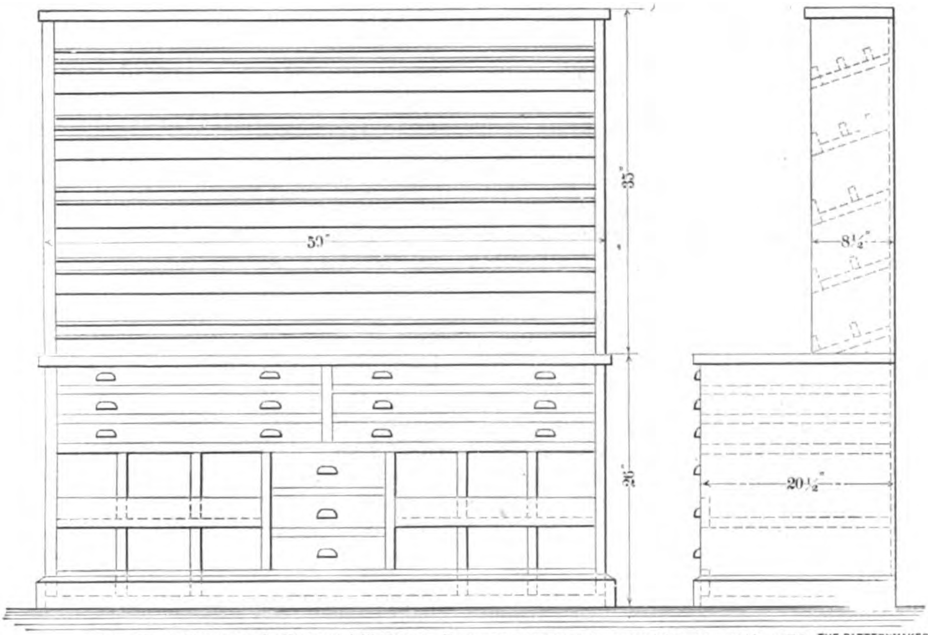


Fig. 7. CASE FOR PATTERN LETTERS, FILLETS, DOWELS, RAPPING PLATES, ETC. THE PATTERNMAKER

with it. These cards may be of ordinary cardboard stock, cut 3 x 4 in. and requiring no printing or ruling. The cards representing the patterns of each machine should be grouped as for instance, an engine lathe, divided into such groups as the bed, headstock, tailstock, carriage, etc., and these groups separated by guide cards, which may be cut 3¼ x 4 in., with these designations written on the exposed quarter of an inch. Such a guide card will stand more hard usage in constant handling than those cut with the usual small tabs.

These cards should be kept in small, plain drawers, each holding the cards for one machine, the letter and name of which will be marked on its front. As cardboard stock may be had in twelve or more colors and shades, these should be utilized for machines of the same general type, as a matter of convenience. Or, if desired, cards of different colors may indicate the material used in the castings. For instance, a grey card for grey iron castings; a brown card for malleable iron castings; a blue card for steel castings; a yellow one for brass castings; and an orange one for bronze castings.

When the patterns are in the pattern loft the cards remain in the usual card drawers. When the patterns are sent to the foundry the cards representing them are moved from their accustomed drawer to one or more large drawers marked " At the Foundry," and are replaced when the patterns are returned. If the dates when these changes are made should be required the cards may be made a little larger, and the dates of the issue and return of the patterns be entered on them with a rubber dating stamp. The backs of the cards as well as the fronts may be thus used. When all available space has been utilized a new card may be made out. There appears to be only one objection to the use of cards and that can be easily overcome by a reasonable degree of care and attention. This is the liability to put a card in the wrong place, thus causing considerable loss of time to again locate it. When a scheme of different colored cards is used the liability of this error is much lessened. The card system still remains the quickest and least complicated, as well as the most flexible one in use at present.

The time of all employes should be kept on cards in a time recording clock, a day time card being registered for the use of the time keeper, and also on job time cards, each of which represents the time spent by a single employe on a single job, or order number, these aggregating, at the end of the week, the same number of hours as the day time cards. In addition to these cards there is a material and cost card, kept by the foreman, which contains, on one side an account of all time spent on the job by all who have worked on it, and on the other side an account of all material used and properly chargeable to that order number. This card is turned in to the cost clerk when the job has been completed. These cards should be 5 x 7 in. and of thick card, ruled and printed similarly to that used for the same purpose in the machine shop departments, except that the articles enumerated will be, white pine lumber, cherry lumber, wood screws, wire nails, wood fillets, leather fillets, wood dowels, brass dowels, rapping plates, pattern letters, etc. The cost of gum shellac, alcohol, glue, dry colors, etc., will be charged upon a percentage plan, the amount used in a month being kept once or twice a year and its relative value to the value of patterns made in the same period being sufficiently accurate for the purpose.

If the system herein described is faithfully, consistently and carefully carried out it will be found to exercise a good effect upon the employes by interesting them in its methodical and orderly management; it will save much time usually lost in this class of work; it will produce more good work with the same number of men, or the same expense; every man will know his duties and responsibilities; the daily routine of the shop will run smoothly and without friction; and there will be a prevalent air of economy and efficiency in the department that is seldom found where the usual methods, with their wasteful disregard for time and material are in vogue. Properly managed, the pattern shop may be one of the best and most economical departments of the entire plant, but carelessly managed it is no small factor in reducing the profits on manufacturing operations.

When you purchase your ticket for the A. F. A. Convention at New York, be sure and be at the station twenty minutes or half an hour early, so as to secure a certificate or receipt from your ticket agent, which will entitle you to a return ticket for one third fare.

The plant of the Toledo Castings Co., Toledo, O., has been sold at sheriff sale to R. W. Kirkley for $9,001, two-thirds of the appraisement.

ASSOCIATIONS AND SOCIETIES.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care J. W. Paxson Co.

The 146th meeting of the Association was held at the Manufacturers' Club, 1409 Walnut street, Philadelphia, on Wednesday evening, April 5th, President Devlin occupying the chair. Howard Evans, Secretary, read an invitation from Dr. Richard Moldenke, of the American Foundrymen's Association, requesting the members to attend the annual meeting to be held in New York City on June 6th, 7th, 8th, and possibly the 9th. Mr. Evans stated that the 15th anniversary of the Philadelphia Foundrymen's Association would occur in May, 1906, and it was almost a foregone conclusion that the next annual meeting of the American Foundrymen's Association would be held in Philadelphia. The President then introduced Mr. John A. Makem, of the evening School of Accounts and Finance of the University of Pennsylvania, who read a paper on "Foundry Cost Accounts." There was considerable discussion of the paper, after which the meeting adjourned.

Test for Fragility.*

Thorsten Y. Olsen, of the firm of Tinius Olsen & Co., Philadelphia, was called upon to read his paper entitled "The Fremont Method of Determining the Fragility of Iron and Steel." The speaker explained that his knowledge of the subject was based mostly on translations from the French of Mr. Fremont's papers to the Society for the Encouragement of the National Industry, together with a personal acquaintance with Mr. Fremont at Paris in 1900. In addition, he had been able to make various experiments on one of the Fremont machines at the laboratory of Tinius Olsen & Co. The speaker illustrated his address by the use of lantern slides, some of which are reproduced here through the courtesy of the Engineers' Club of Philadelphia. Mr. Olsen said in part:

"According to Mr. Fremont, the test of tension owes its great growth to research work on iron and steel by Mr. David Kirkaldy in 1860, together with the development of the Bessemer steels. From this time the test of tension increased in importance, while that of shock or impact lessened. With tension testing definite results may be obtained; in fact, the standard machines of today are far more accurate than the homogeneity of the metal warrants. Today all the formulæ on which engineering problems are based are derived from results obtained from tension testing. Standards have consequently been adopted for various materials, varying with the known stresses they may be subjected to.

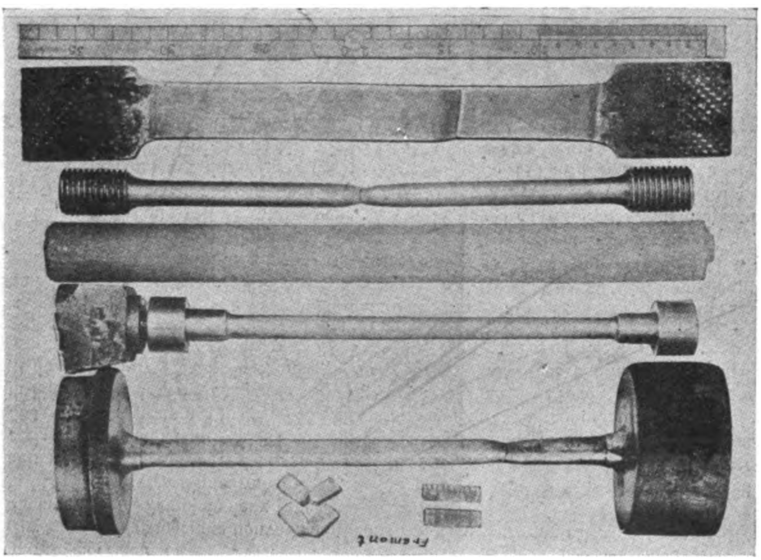


FIG. 1.

"Due to the lack of homogeneity of a steel and to the unknown stresses which must frequently take place, factors of safety are stipulated. Thus, if a boiler or a rail is designed properly it should break only by an unknown

*Paper read before the Philadelphia Foundrymen's Association on March 1, 1905.

fault in the material. Accidents occur; but should they be called accidents when possibly they might be avoided? The defects in the steel are either lack of homogeneity or exces-

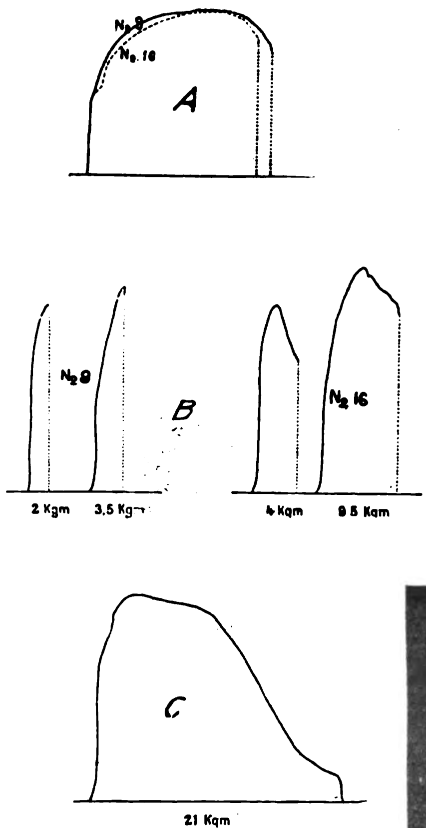
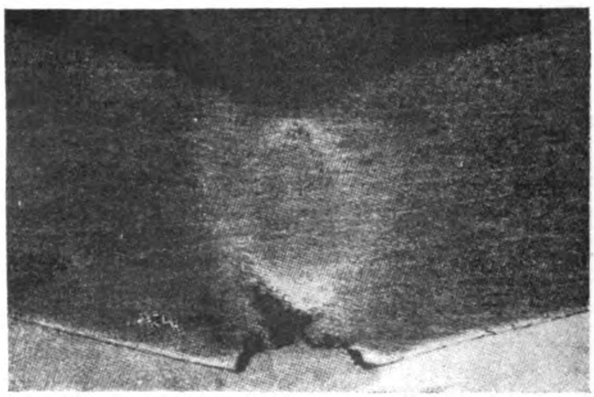


FIG. 2.

sive fragility, or both. While the manufacturer has been plodding on, testing his material as required, being then safe from further responsibility or criticism, the scientist has been endeavoring to obviate, to the best of his knowledge, these two faults of steel. The first fault may be eliminated only slightly by making a greater number of tests; the second, fragility, by an impact or shock test. Today there is an impact test prescribed for a rail; why not for a boiler plate, wheel tire, or any portion of a mechanism subjected at some time or other to an abrupt or intermittent stress?

"'Fragility' is a known factor as far as the knowledge of its existence, but no farther. Through lack of method, machine and standards, the consumer and producer alike have been compelled to ignore the fragility of their steel. Mr. Fremont, intent on relieving this state of affairs, commenced a series of investigations to determine the best means of testing for the fragility of steel.

"In France, testing as done in this country is looked upon as an extravagance, and only the largest companies can afford a moderate sized testing machine. The cost of the material and preparation of tension-test pieces are also considered a great expense, and hence Mr. Fremont, considering this, together with the desire of testing portions of plates nearest to the portion actually used, and of testing thin plates, made his test specimen very small throughout his various experiments. Thus his specimens are 10 mm. wide by 8 mm. thick and 30 mm. long, with a notch cut crosswise in the center of one of its broad sides, 1 mm. wide by 1 mm. deep. Fig. 1 shows the comparison of some tensile specimens with those of the Fremont type. Mr. Fremont first experimented with the bending test, and bent his small specimens



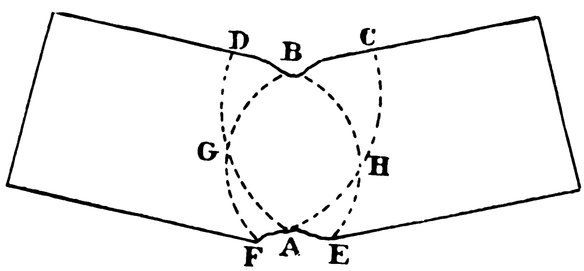
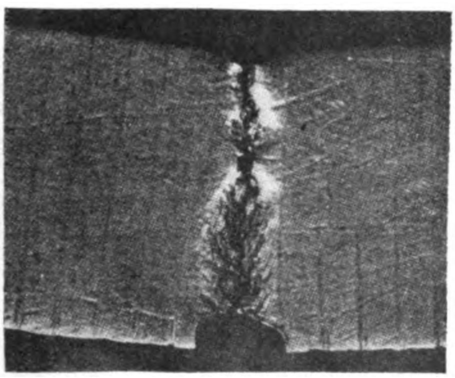


FIG. 3.

over a die 20 mm. long, with a punch-shaped tool in a machine. This machine was arranged with an autographic apparatus for producing the stress-strain diagram of the test.

"Now take the two steels which have given approximately the same diagram by the tension test. Call these two steels No. 9 and No. 16, as in Fig. 2. Subject the same material to a bending test. The second set of curves were obtained from these two steels tested both with the rolling and at right angles to it. These curves show that in both cases No. 16 broke with a greater amount of work than No. 9, although the reverse was shown by the test of tension. Then, again, at C is a bending diagram of a steel which gave a similar tension diagram. This, as can readily be seen, gives a far better bending test than either of the other two steels.

"These bending tests reveal some quality of the steel not revealed by the tension tests. Does the bending test reveal all? Will it reveal this quality on a less ductile steel? Take a soft steel, prepare a specimen as formerly, placing a notch at its under side to reduce the elongation, then polish one side and submit it to a partial bending. The deformations



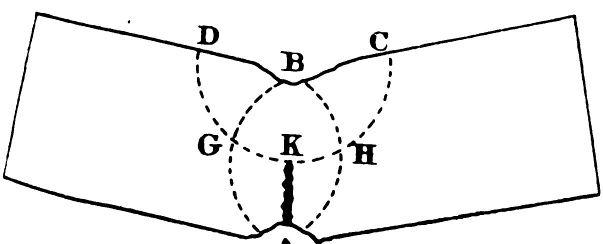


FIG. 4

are easily seen in Fig. 3. They consist of the interposition of two elementary deformations more distinctly shown in the diagram. One deformation is that of swelling; the other that of depression. The depression E F G B H is nearly an ellipse, of which the major axis coincides with the line A B joining the point of impact to the notch. The swelling is a portion of the ellipse having the same major axis as the preceding, but the extremities of the major axes do not coincide. The two ellipses

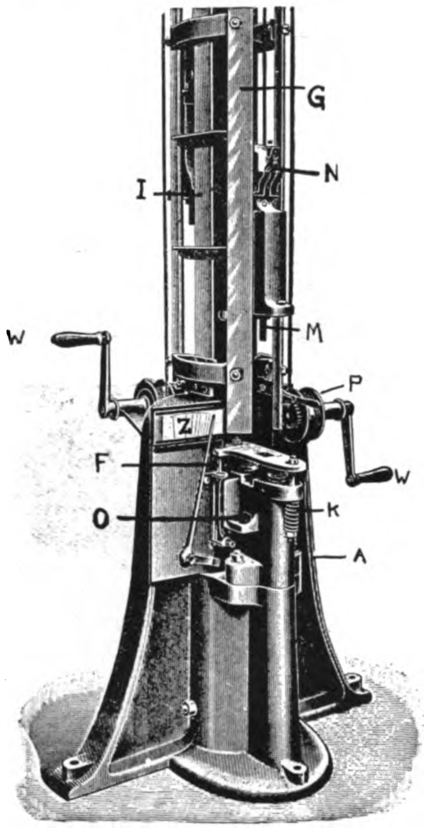


FIG. 6.

have the part A G B H in common, and thus the two deformations are in part neutralized. The other portion of the ellipse produces the maximum deformations, and the rupture takes place along the synclinal lines.

"Take now the case of a fragile steel as shown in Fig. 4. In this case the ellipse caused by the compression or the swelling is reduced to nearly nothing. The rupture is made downward by tension following the line A K in the diagram, and the rupture is effected abruptly with a very small expense of work. For steels of intermediate quality, the two ellipses will vary from one extreme to the other. The rupture of these steels depends upon the position of the point K of the ellipse compression. If the point K goes to A the metal will not be weak, while if the point K rests in the neighborhood of point B, the metal will be extremely weak. Thus both the prominence of the swelling and the position of the point K are important factors in this determination for the fragility.

"Here again in connection with these deformations Mr. Fremont states that in the period of permanent deformations the neutral surface is neither parallel to the faces nor at equal distances from the faces. The position of this surface may vary with the condition of the test, and, conditions being equal, with the quality of the metal; in other words, the more fragile the steel, the closer the neutral surface approaches the compressed side, and vice versa. As the neutral surface is not at equal distances from the faces, especially for fragile steels, the idea is inferred that a difference exists between the elastic limit for tension and for compression; thus Mr. Fremont, in a note to the French Academy of Science, stated that 'a steel is fragile—that is to say, it breaks abruptly by bending with the expenditure of a small amount of work—or non-fragile—that is to say, it breaks only in exerting a quantity of work proportional to that exerted for rupture by tension—according to whether the ratio of the elastic limit of tension to the elastic limit of compression is less or greater than unity.' This would not be an absolute means of judging the fragility, as the elastic limits would be taken from static tests, and not by means of a blow or impact.

"It has been proposed to require all steel to stand a certain drop of a hammer, and keep this a standard. Then, however, two points for discussion would arise: 1. The possibility of an arbitrary appreciation of the commencement of rupture. 2. The total resistance of the metal could not be measured.

Let us take a slightly different form of drop testing. Take a bar and mark it off by small notches and place it under a hammer, dropping the same through successive heights, until a point is reached when an increase or decrease will rupture or prevent rupture of the bar. This gives the result only after testing a great number of bars; it also supposes the metal to be homogeneous; and finally it does not reveal accurately the fragility of the steel, because a steel breaking with an amount of work equal to N ft. lb. produced by a height of fall equal to P will break with a quantity of work less than N produced by a fall greater than P. To illustrate this, Mr. Fremont took from the same steel six specimens of the same size and marked them 1, 2, 4, 5, 6, and 3. He then tested them by shock at increasing speeds of from 1 meter to 1½ meters. These specimens so broken are shown in Fig. 5. The first five appear about the same, the sixth, or No. 3, alone being broken off abruptly. The metal had thus become fragile for a speed of 1½ meters.

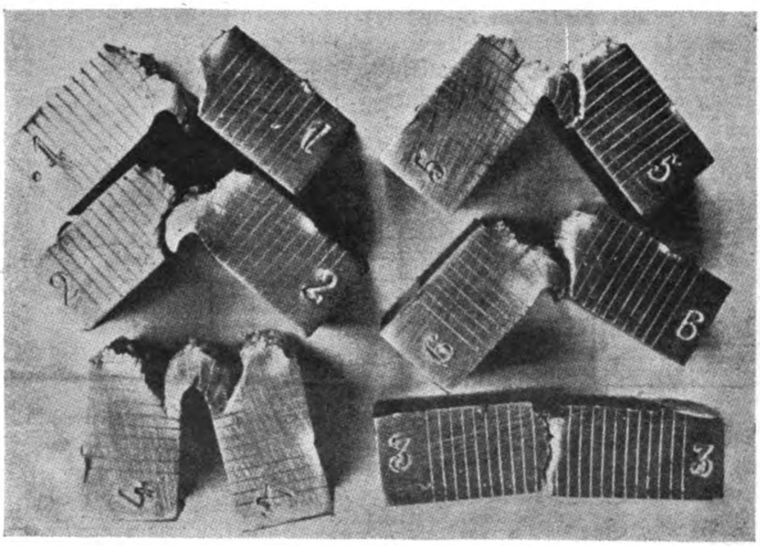


FIG. 5.

"To explain this fact it is supposed that the transmission of the forces in the material is not instantaneous and so depends on the speed of impact. The volume of the metal concerned will vary inversely with the speed of impact. In the product of the resistance by the deformation, the factor 'deformation' decreases as the speed of impact increases, and the rupture will be made with a less expenditure of work.

"The scientist Carnot in 1889 stated: 'If we suppose a steel or iron submitted to a continuous slow force, it is understood perfectly that this persistent force transmits itself successively from molecule to molecule in such a manner that all the molecules are submitted to like forces. In the contrary case, when the force is abrupt or instantaneous, it is understood that all the molecules touched can be disaggregated from the beginning, while the other molecules will support no apparent effort.' According to this, then, metals can exhibit very different qualities when submitted to a slow force or to an abrupt one.

"In tension testing the speed is a more or less important factor, depending on the ductility of the steel, and it is well known that an increase of speed increases the resistance of the metal but decreases the elongation.

"By comparing tests effected by rupturing specimens by a repetition of blows and by a single blow, Mr. Fremont found that some steels ruptured by a single blow required but one-third to one-fourth the amount of work required by the repeated blows, and thus impact testing employing a repetition of blows is little better than a bending test. Steels appearing non-fragile by the first method would appear fragile when subjected to a single drop of a hammer just sufficient to break the bar. As the shock test varies with the speed of impact and the deformations become smaller, the fragility slightly shown in the bending test will appear in its true form in the impact test.

"The rate of molecular transmission of force through a steel may be one way of defining its fragility. It is also a fact that for the same steel this rate approaches a limit independent of the speed of impact when twice that sufficient to rupture the specimen. Knowing the desirability for an accurate and easy means for shock testing, Mr. Fremont presented a communication to the Academy of Science in 1897 proposing a method of registering the amount of work required to produce rupture by this means.

"As the speed of impact is a great factor, it is necessary to make the speed of the hammer sufficiently great to rupture the specimen with one blow, whatever the quality of the metal. If the steel then proves non-fragile to a drop of this kind it has been proved non-fragile to the test of a cannon. To determine the amount of work absorbed to produce this rupture, it is necessary to measure the residual work that is possessed by the hammer after rupture of the specimen. After numerous tests by shock Mr. Fremont finished a machine embodying principles by which this residual force could be measured. First, 'crushers' were employed from which the residual force in the hammer could be measured from their known compression; this, however, was not very practical, and in the commercial machine a set of springs is used to measure this residual force.

"The machine as built today is shown in Fig. 6. The whole of the machine is 18 ft. high; the part shown is about 7 ft. This represents the lower portion. The design is made double; i. e., it is arranged so that two may operate on the same machine at the same time. The base of the machine is composed of two parts connected by bolts. Between them, and held tightly by them, is a central I-beam marked I. This carries the six cast-iron supports, at intervals, to which are bolted the four rolled steel guides marked G. Two anvils are bolted on opposite sides of the base, the whole weighing more than 1,500 lb. The weights of the hammers are 20 and 30 lb., or about 1-70 of the total weight of the machine. The anvils marked A contain in front and in back of the matrix vertical cylindrical holes serving for the lodgment of two springs. A cap of hard steel is placed directly over them. It is this cap or platform which receives the hammer after the rupture of the specimen.

"The hammer compresses the springs and the space traversed by them is then measured. As the springs rebound after the blow, it violently repels the cap, and so to offset this new shock the cap is held by two small springs, one of which is visible on the front of the anvil at K. These springs thus serve merely as a deadener to the cap when rebounding. On each side of the base and to the right of the operator is a windlass marked W, by which the hammer is easily and quickly raised. A ratchet and lever placed at P prevent the downward motion of the hammer when placing the specimen in position."

"Each hammer has inserted at its lower extremity a hardened steel punching tool, as at M. A gripping device at N holds the hammer to the pulling cord until automatically released at the top of the machine. It is also released at any point by attaching a cord near N.

"To operate the machine we first raise the weight enough to allow room to place the specimen in position, notch side down, with notch directly to the center of the die. Then we turn the windlass, raising the weight to the top, where it is automatically released, and falling, breaks the specimen, which in turn falls through the die into the pocket at the side of the machine. Having broken the specimen, it is necessary to measure the work required to cause the rupture. The cap covering the springs pushes down a light steel tube at F, which is held by friction so as to give an accurate measurement of the deflection of the springs. This deflection is further multiplied by the aid of the instrument shown at Z.

"To calibrate the machine the hammers are raised through successively increasing intervals of height and dropped on the platen covering the springs. Corresponding marks are placed on the card of the instrument. Thus,

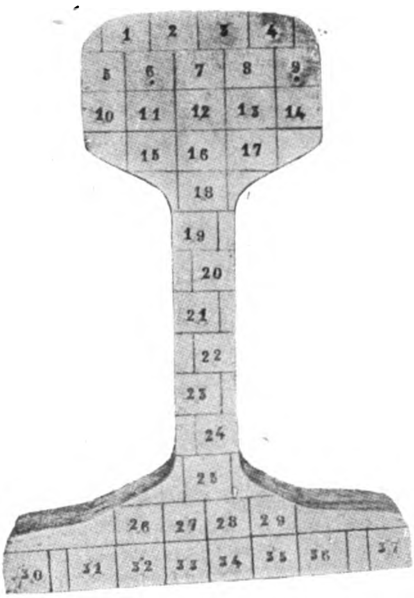


FIG. 7.

the machine can readily be calibrated at any time with about ten minutes' work.

"The method, by using small specimens, reduces the cost of test pieces and their preparation, thereby furthering the great production of tests and thus aiding in establishing a standard homogeneity test. A second advantage is that the small specimen permits of testing thin plates, both with and across the rolling, as well as the possibility of testing parings or clippings from actual material used, or those nearest to any section subjected to the greatest known stress. In the third place the machine affords an accurate method of measuring the work necessary to produce rupture under standard conditions, always maintaining the same speed of impact. The machine as manufactured in this country will have a standard drop of 13 ft. with hammers weighing 20 and 30 lb., as these are the nearest English units to that used in the metric system.

"The specimen will be ⅜ in. wide, 5-16 in. thick, and 1¼ in. long, with a saw-cut 1-16 in. deep. The die is 13-16 in. wide. The machine can be shifted from the one standard to the other without any material change. The specimens may be prepared either by hand or in quantity by a small machine constructed for the purpose.

"Fig. 7 represents the section of a rail showing the method of cutting out Fremont specimens from the entire section. Thus, any rolled form can readily be tested to determine the effect of the rolling on any portion of it. The rail after the test is shown in Fig. 8, the pieces bent having been subjected to the bending test, while those appearing broken abruptly were tested by shock.

"In testing cast iron for fragility a machine similar to that described can be used where neither the drop nor the weight of the hammer need be as great, and thus lighter springs could be used which would show smaller differences in the material. As cast iron is extremely fragile, the speed necessary for rupture need not be much greater than that necessary to produce rupture for steel, or in other words the amount of work required to produce rupture would not vary to such an extent with the speed of impact as in the case of steel. Thus, although cast iron may be tested on a machine as described, it would not be necessary on account of maintaining the same conditions of test. A smaller and cheaper machine could thus be made for such work."

Discussion.

A. E. Outerbridge Jr.: The machine is different from one with which I am familiar, where the residual force is measured in an entirely different way. I would like to ask Mr. Olsen if he tested any of those pieces on a rigid, non-yielding anvil? I understand the anvil is practically supported on springs which give at the moment of impact, and the residual force is determined by the compression of the springs?

Mr. Olsen: The specimen is not connected with the springs; that lies on the anvil itself. After the specimen is broken then the hammer falls on the plate connected with the springs.

Mr. Outerbridge: The residual force in the hammer is measured by the compression of the springs?

Mr. Olsen: Yes. I have some broken specimens which in a tension test showed the same elastic limit, ultimate strength and elongation, but when subjected to shock test broke in various manners. Some show a fibrous structure, while others show a crystalline structure. Those exhibiting the fibrous structure broke with 300 to 400 percent greater work than the crystalline structures.

Mr. Outerbridge: It may be interesting to the members if I give you a brief account of an impact testing machine which has been in use in William Sellers & Co.'s works for about ten years. It is intended for impact tests of cast iron, but I think it would be equally useful for steel. We made a great many tests of that kind and the same difference is observable in cast iron that we have heard about tonight in steel; that is to say, you may have bars of cast iron which show a very high tensile strength, and of course there is very little elongation in testing cast iron, but when you subject two pieces of cast iron (the companion bars having shown approximately the same tensile strength) to an impact test where you are able to measure the residual force remaining in the hammer after the break, you will find there is sometimes an enormous difference in resilience amounting to several hundred percent, and that is a very important matter. So far as I know, no account has ever been given of the machine I am about to describe now. We first made a machine on the same principles as the one described, which is what we called a "gallows" machine, where the weight, 14 lb., is allowed to fall from a certain height and the residual force is measured by the hammer. We subsequently modified that machine by making an improved form of hammer, somewhat like this mallet. This may represent the hammer, which was in this case 20 lb., having a steel nose put on the end; in fact, the whole hammer was a piece of steel on a rigid arm, which was supported about 3 ft. in length on ball bearings, so that the friction was reduced to the smallest possible degree. This hammer is raised to a certain point where there is a trigger that holds it. When that trigger is released the hammer falls, and if there is no intervening object to impede its force, it will, of course, swing to the full length of the arc, that point being measured by a moving pointer which travels with the hammer and remains at rest at the extreme distance, thus recording the swing of the hammer on a graduated arc. The hammer, if started, will continue to swing something like a quarter of an hour, each time the hammer going a little less far until eventually it will come to rest. It takes more than 15 minutes to come to rest, owing to the fact that the friction is reduced to a minimum by the ball bearings. Just at the vertical point there is a rigid support for cast iron test pieces. It is

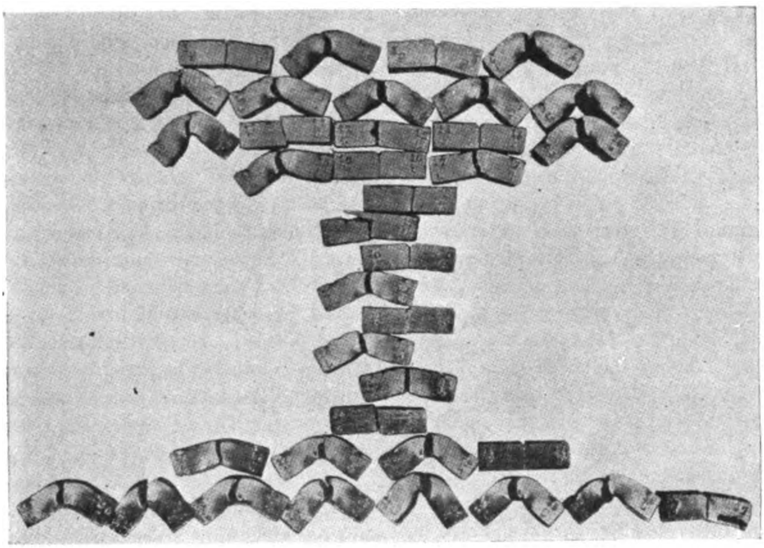


FIG. 8.

a support similar to that which we use for transverse tests of cast iron. The bar is 1 x 1 x 15 in. and put in with the supports 12 in. apart and rigidly fixed so that there is no movement. In this case there are no springs. There is alongside this test piece a pointer which is just sufficiently rigidly supported so that when you move it out to any point it will stay there—it won't fall back. The arc is graduated in inches up to the extreme end. As I say, when there is nothing interposing, the hammer will swing out to the extreme end and then come back. The pointer will be carried with the hammer and left at the extreme point to which the hammer swings. Then, if you want to measure the amount of decrease each time the hammer swings you simply move that pointer back and then the hammer carries it forward again. Of course there is a trifling resistance offered by the pointer, but it is the same in all cases, so that this is negligible. This hammer is so arranged that you break the bar on the first blow on all occasions. If you have a piece which offers very considerable resistance—take a piece of very strong cast iron for example—the resistance offered by that piece will be quite considerable, and of course the hammer will not go out so far, and the pointer will rest at the place of its extreme swing. It will never be moved by the second swing, and the moment the piece is broken it falls out of the way. We have made a large number of tests of cast iron with that machine and have many records. I am not prepared tonight to give an account of these records, but we found by that machine that there is a very much greater difference in the resistance to impact than was revealed by the transverse test machine, either from the resistance to strain or from the bending record; in other words, the ductility or resilience, or bending quality, or resistance to shock of cast iron cannot possibly be measured accurately by either the transverse or tensile tests alone. There is no measuring by compression springs whatever in this machine. It is simply the resistance given by the breaking of the metal that is recorded by the swing of the hammer.

Mr. Olsen: I believe there is a machine of that kind at the Lehigh University. In steel, where you require a certain speed of impact, which according to the Fremont method is absolutely necessary, it would be useless. If you increase the height of fall you will break the specimen with a less amount of work, so one specimen passing your test will fail when subjected to the Fremont test. If I raised my hammer up to half the height I would break the bar, but it would take a greater amount of work. If I raise it twice that height it will take a less amount of work.

Mr. Outerbridge: The same principle applies where it is a swinging hammer. It is still impact.

Mr. Evans: Is the drop of that weight the same as the impact of a cannon ball?

Mr. Olsen: The speed of the Fremont machine is equivalent to the speed of a cannon as far as the breaking of the specimen is concerned. After you reach a certain point any further increase in speed will not change the transmission of the force through the molecules. There seems to be a limit. If you get a less speed it is within the limit. The trouble with the pendulum machine is that you cannot increase the speed sufficiently for testing steels, and the specimen is not placed on a rigid anvil. You could not easily get a speed of hammer equivalent to a drop of 13 ft. That is necessary for the steel test. If you get a much lower you will get within the limit before mentioned.

Mr. Outerbridge: The first weight we made was 40 lb., and we found that that was excessive, so we reconstructed the machine and reduced the weight to 20 lb.

Mr. Olsen: If you increase the height of fall any further the amount of work required to break the bar will not decrease. There seems to be a limit where the transmission of the forces will not decrease.

Mr. Outerbridge: We found a very curious thing in connection with the cast iron drop testing machine. I had occasion to describe that in 1896 in a paper read before the American Institute of Mining Engineers. We found if we had a dozen bars of iron cast of the same size, from one ladle of iron in one mold, presumably under precisely the same conditions, by allowing this drop weight of 14 lb. to fall a height of 12 in. it would break any of the pieces; and before we had means of measuring the residual force we did not know whether that piece would have broken by a drop of the hammer of 6 in. or 12. This drop fell vertically in guides. There was no friction at all, because it fell in free space. In order to ascertain whether the fall of 12 in. was excessive—more than necessary for the break—we took one of those companion bars and raised that drop by inches, 1 in., then 2 in., 3 in., 4 in., 5 in., 6 in., 7 in., 8 in., 9 in., 10 in., 11 in., 12 in. It would naturally be supposed that the bar would break before the hammer was raised to 12 in., because it had been subject to 11 blows at constantly increasing heights. We were surprised to find that in no case did the bar break at 12 in., whereas, in every case, if you allowed that hammer to drop from 12 in. in the first place, the bar would break. The question was, what was the cause of that difference? In a large number of experiments we showed conclusively that it was owing to the fact that each slight blow that you gave to the cast iron enabled it in a measure to relieve itself of the cooling strains, and therefore after it had been subjected to a number of blows, from a height not sufficient to break the bar, the bar was so much increased in its shock-resisting quality that it would not break. In some cases I have found that it took 20 blows from a height of 12 in. after the hammer had been allowed to fall from a lesser height several times to break the bar. These experiments are all recorded in the paper which I read before the American Institute of Mining Engineers in 1896. Everybody has known for a long time that if you strike a sharp blow on the rim of a pulley that has been cast (supposing the pulley is defective, or for some reason you want it broken up), there will be a concussion and the pulley will open so you can put a knife blade very readily in the crack. Sometimes you can put a steel wedge in the opening. It may open as much as a sixteenth of an inch; but if you strike an old pulley that has been run in the shop for a length of time—a worn-out pulley that you want to break up—and if you give it exactly the same blow, when you break it you will find there is no sudden snap and no wide crack; you could not put a piece of tissue paper in it. This marked difference is due to the fact that the cooling strains have been relieved by the mechanical action of vibration in service. Steel is an entirely different metal from cast iron and the same conditions do not exist. It might be a good thing, however, to try these tests on steel; instead of letting the hammer fall from the ultimate height, take a duplicate piece and give it 20 blows from one-half the height and then raise it by inches to the ultimate height and ascertain whether the piece will break by a blow from a height which was sufficient to break a companion piece with one blow.

Mr. Olsen: In cast iron of small dimensions I do not think, if it is shown by the repeated blow as in using large specimens, it would show up.

Mr. Evans: According to that the tumbling barrel for cleaning castings must make the castings stronger.

Mr. Outerbridge: Yes; that is true. It was formerly the rule with us that all fragile castings must be cleaned in the pickling tub, and must not go to the tumbling barrel for fear of breaking the small pulleys. Now that rule has been entirely reversed. All fragile castings are put in the tumbling barrel now.

After the adoption of a vote of thanks which was extended to Mr. Olsen for his presentation of the subject, the meeting adjourned.

New England Foundrymen's Association.

Fred F. Stockwell, Secretary, care of the Barbour-Stockwell Co., Cambridgeport, Mass.

The regular monthly meeting of the New England Foundrymen's Association was held at the Exchange Club, Boston, April 12, at 5 p. m., Vice President W. B. Snow, in the chair. Routine business was disposed of, after which the chair appointed Messrs. Henshaw, Stockwell and Fitch to serve on a committee for revising the constitution to comply with the present conditions of the association. Owing to the lateness of the hour it was voted that the discussion of the quiz questions be omitted.

After a short intermission the meeting adjourned for dinner. Following this the chairman introduced as the speaker of the evening Mr. V. A. Trundy, assistant secretary of the American Mutual Liability Insurance Co., who gave an address on "Liability Insurance."

Pittsburg Foundrymen's Association.

F. H. Zimmers, Secretary, care Union Foundry and Machine Co.

At the meeting of the Pittsburg Foundrymen's Association, held at the rooms of the Engineers' Society of Western Pennsylvania, at Pittsburg on April 3, two papers presented by David McLain, of Milwaukee, were read. One treated the production of steel castings historically, while the other was on the "Melting of Brass with Oil in Steel Furnaces." H. C. Babbitt, of the Westinghouse Electric & Mfg. Co., briefly related his experience with the use of a Tropenas converter for the production of steel castings, and H. M. Lane, editor of the *Foundry,* also addressed the meeting. In May a smoker will be given by the association, and an effort will be made to organize the foundry foremen and superintendents into an association as an adjunct of the Pittsburg association. Mr. McLain's paper on melting brass with oil in steel furnaces follows:

"While I was in charge of a crucible steel and iron foundry some years ago, our concern wanted to make their own brass castings as they had considerable trouble in securing service—their castings being light and very intricate. I had never handled a brass shop, and began looking around for a man to take charge of it. I had been wondering where we could place the new department; and, as we had plenty of room in our foundry, decided to place the brass molders near the steel furnaces. I could not see why we could not melt brass in our furnaces, as we could regulate the flame to suit the work. I went around among my friends in the brass business, trying to find out whether I was right or wrong before I started .

"Before telling what they said, I will give you the conditions that existed in our foundry: We had six furnaces, two melting chambers to the furnace, and two pots to the chamber. At this time we operated from two to four furnaces per day, and six heats or twelve pots was the day's work, and the melter was through at from 2:30 to 3:30 o'clock, and the oil turned off for the day. We did not look for our steel pots to make more than three heats per pot, when the best of them were picked over and set to one side, and the balance thrown out. The ones we set aside we intended to use in case one of our pots burst in the furnace. Now, I figured, if we could use these old crucibles for melting brass it would be saving the price of brass pots; and if we could place the pot full of metal in the furnace after turning off our oil, that would help us greatly, as our company did not want to build a brass foundry until they were larger users than they were at this time.

"Now, this was the way it looked to me, and it looked right, but, as I said, I wanted to know what my brass friends thought. When I told them that I intended to melt with oil they told me it would not do. No, they had never used oil, but they knew it would burn the metal and so forth. They told me that it was a crazy idea to use those old pots; they would have small particles of steel in them and would spoil the metal. I had told our manager that I thought we could work it this way, and I wanted to try it before telling him it was no good. But it proved to be all right, so far as using the old pots and the oil was concerned.

"We would place our filled pot in the furnace immediately after pulling our last steel pot, and would have our metal melted in from 35 to 40 minutes. The castings gave good satisfaction, but, as we were a young and growing concern, we had to build a brass foundry, as we needed the room for our iron and steel molders, and we put in six brass furnaces of the regular type. But it demonstrated to our entire satisfaction that brass could be melted with oil in a steel furnace, both after our steel was melted and when we chose to light a furnace if we were in a hurry for some castings. It also proved that we were right in thinking that we could use those old pots. We have gotten as many as 16 heats from an old discarded steel pot—but about eleven heats were the average.

"After we started our brass foundry I had placed there one of the best men I could find to take charge of it—a studious, thorough mechanic. I advised him to see what he could do with those old pots, and he has gotten as many as 18 heats, but this is an exception. We talked the matter over and finally decided he should take a new steel pot, and see what he could get from that. Although he was afraid at first that probably the steel pot might affect the metal, and besides the steel pot was not as handy; but when he took the steel pot he cut a lip on each side to make easier pouring. We watched the castings in the machine shop and they were all right. We got 32 heats from the first pot, and, if I am not mistaken, 35 from the next, and our average was 31 heats for the first six pots."

Buffalo Foundrymen's Association.

The regular monthly meeting of the Buffalo Foundrymen's Association was held in the Builders' Exchange on Tuesday, April 18th, President Lyman P. Hubbell occupying the chair. Twenty-seven members were present and after the regular routine business the president introduced Mr. W. H. Carrier, of the Buffalo Forge Co., who presented a paper on "Air Blast for the Foundry Cupola." After some discussion of the paper, a vote of thanks was tendered Mr. Carrier and the meeting adjourned.

The Associated Foundry Foremen.

Frank C. Everitt, Secretary, 2413 Third Ave., New York, N. Y., care The J. L. Mott Iron Works.

The Associated Foundry Foremen have sent out a circular letter to foremen of the different foundries throughout the United States, calling attention to the objects of the association and asking all interested to join. The circular also calls attention to the arrangement made with *The Foundry*, by which all members of the Foundry Foremen's Association receive *The Foundry* as a part of the return for the dues which they pay. This arrangement was made with the Foundry Foremen at their request and does not signify that *The Foundry* is the official organ of the association, or that there is any closer bond than has existed in the past, but as *The Foundry* stands for the best possible foundry practice, and as the organization of the Associated Foundry Foremen stands solely for the improvement of foundry methods, it is unnecessary to say that the closest bond has existed and always will exist between this organization and *The Foundry*, and as the interests of each lie in the same field, it is but natural that each should help the other in every way possible.

In this circular letter it is stated that if application for membership is received during the year, the dues will only have to be paid for the balance of that year ending June 1, and not for the full year. The dues will then be renewed on the first of the following year. The dues for the Associated Foundry Foremen's Association are two dollars per year, payable in advance. In cities where locals exist, there is an additional payment due to the local.

Elsewhere in this issue we publish a statement concerning the headquarters of the Associated Foundry Foremen at the convention of the Associated Foundry Foremen and the American Foundrymen's Association, which is to be held in June.

Milwaukee Foundry Foremen.

Thomas Glasscock, Dist. Vice Pres., care Pawling & Harnischfeger Co., Milwaukee, Wis.

The Milwaukee Foundry Foremen met on April 3, with 28 members present. One new member was elected and the regular business transacted, after which Mr. McLain read a paper on steel casting, in which he reviewed the progress in steel foundries for the last 25 years. He also gave a talk on melting brass in a steel furnace. Copies of these same papers were read before the Pittsburg Foundrymen's Association and are printed in connection with their meeting.

The question came up for vote as to whether they should have one or two meetings a month, and it was decided that it would be the best to have one meeting a month.

Mr. Henry Beagel, of the Allis-Chalmers Co., is to read a paper at the next meeting.

BANQUET TENDERED TO THE ERIE FOUNDRY FOREMEN.

One year ago the Erie Foundry Foremen's Association tendered a banquet to the Foundrymen of Erie and on April 1st the foundrymen entertained the foundry foremen of Erie. The banquet was an affair long to be remembered for the quality of the menu, for the originality of the menu card, and for the sparkling wit displayed in the toasts and speeches. The following is taken from the menu card, showing the menu and the program.

BANQUET GIVEN IN HONOR OF THE ERIE FOUNDRY FOREMEN'S ASSOCIATION BY THE ERIE FOUNDRYMEN, AT THE REED HOUSE.

April 1, 1905.

PROGRAM.

Matthew Griswold Jr., Toastmaster.

"Why we organized the Erie Foundry Foremen's Association and the benefits resulting therefrom,"............ ....Mr. Wm. F. Grunau.

"Good fellowship among the foundries.... ....Mr. Chas. W. Davenport.

"The possibilities of our organization".... ....Mr. Jas. A. Murphy.

"Agreements and their value to the foundry"..................Mr. U. P. Rossiter.

"The Ladies" (in the core room)........ ....Mr. Harry E. Kies.

"Foundry System".........Mr. B. J. Walker.

"The 'Machine' in the foundry"......... ....Hon. Matthew Griswold.

"Cast Iron Thoughts"...Mr. Thos. E. Durban.

MENU.

Sand cut up at 7:30 p. m.

Oyster Cocktail, high in sulphur.
Bull Ladle Consomme.
Amontillado.

Olives, well pickled. Sanded Almonds.
Celery.
Follow Boarded Shad.
Cucumbers.

Small Fillet, Mignon a la Cherron.
Punch, well annealed, a la Roman.
Hauts Sauterne. Cigarettes.
Guinea Hen, core oven roasted.

New Bermuda Potatoes, sand blasted.
Spinach, a la Francais. Pommard 1881.
Lettuce, with large header and Tomatoes, French facing.

Ice Cream, chilled. Cake. Fruit.
Roquefort Cheese, well vented.
Cafe. Water Crackers.
Moulds a la Havana (a three sprue job.)
German Brew.

A little explanation of some points of the menu will be of interest. For instance, the follow board shad was planked shad served on little follow boards. The cigarettes were passed in a hand ladle. The last item, entitled "Molds a la Havana," consisted of individual flasks served to each person. These were small flasks with follow boards all clamped up. Upon removing the clamps it was found that each box contained three excellent cigars. The pouring off then occurred.

A very good model of a regular cupola about two feet in diameter had been built at one side of the banquet room. It was connected with blast pipes and all the regular paraphernalia of the genuine article. After the blast was put on, they waited some time and then tapped the cupola, when, to use the words of the secretary, "Fluid iron (?) poured forth, covered with a white, foaming slag." The precious liquid was caught in a shank ladle and passed around to the individual workmen (?) and every one poured off his own work. It was past midnight when the bottom dropped, and even then the unusual statement was made—"Let the heat go on; we'll work after the whistle blows." All present certainly had a good time and one which they will remember for many years.

Erie Foundry Foremen.

W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

The regular meeting of the Erie Foundry Foremen's Association was held Monday, April 3, with President Grunau presiding. There was a large attendance and after the regular routine business, an interesting paper on "Cost Keeping in the Foundry," was read by W. F. Grunau. The members also spent some time in discussing the banquet which had been tendered them by the local foundrymen's association on April 1st.

Cleveland Foundry Foremen.

W. H. Nicholls, 608 Gordon Avenue, District Vice President.

The Cleveland Foundry Foremen are arranging for a banquet to be held May 6th, to which all of the foundrymen of Cleveland and vicinity are invited. It is expected that there will be a large attendance. Dr. Moldenke is to be present and several others will respond to toasts. The Cleveland Club of Associated Patternmaker Foremen has been asked to cooperate with the Foundry Foremen in this banquet.

PHILADELPHIA FOUNDRY FOREMEN.
W. P. Cunningham, Secretary, Pencoyd, Pa.

NEW YORK FOUNDRY FOREMEN'S ASSOCIATION.
S. M. Williams, Dist. Vice Pres., 221 Third Street, Elizabeth, N. J.

CHICAGO FOUNDRY FOREMEN.
David Spence, Dist. Vice Pres., 142 Bunker St.

INDIANAPOLIS FOUNDRY FOREMEN.
W. H. Holmes, Dist. Vice Pres., care American Foundry Co.

HAMILTON, ONT. FOUNDRY FOREMEN'S ASSOCIATION.
A. Chase, care Sawyer & Massey Co., Secretary and Treasurer.

REVIEWS.

SCIENCE IN THE IRON FOUNDRY.

The Iron and Coal Trades Review, Feb. 24.—The famous iron master, Mr. J. E. Stead, F. R. S., F. C. S., etc., delivered an address before the Cleveland (England) Institute of Engineers recently, in which he reviewed the progress made in the foundry by the aid of science. Science in the foundry, he holds to be, "the exact knowledge of things relating thereto, which have been proved by demonstration." Only recently has the study of cast iron been taken up, and it now receives a great deal of attention. Analyses of castings vary very much, yet the first rate ones of the several classes always run within certain well defined limits. Hence it is the object of the founder to build up his mixtures to come out to these several compositions. The founder must demand pig irons from the furnaces which have uniform composition, so that his mixtures made with them will work out well. The old-time grading by fracture must now be set aside altogether, and the new order of things adopted. Back in 1885, Mr. Stead advised the mixing of two kinds of iron, one a "glazed iron," the other a white iron, both being unsalable, and predicted good gray castings from the mixture. A Mr. Wood tried it and met with perfect success. The "glazed" pig had 4.43 percent silicon. As the result of this trial, the glazed pig iron became an article much sought after, and originated the introduction of ferro-silicons in the foundry.

Mr. Stead thinks that sulphur does not do much harm in the iron as long as it is not allowed to harden it. In other words, the silicon must be kept high where this is likely to occur. Founders who make very light castings for high speed machining are not likely to indorse this view, and will keep sulphur out at all hazards.

A founder should get a good metallurgist to care for his mixtures and general practice. He seldom finds such a man, as most chemists, while capable of determining the constituents of cast iron, are not good metallurgists. Hence there is a field for properly trained foundry metallurgists, and these men must at the present time be trained in the foundry or "made." Mr. Stead advises that a foundry metallurgist should give his employer a review of all published foundry literature regularly, in abstract form, to show that he has absorbed it, as well as to post the foundryman along this line of his business.

In the discussion which followed, Mr. Hutchinson, a furnaceman, recited his experience with the foundrymen of Germany, Austria and England. He found that they did not want iron by analysis at all, but bought by fracture grading altogether. The furnace had chemists, and sent the proper iron for the work the foundryman had to make. In America we have things different. The heavy kickers who want special fractures get beautiful ones in their metal sent them. Those who know, however, get just the composition they want, irrespective of fracture, and fare much better. They will arrive at this point in England after a while also, and Germany is fast following the American footsteps herein also.

Other foundrymen taking part in the discussion gave distinctively favorable views on the foundry laboratory. One foundryman, however, thought it would take thirty years to get the English foreman to mix his iron by analysis. He ought to take a trip to America and see how the foremen take to scientific mixing of metals here.

In reply to the questions and criticisms of his paper, Mr. Stead simply remarked that a piece of pig iron (shown by Mr. Hutchinson), which would be photographed as a frontispiece to his published paper, having a No. 1 and a No. 4 fracture on the same surface, and yet was of uniform composition, would be his best answer. Where would the practical grader come in on this?

THE MICROSTRUCTURE OF CAST IRON.

The *Ironmonger*, Feb. 25.—At a recent meeting of the Staffordshire Iron and Steel Institute, Mr. O. F. Hudson read a paper on the above subject. Cast iron, on account of its great impurity, presents more difficulties under the microscope than steel. By considering cast iron as a steel, with its graphite scattered throughout the mass in flakes, the study of this material is greatly simplified. That iron, which has the least combined carbon, or, in other words, has the mildest steel as a matrix, is necessarily the softest and easiest to machine, and the graphite forms a good lubricant for the cutting tool.

Prof. Turner, in the discussion that followed, is quoted as saying that cast iron is easy to study under the microscope, as specimens can quickly be polished and etched, and from the structure its adaptability for the purpose intended can readily be told. It is a question if Prof. Turner has not been misquoted, and that steel was meant; for all students of cast iron are eagerly awaiting the man who will make the microscope available for practical use in the foundry. So far we are quite a ways off.

The Mobile Foundry Co., of Mobile, Ala., has been incorporated with a capital of $10,000. The incorporators are: J. H. Mahler, Harry W. Ollinger and C. J. Mahler.

The Western Machine & Foundry Co., of Wichita, Kan., succeeds the Wichita Bridge & Iron Co., which was forced into the hands of a receiver about a year ago, but paid off 90 cents on the dollar and has been reorganized and placed on a firm financial basis, with Geo. Christopher, of Wichita, president, H. Anthony, vice president, and James Warren, secretary and treasurer.

Jack Goodwin, of Caldwell, Idaho, is organizing a stock company with a capital of $10,000 for the purpose of putting in a foundry and machine shop to look after local trade.

W. B. Hayes, formerly of Bradford, Pa., has recently returned from Burmah, India, where he was employed by the Burmah Oil Co. This company is operating extensive oil fields in Burmah and Simla, and in order to obviate the necessity of transferring materials to and from the fields for repairs, etc., they have installed machine shops, foundries and a general repair department in the oil fields. A number of Americans are employed with this company.

METALS IN FOUNDRY PRACTICE.

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Steel, Brass and Bronze.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.

J. B. Nau, Metallurgy of Steel and Steel Castings.

Dr. Richard Moldenke, Malleable Castings.

C. Vickers, Brass Castings.

We have also made arrangements with several others to act as special contributors upon Brass, Bronze and other subjects. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

Castings for Automobile Cylinders.

The iron needed is close grained with low shrinkage and soft enough to tool with ease, as good cylinders can be made in the United States as in France. The making of cored automobile work is improving and advancing the art of molding and casting of iron more rapidly than could have been done in any other way and will have a great influence on other inventions requiring complicated and intricate cored castings.

Semi-Steel.

What is the powder that is put into the ladle to produce semi-steel? Our machine shop turns out a large amount of steel borings and turnings. To use them should we put them into wooden boxes the same as we do cast iron borings or would you put them in the ladle and tap the iron on to it?

Answer.—Semi-steel is ordinary cast iron containing from 10 to 20 percent of wrought iron or steel. The steel should be put into the cupola along with the pig iron. You can place 100 lb. of clean steel borings in a pine box and nail the cover on and charge instead of 100 lb. of pig iron. You can find by experiment how much borings you can use. It is usual to use steel scrap in larger pieces such as the planing chips or strips cut from boiler plates.

This mixture would not be fluid enough to run freely into a mold and would throw off gas which would cause the casting to be unsound. Aluminium in some form is placed in the ladle before the iron is tapped into it. Pure aluminium in chunks is by far the best with perhaps a little larger amount of granulated ferro-manganese, say one-tenth of one percent of aluminum. The granulated ferro-manganese is much better than the powder.

The base of any flux for semi-steel is aluminium.

The strength of semi-steel will be more than 20 percent greater than ordinary iron castings.

CLOSE IRON FOR CASTINGS.

We make a fairly good grade of gray iron castings, only we would like to be able to get closer grained iron and not have it too hard. Can you put us in communication with any one who could give us information for using aluminium by applying it in the molten metal to give the above effect, or how should it be applied? What is carbonese used for in connection with the molding trade?

Answer.—Softness will depend upon the percentage of silicon in the iron, therefore, you must first find how much you need and then get it into the mixture. You can purchase pig irons that contain the right amount of silicon or you can use some pig containing too much and other pig with too little, making the average correct.

This decided, the closer the grain of the pig iron the closer the grain of the castings, or you can introduce a liberal amount of machinery scrap, which always has a close grain. Stove plate scrap has a very close grain and is expected to contain about 2.75 percent of silicon.

Aluminium placed in the ladle will soften the iron slightly and will produce sound castings. Purchase commercially pure aluminium but never the cheaper casting aluminium. Use about one-tenth of one percent or less and it will instantly mix through the molten iron and remove gases and make solid, strong castings.

Carbonese is a trade name for a flux composed wholly or nearly so of ferro-manganese. The latter can be purchased in lumps and placed in the cupola and melted along with the iron or can be purchased in a granulated form, when it is placed in the ladle and the melted iron falls upon it. If you cannot purchase granulated ferro-manganese in small quantities you had better use carbonese. It removes sulphur and removes gases and in that way makes sound castings. Some like it and some do not.

By keeping the silicon high enough to make the castings soft you can get the required grain by a careful selection of close grained pig irons and scrap without the addition of any medicine. You will generally find that the close grained irons have low silicon. Using such irons and increasing the silicon by the use of a six or eight-percent silvery iron will give you closer grained castings than a mixture of pig irons, each of which contains the silicon needed in the casting.

BRASS FOUNDRY NOTES.

BY C. VICKERS.

RECOVERY OF BRASS FROM SLAG.

Inquiry.—Kindly let us know what we can put into the slag that forms in our brass crucibles that will enable us to melt this brass or slag and recover the brass which it contains.

Answer.—The accumulation of slag on the walls of a crucible can be largely prevented by careful attention on the part of the furnaceman. After every heat the walls of crucible should be scraped with a long chisel pointed bar.

A slagged crucible is very expensive, as it takes longer to melt the brass, the slag being a non-conductor, prevents the passage of heat through the walls of the crucible, and also greatly diminishes its capacity.

Cleaning the crucible while hot will greatly help to prevent slagging, but in spite of this it will form and become so hard that the bar will not detach it, without danger of breaking the pot. In that case place the crucible in the furnace after the first heat is out and the furnace is well heated. Coke up the crucible but do not charge it; let it become white hot, then the slag can be all scraped from the wall of pot with a poker while it is still in the fire, then throw a little charcoal on the slag to reduce it and proceed with the heat as usual. Some founders try to remove the slag when the pot is cold. This is a tedious job and injurious to the crucibles.

The precautions above stated will keep the crucible fairly clean, but a worn out crucible will generally have some slag sticking to the walls. Break up the crucible, detach the slag, and pound it up, mix with fine charcoal and place the whole in the bottom of the new crucible taking the place of the old one; the charcoal will reduce the oxide to metal. Never allow slag to accumulate, never keep old pots, but let every new pot succeed to the slag from its predecessor. But if there is a pile of slag on hand, pound it, mix with charcoal and proportion amongst the heats until used up.

C. VICKERS.

COMPOSITION METAL.

Inquiry. In the United States and Canada there is a composition very largely used which is approximately a whiter mixture than brass and also cheaper. It is a recognized metal and usually sold nickel plated. It is sometimes called electro nickel on compo. Could you give us the composition of this metal, that is, the compo?

Answer. White alloys may be divided into three distinct classes, viz:—First, the alloys of copper, with nickel and zinc, known as German silver, nickel bronze, etc. Second, the soft white metals, consisting of tin with copper and antimony, or, lead and tin, lead and antimony and so forth.

These alloys are known under the names of "Brittannia," "pewter," "babbitt," "white-metal," "stereotype metal," "antimonial lead," and so forth, percentages of zinc are also often carried by the soft white metals; and third, the white brasses, in which zinc predominates. In these alloys, copper, iron, tin, etc., are added to the zinc, to change its crystalline nature. Any white alloy which resembles brass in that it is harder, and more infusible than the soft white metals, and is at the same time cheaper than brass, belongs to this third class, and contains zinc as its base, because if it was a brass whitened by nickel, its cost would be greater than ordinary brass or bronze, therefore the composition alluded to by this correspondent must belong to this class.

A few examples of these alloys are given:

Decoration Metal.

1. Yellow brass, 15 lb.; melt, add gradually, zinc, 75 lb.; aluminium, 3 lb.

2. Yellow brass, 15 lb.; zinc, 75 lb.; tin, 10 lb.

3. Yellow brass, 15 lb.; zinc, 80 lb.; iron, 2 lb.

Melt the yellow brass first, add zinc gradually, then the iron in the form of cast iron borings, or in the shape of ferro-zinc.

Harder alloys are:

1. Copper, 40 lb.; zinc, 60 lb.

2. Yellow brass clippings, 50 lb.; zinc, 40 lb.

Note—Great care must be exercised while melting not to burn the zinc away by overheating.

C. VICKERS.

The Pendleton Iron Works, Pendleton, Ore., successor to May & Zeiger, have elected the following officers: Marion Jacks, president; Fremont Arnold, secretary and treasurer; and W. L. Zeiger, manager.

MALLEABLE CAST IRON NOTES.

BY DR. RICHARD MOLDENKE.

SELLING PRICE AND COMPOSITION OF MALLEABLE CASTINGS.

M. E., of Montreal, P. Q., writes asking what kind of malleable castings were meant when in the March number of *The Foundry,* page 31, it was stated that in America we were selling them from 2.2 to 3 cents per lb. In reply we would say that at the time the March *Foundry* was issued malleable castings for car purposes, which are admittedly among the best made, so far as quality, but not good looks, are concerned, were selling for 2.15 up to 2.25 cents a lb. delivered. We know of cases where some malleable works, to fill up, were taking this work for a shade over 2 cents, and thereby selling at cost, if not under. Today the price has gone up to 2.50 to 3 cents, and it should be still higher, and will be after the concerns with porcine proclivities have filled up. As this class of castings comprises over 50 percent of all the malleables made, the price is a fair criterion for the rest of the industry. The smaller the casting, of course, the higher the price. Those above referred to ran from a few ounces to 50 lb., the average for the orders taken being some 6 lb. apiece.

M. E. further asks what the average analysis of the pig irons in America used for malleable purposes may be. Here it is. Silicon 0.75 to 1.50, for very light work, up to 2.00; manganese preferably below 0.60, though sometimes it runs higher, and then simply has to be burned out to prevent trouble in the anneal. Phosphorus, below 0.200, though for charcoal irons it may run up to 0.225; sulphur not over 0.04; total carbon immaterial, though it runs from 3.50 up to 4.15. These figures are for the best quality malleable. If the sulphur is exceeded corresponding detriment will follow.

Good foundry practice demands good foremen. To keep good your foreman must keep learning. This means attend the American Foundrymen's Association Convention, New York City, June 6th, 7th, and 8th.

FLUOR SPAR.

BY R. C. HILLS.

There has been much criticism of late upon the use of fluor spar for foundry purposes. Undoubtedly its value in this line has been somewhat exaggerated.

We find on looking into the use of this flux in the foundry line that possibly many of the users of fluor spar are not aware that one of the most valuable methods of using this article is by putting a small quantity in the bottom of the ladle, then drawing the molten iron upon it, thus facilitating the mixing of the flux with the metal.

I, personally, have made several experiments which have brought about satisfactory results. For instance, one of my tests in gray iron was to put in the bottom of the ladle 3 percent of ground fluor spar, drawing the molten iron upon it. By the time the molder had reached the mold with the ladle, the excess slag was quite apparent, rising to the surface and forming a heavy mass, which he stirred a half minute in order to be sure of a perfect mixture and then skimmed off. This shows the powerful action of this material upon iron. We poured two test bars from this ladle. We also poured two bars from the regular iron. These bars, when broken by a breaking test machine, showed that the bars in which the flux was used showed 11 percent greater breaking strain.

In malleable iron, the test was even more interesting. I sent four regulation rods, two with and two without the flux, to a university that professed to be very much interested in this line of work, and upon which I knew I could depend for a fair test. In fact, nothing was known about the material which was being tested. The report received from them showed in round numbers an increase from 55,000 lb. tensile strength, to 60,000 lb., and an increase in elongation from 4 to 5 percent; this, of course, proving the superior malleability of the bars in which the flux was used. I sent some of this material to a firm who are making frogs. They reported satisfactory results. At the time I sent this, I knew nothing of their trouble, but they told me that it prevented, to a large extent, cracking, with which they had had a great deal of trouble. My own experiments so far have met with the same success.

I have also made some experiments with fluor spar in brass; it has increased the strength of the metal and given better results in the finished casting.

You have noticed in the above that I have given no chemical analysis; the reason for this is that I consider the results will speak for themselves, but I have one or two analyses which prove the average betterment in practical tests, showing from 10 to 12 percent general improvement. This flux seems to leave no impurity untouched, but reduces them all; and the strangest part of it is that experiments show that the reductions are in proportion, that is, not reducing the percent of one impurity more than another, thus when you have used this flux you have not changed the nature of your casting, but have made a general betterment, which, in the majority of cases, will not injure the casting for the purpose intended, making gray iron softer, but still holding its wearing power, making malleable iron more malleable, but increasing its tensile strength.

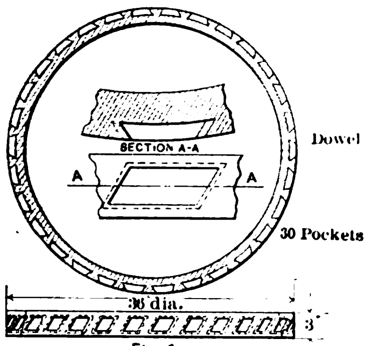


Fig. 1

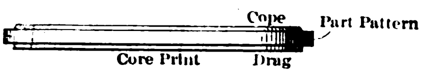


Fig. 2

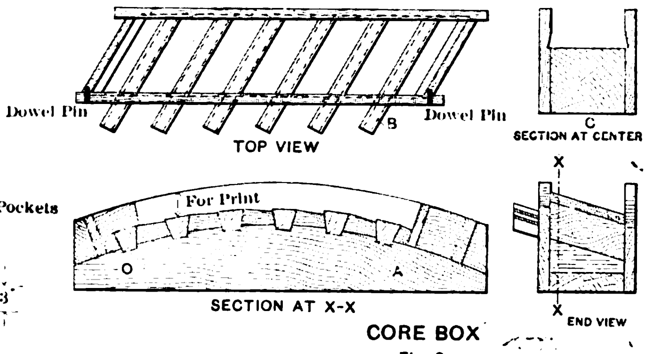


Fig. 3

LARGE PISTON RING.

BY S. M. RENKIN.

Recently we had a large piston ring to make and while the pattern and core box are very simple when explained, I do not think any patternmaker would make them without a little study.

Fig. 1 shows two views of the ring, also enlarged sections. Fig. 2 shows how we turned the pattern after building it in the regular way, of segments. You will notice how we made the pattern solid and let the core print run all the way around the same depth as the pockets, giving the part of the pattern from the print up plenty of draft so it could be lifted off in the cope.

Fig. 3 shows three views of the core box. First we made the block A, the radius of the top of it being the radius at the bottom of the pockets in the ring, and then laid off the length which we made just one-sixth. This can be made either one-sixth or one-eighth, the length depending entirely on the size of the ring. It should be made so it can be handled easily. Then we laid off the pockets and cut the slots for the loose blocks, as shown at O. The sides were then made with the edge the same radius as the outside of the print, the ends being put on the same angle as the pockets. On account of the blocks being beveled it was necessary to cut holes through the one side and pull the blocks out before taking out the core; further it was necessary to dowel the one side, as shown, on account of the sides having a bevel to form the top and bottom of the pockets, as shown at C. There is another advantage in having the one side loose and that is so the core can be turned out on the straight side.

NEW BOOKS.

"Smoke Prevention and Fuel Economy," by Booth and Kershaw, published by the Norman W. Henley Publishing Co., New York, N. Y., price $2.50. While this book is written from an English standpoint, it is certainly of very great interest to both English and American engineers and to all interested in the prevention of smoke.

It deals first with the subject in a general way in the introductory chapter, and then has one or two pages on domestic smoke. This is followed by a consideration of the chemistry of combustion. Next there is a chapter on present methods of burning fuels and their defects, and in this the writer takes up not only boiler furnaces, but crucible and other styles of furnaces used for metallurgical work. The advantages and disadvantages of the different styles of boiler furnaces are very carefully considered, and it may be said that the authors condemn some of our American practices very severely, and, judging from the amount of smoke coming from some of our chimneys, we cannot but feel that the condemnation is warranted.

In another chapter improved methods of burning fuel are considered and compared, both for boiler firing and for furnaces for metallurgical work. The fifth chapter is devoted to the examination of gases, and sets forth the various methods commonly used for taking and testing samples, both for snap samples and for continuous sampling.

There is an appendix of over 40 pages dealing with patent abstracts, including American, English and foreign patents. The appendix also contains useful tables. The book is very well indexed, and is written in a clear, concise manner, which makes it exceedingly interesting reading. All who have anything to do with the burning of fuel will certainly be profited by reading this work.

The American Foundrymen's Association, with its affiliated Foundry Foremen and Foremen Patternmaker Sections, stands simply for good foundry practice. It never has had anything to do with labor questions. Convention at New York, June 6, 7 and 8th.

REMOVAL OF AMERICAN STEEL FOUNDRIES.

The executive officers of the American Steel Foundries until lately were located at No. 74 Broadway. With the object of concentrating all of the departments of this well known concern it was found necessary to lease the entire eleventh floor of the recently completed building known as No. 42 Broadway, and henceforward communications should be sent to this new address.

It is well known that in the new movement toward consolidation of allied industries one of the chief elements of success involved the systematizing and harmonizing of every branch of the business. With this end in view the executive officers of the American Steel Foundries are inaugurating, simultaneously with the removal, a new system of accounting and distribution of orders, which will improve the organization and simplify their work. This will assist them in taking care of the many large orders they are receiving due to the increased demand for new equipment by the railroads and other large producers. The output of their eight plants for all kinds of steel castings is enormous, and they are always in a position to undertake new work and make prompt deliveries. With the acquisition of the Simplex Railway Appliance Company they are even better equipped than ever to fill the requirements of railroad companies and car builders.

SUMMER SCHOOL FOR ARTISANS.

A summer school for artisans under the direction of the College of Engineering of the University of Wisconsin will begin June 26 and continue for six weeks. The principal subjects are as follows: Steam engines and boilers, electricity, materials for construction, fuels and lubrication, and shop work. Under the latter heading they will take up the use of tools, both in wood and metal, and such subjects as blacksmithing, patternmaking, etc. The work is very similar to the ordinary shop work of the college, except that a greater proportion of time is given to the practical problems. The requirements for admission do not extend beyond a working knowledge of English and arithmetic. Students taking correspondence courses in engineering have found the Summer School for Artisans extremely useful, as a place in which they could obtain experience along the lines concerning which they had been studying.

PRIZE OFFER.

The Engineering News Publishing Co., of 220 Broadway, New York, N. Y., have offered two prizes amounting to $350, for the two best papers on "The Manufacture of Concrete Blocks and Their Use in Building Construction." The subject of concrete construction is of interest to all classes of manufacturers. This is certainly a worthy offer on the part of The Engineering News Publishing Co., and should result in bringing out some valuable literature on this new and interesting subject. .

CASTING IN BRASS MOLDS.

A writer in the *Manufacturing Jeweler,* of Providence, R. I., states that for casting soft metals in brass molds, it is necessary first to have a good groove cut in the molds for a vent for the escape of the gas and air, and second, that the molds must be blued, this being accomplished by dipping the mold in sulphuric acid and then placing it on a gas stove until it is a dark blue color. Without this bluing, it is impossible to obtain a sharp casting. We should like to hear from others upon the subject of casting soft metals in brass and bronze molds.

TRADE PUBLICATION.

The April number of *Graphite*, published by the Jos. Dixon Crucible Co., of Jersey City, N. J., is a special issue in which they illustrate a large number of structures which have been painted with Dixon's paints. They also give considerable information concerning the use of paints for protecting structures. This is certainly a subject in which all foundrymen are interested, and the Dixon Co. informs us that they will be glad to send a copy to any one desiring the same.

The C. W. Hunt Co., of West New Brighton, N. Y., have gotten out a catalogue entitled "The Hunt Noiseless Conveyor." In this catalogue they describe machinery intended primarily for the handling of coal and similar materials. There seems to be no reason why it would not be equally efficient for materials about a large foundry. The catalogue is very fully illustrated.

The Double Friction Coil Clutch Co., of 207-42 River street, Chicago, Ill., has recently brought out a new device for joining shafts for power transmission. It consists of a specially designed clutch containing a double friction coil capable of transmitting a very large amount of power at either high or low speeds. The company is sending out a neat little catalogue 3½ x 6 in., describing its device very fully.

REVOLVING BRUSHES.

BY H. KAROW.

In an article by Oscar Leyde on the cleaning of castings, the subject is very nicely explained, but the revolving brush is not mentioned. The revolving brush, mounted upon an emery wheel stand, is in my estimation the best thing for cleaning between the teeth of gears and in similar cases. Our gears were formerly cleaned with the hand scratch brush and file, but it was a very slow job, when the results were compared with the revolving brush driven by power. There are different grades of brushes obtainable, some stiffer, others softer.

Such brushes are especially useful for cleaning castings intended for patterns. In fact, by using a medium or fine brush, good castings can be cleaned and polished so well that they will require no subsequent scraping or filing. I believe that after any foundryman has once used a revolving brush he will never be without it again.

Good Fellowship,
Good Papers on Foundry Subjects,
Good for Your Own Business,
The American Foundrymen's Association Convention, New York, June 6th, 7th and 8th.

PERSONALS.

Mr. James Wilson has just returned to Buffalo, N. Y., after an absence of four years in England in the interest of the New York Car Wheel Works, of Buffalo, N. Y. During this time the British Griffin Co., of Barrow-in-Furness, England, has been put in operation and a very prosperous business built up in chilled wheels and castings.

Mr. Wm. McGrail has resigned the foremanship of the Allen Fire Supply Co., to accept the foremanship of the Textile Machinery Co.'s brass foundry at Providence, R. I.

Lewis B. Reed, Omaha, Neb., who after graduating from Harvard University, two years ago, entered the employ of the American Radiator Co., Chicago, has been placed in charge of the European business of that company. He sailed on Mar. 29, and will make his headquarters in London.

Mr. Isaac Taylor, formerly foreman of the Textile Machine Brass Works foundry of Providence, R. I., has accepted a position as foreman of the Allen Fire Supply Co., of Providence, R. I.

Mr. Chas. A. G. Winther has resigned his position as general superintendent of the Chapman Valve Mfg. Co., of Indian Orchard, Mass.

Wm. T. Nicholson Jr. has accepted a position as New England agent for the Waterbury Crucible Co., of Waterbury, Conn., with headquarters at Providence, R. I.

Mr. David McLain, of Milwaukee, Wis., has gone over to Madison, Wis., to take the place of superintendent of the Gisholt Machine Co.'s foundry.

Mr. H. B. Abbot, formerly manager of the Terrell Iron Works, Terrell, Texas, has accepted a position as manager of the Greenville Foundry & Machine Works, Greenville, Texas.

DEATHS.

James McQuiston, aged 76, died at his home in Pittsburg on April 11. Mr. McQuiston spent several years with the Atlas Foundry Co., after which, in 1870, he established the Pittsburg Galvanizing Works, of which he was the proprietor at the time of his death.

Henry Hanna, a wealthy and honored citizen of Cincinnati, died at his home Mar. 27. Age 93 years. Mr. Hanna was a heavy stockholder in many business enterprises, including the Newport Iron & Steel Works, the Addyston Pipe Foundry and a number of banks. He was actively engaged in business until about a year ago.

Moses Atwood, vice president and general manager of the Pittsburg Valve, Foundry & Construction Co., died at his home in Allegheny Mar. 18. Mr. Atwood was 57 years old and had been connected with various industries in and about Pittsburg. He was active in the business enterprises which resulted in the merging of several companies to form the Pittsburg Valve, Foundry & Construction Co. in 1900.

FIRES.

The Bowler Foundry Co., of Cleveland, O., was damaged by fire to the extent of $2,000 on Mar. 29. The fire is said to have been caused by the overheating of a journal box on one of the shafts.

The plant of the Star Iron & Foundry Co., of Montreal, Canada, was destroyed by fire on Mar. 27. The fire also destroyed a number of adjacent buildings.

The steel department of the Youngstown Foundry & Machine Co., of Youngstown, O., was destroyed by fire on Mar. 19. The loss is $20,000, partially covered by insurance.

The foundry and machine shops of the Stroh-Morris Foundry & Machine Co., Charleston, W. Va., were destroyed by fire Mar. 16. Loss, $25,000.

The foundry of the American Foundry Co., of Toledo, O., was damaged to the extent of $5,000 by fire on Mar. 29. The loss is covered by insurance and the plant will be rebuilt at once.

The Fisher Machine Works, of Leavenworth, Kan., were destroyed by fire on April 6. Valuable machinery and patterns were destroyed, including some new machinery ready for shipment.

The foundry of Emrick Bros., Hastings, Neb., was damaged by fire to the extent of $2,500 on April 15. The loss is practically covered by insurance.

NEW CONSTRUCTION.

The Norwood Engineering Co., Florence, Mass., will soon erect two additional buildings, one 130 x 70 ft., and one 40 x 30 ft. It will also build an addition to the foundry, 70 x 60 ft.

The Weir Stove Co., Taunton, Mass., will build an addition to its molding shop and a building to increase the company's capacity for mounting and storing castings.

The Westinghouse Machine Co., Pittsburg, in the summer of 1903 laid foundations at Attica, N. Y., for a plant for the manufacture of stokers. The foundations were entirely of concrete and were laid for four buildings besides the office building, consisting of a machine shop 250 x 150 ft., a foundry 60 x 500 ft., a pattern shop 35 x 250 ft. and a power house 30 x 100 ft. When the preliminary work was completed, in 1903, it was the intention of the company to construct the buildings the following year; but owing to a general depression in business this plan was not carried out. It is now announced that at an early day work will be begun and the construction of the buildings will be completed.

The new brass foundry of the Consolidated Car Heating Co., of Albany, N. Y., is nearly completed. The old foundry is being demolished.

The American Steel Foundries Co. have announced that they will spend $65,000 on their Sharon, Pa., plant.

The Pittsburg Malleable Iron Co., of Pittsburg, Pa., has taken out a permit for an iron clad foundry building to cost $4,000.

The American Pulley Co., 29th and Bristol streets, Philadelphia, Pa., will build an addition to its plant, 50 x 150 ft., one story.

The Globe Foundry Co., Johnstown, Pa., will double the capacity of its plant by an addition which will cover an area of about 5,000 sq. ft.

The Bromell, Schmidt & Stacey Co., York, Pa., has added a large boiler shop to its plant. The old shop has been converted into a foundry annex, which makes the foundry three times as large as it originally was. The foundry will be rebuilt.

W. M. Currier, B. E. Taylor and Ralph Lloyd will build a machine shop and foundry at Coudersport, Pa. The building will be 210 x 36 ft.

The Stacey Mfg. Co., Elmwood Place, Hamilton Co., O., has built a new plant at Elmwood Place, which is a suburb of Cincinnati. The main building is 150 x 510 ft. The power house is a separate building, 50 x 65 ft. The general offices are on the second floor of the main building. The new plant is equipped with the most modern machinery and appliances, including two ten-ton electric traveling cranes having a 65-ft. span. The company employs from 150 to 200 men. The foundry and cast iron departments are still located at Cincinnati, but the company proposes to erect another building either this summer or fall, on the east side of the main building at Elmwood Place, to take care of these departments.

The Columbus Pneumatic Tool Co., Columbus, O., is now located in its new plant and has largely increased its output, having been greatly overcrowded with orders at the old plant. The company owns the entire square in which the plant is situated, and some time in the near future expects to establish a large foundry in connection with the present works. The present foundry department is a small one, having been established as an experiment, but it has proved so successful that arrangements will be made for erecting a much larger one.

The Best Foundry Co., Cleveland, O., recently incorporated, will erect a foundry at Bedford, near that city. The main building will be 180 x 400 ft.; finishing department, 50 x 275 ft., and pattern storage building, 40 x 40 ft. Plans have been prepared by Kaltenbach & Griess, Cleveland.

The American Foundry Co., Toledo, O., whose plant was recently destroyed by fire, will rebuild on a larger scale.

The Day-Ward Foundry Co., of Warren, O., has replaced the foundry which was destroyed by fire last year with a new building, which has just been completed. The new building is 80 by 200 ft. and of brick and steel construction. It is fitted with a 5-ton Pawling & Harnischfeger electric crane.

Work has been started on the plant of the Stark Foundry Co., at Canton, O. The owners hope to have the plant completed by the first of June. The structure will be 50 by 100 ft. They expect to do a general jobbing business in gray iron castings.

The Favorite Stove & Range Co., of Piqua, O., is making quite extensive additions to its plant, including an addition to the foundry, which is 20 by 70 ft.

The Conway Stove Co., Toledo, O., has decided upon Fremont, O., for its permanent location, and will begin at once the erection of a brick building 700 x 80 ft.

The Hamilton Foundry & Machine Co., of Hamilton, O., is making extensive additions to its plant.

Ground has been broken at New Castle, Ind., for the erection of a new plant by B. F. Allen & Son. They will manufacture brass and iron castings.

The Wayne Stove Co., Fort Wayne, Ind., recently incorporated with a capital stock of $50,000, has not yet decided whether it will build this year. The company has received offers of buildings and land in several cities, but has not as yet accepted any of the offers.

The Barcus Horse Stock Mfg. Co., of Wabash, Ind., whose plant was recently destroyed by fire, have let a contract for a new stone building 60 x 126 ft. to replace the building destroyed.

The Home Stove Works, Rockwell street and 18th place, Chicago, will build a three-story structure mill construction, 56 x 125 ft., to be used as a shop and warehouse combined. Part of the plant will be used as a mounting shop and japanning department for piano plates.

Plans are being prepared for enlarging the plant of the Oregon Foundry & Machine Co., Oregon, Ill. The company is doing a prosperous business.

F. W. Reese, of Paris, Ill., is constructing an addition to his foundry.

The recent fire at the plant of the Lakeside Malleable Castings Co., Racine, Wis., destroyed the foundry and core room completely, but left the other buildings untouched. A new foundry and core room will be built, and will be about 25 percent larger than the old buildings.

The Valley Iron Works Co., Appleton, Wis., is building an addition to its brick foundry and installing a traveling crane, which is being built by Pawling & Harneschfeger, Milwaukee, which will be running in about three weeks. Plans for additional machinery are not yet completed.

The Malleable Iron Works, Waukesha, Wis., are being improved and some additions are being made, including two annealing ovens.

The Marshall Furnace Co., Marshall, Mich., is erecting an addition to its foundry, 30 x 45 ft.

Work on the new office and manufacturing buildings of the Aldine Grate & Mantel Co., Grand Rapids, Mich., will be begun this month. The foundry will be 50 x 100 ft. The factory for wood and iron working will be 50 x 125 ft.

The West Allis Malleable Iron & Chain Belt Co., West Allis, Milwaukee, will build an addition to its foundry, which will be 70 x 220 ft. An addition 64 x 70 ft., two stories, to the machine shop is also arranged for. The additions will double the capacity of the plant.

Loeffelholz & Co., Milwaukee, Wis., are planning to build a new foundry, which will be of frame with hollow tile composition roof, to cost $3,000.

The foundry extension of the Brown-Corliss Engine Co., of Corliss, Wis., is being very rapidly pushed toward completion. The company is now working night and day.

John Elliott, of Faribault, Minn., has announced that he will build a new foundry and machine shop in Northfield, Minn., the building to be 46 x 48 feet, and to be in operation about May 1st.

The first building to be erected by the Otto Gas Engine Works at its new plant in Wilmington, Del., will be 175 x 500 ft. Negotiations are pending to erect a large foundry on the land already purchased by the Otto Company. The foundry is an independent concern but will do work for the Otto Company.

The Fort Payne Stove & Foundry Co., Fort Payne, Ala., has decided to rebuild its plant which was burned some time ago. Work will be begun at once.

The foundry of the Hardie-Tynes Machine & Foundry Co., of Birmingham, Ala., which was recently destroyed by fire, will be rebuilt as quickly as possible.

Ground was broken a few days ago for the erection of the new plant of the Southern Skein & Foundry Co., at Chattanooga, Tenn. Wagon skeins will be the principal product. About 150 men will be employed.

The contract for the erection of the main buildings of the Coosa Pipe & Foundry Co., of Gadsden, Ala., has been let by the general manager, M. W. Bush, to T. F. Marlow. The main building will be 175 by 250 ft., in addition to which there will be several smaller buildings.

The Johannigman Foundry Co., of Covington, Ky., were forced to remove from their old position on account of the fact that it was purchased by the railroad, and they have secured a new site on which they will erect a new $35,000 foundry.

The Tuscaloosa Foundry & Machine Co., Tuscaloosa, Ala., has completed its new foundry, 50 x 70 ft., and will build a machine shop, 30 x 80 ft. The company will do a general foundry and machine business.

The Fulton Foundry & Machine Works, Atlanta, Ga., are preparing plans for the proposed foundry and machine shop buildings to be erected on the site recently purchased.

The High Point Pipe & Foundry Co., recently incorporated with a capital of $100,000, will build a plant at High Point, N. C., to have a daily output of from 10 to 12 tons of pipe. The officers are: President, J. Q. Adams; vice president, E. M. Armfield, and secretary-treasurer, O. N. Richardson.

The Swege Foundry Co., Covington, Ky., will rebuild its plant which was recently burned.

The plant of the Davis Foundry & Machine Works, Rome, Ga., recently destroyed by fire, will be rebuilt. The capacity is to be doubled.

Golden's Foundry & Machine Co., of Columbus, Ga., is erecting a new foundry, 100 by 250 ft.

It is stated that the pipe foundry of the Minnequa plant of the Colorado Fuel & Iron Co., at Pueblo, Col., will be enlarged at some time in the near future.

Mr. John McKinney expects to have his new foundry at Woodburn, Ore., in operation by the latter part of May.

It is reported that the Dickson Car Wheel Co., Houston, Tex., is planning to construct an iron foundry on the site recently purchased by them.

The Hart-Parr Co., Charles City, Ia., will build an addition to its main building, 85 x 185 ft., and will extend the foundry by an addition 60 x 75 ft. The capacity of the plant will be nearly doubled.

The York Foundry Co., of York, Neb., is building additions to both its foundry and machine shop.

Work on the new building of the Swab Foundry Co., of Elizabethville, Pa., is being pushed as rapidly as possible.

The National Foundry, Mfg. & Supply Co., Williamsport, Pa., has nearly completed an addition 30 x 48 ft.

Geo. W. Beard & Co., contractors, are pushing the work on the new plant of the Reading Stove Works, at Reading, Pa., as rapidly as possible and expect to have the additions completed in a few weeks.

The C. O. Bartlett & Snow Co., of Cleveland, O., whose plant was partially destroyed by fire on April 11, resulting in a loss of $60,000, immediately began repairs for reconstruction, and will be able to complete contracts and fill orders with little delay. It can now fill small orders from stock which was not damaged.

The Toledo Stove & Range Co., Toledo, O., has let the contracts for additions, 167 x 75 ft., three stories.

A foundry building, 67 x 127 ft., is being added to the plant of Ames & Frost, bicycle sundry manufacturers. M. J. Moorehouse, Fisher building, Chicago, is the architect.

The Monarch Coupler Co., Detroit, Mich., is preparing to erect in Delray, near Detroit, a large plant for the manufacture of steel castings in addition to couplers. As soon as the structural steel can be obtained the erecting will be commenced. The capital of the Monarch Coupler Co., which is $100,000, will be increased to $250,000 or $300,000. The new buildings will be erected on the land owned by the McMillan interests back of the plant of the Michigan Malleable Iron Works. The officers of the Monarch Coupler Co. are: President, W. C. McMillan; vice president, T. H. Simpson; treasurer, George M. Black; manager, W. C. McMahon.

The Falk Mfg. Co., of Milwaukee, Wis., are planning to spend $150,000 in erecting works upon the land recently acquired by them. The principal addition will be a large foundry.

GENERAL INDUSTRIAL NOTES.

The Huntsville Foundry & Machine Co., Huntsville, Ontario, recently incorporated, is unlike some enterprises which do a great deal of talking and obtain a charter before operations are commenced. This company had its buildings erected and some casts run off in the foundry, and considerable machine work done, before the charter was granted. There are five members of the company, who provide the capital stock of $20,000. F. H. Tool, the general manager, has been connected with large firms in Ontario and Vancouver. A. C. Suttaby is superintendent of machine shops and T. D. Moarse superintendent of the molding shops. The officers are: President, J. H. Johnson; manager, F. H. Tool; secretary-treasurer, D. M. Grant. Huntsville is a town of 3,500 inhabitants, on the main branch line of the Grand Trunk Railroad, and has not heretofore had a foundry or machine shop. The company considers its prospects for success excellent.

The C. F. Sutton Co., of Toledo, O., are to erect a plant for manufacturing steel castings by the Tropenas process. The plant is to have a capacity of 20 tons per day.

The foundry formerly conducted by the G. M. Emeny Co., known as the Fulton Foundry & Machine Works, Fulton, N. Y., has discontinued business. The equipment on hand has been purchased by the Dilts Machine Works, of the same city.

In the United States district court an order has been issued setting aside the order adjudicating the Finlay-Otten Foundry Co., Buffalo, an involuntary bankruptcy. All of the assets have been transferred to the company and settlement has been made with the creditors. The company will be at once reorganized.

The receivers in charge of the affairs of the Newton Fire Brick Co., Albany, N. Y., have been discharged and the business has reverted to the company, which has been reorganized with the following officers: W. G. Rice, president; C. B. Flint, treasurer and general manager; F. W. Kelly, secretary, and C. H. Sabin, vice president. Extensive additions to the plant are being made.

Bingham & Taylor, who operated a foundry at Buffalo for the past 20 years, have dissolved partnership. Mr. Taylor has retired and the business will be conducted under the management of William P. Taylor. The foundry was established about 50 years ago and for a time was known as the Clinton Iron Works.

The Niles-Bement-Pond Co. has leased an entire floor in the New Trinity Building at 111 Broadway, New York City, which will be occupied by their executive offices after May 1st. This company employs about 5,000 workmen, has two factories in Philadelphia, one in Hamilton, O., and one in Plainfield, N. J., and also owns the Pratt & Whitney Co., at Hartford, Conn.

It has been definitely decided that the Cast Thread Fitting & Foundry Co., of Seneca Falls, N. Y., will remain in their present location. There has been some talk of moving the works to some other city, but a committee of the citizens was appointed to hold a conference with Mr. Cutter, president of the company, and were able to offer inducements which made it an object for the company to remain.

Henry Wray & Son., Inc., of Rochester, N. Y., is a firm lately incorporated with a capital of $24,000 to carry on a general foundry business. The directors are William H. Wray, Chas. F. Wray and Cornelia F. Wray.

John Touhill, proprietor of the Riverside Foundry & Machine Co., Pittston, Pa., has purchased the property at South Scranton, Pa., formerly occupied by the Lackawanna Iron & Steel Co. The property includes six acres and several brick buildings. Mr. Touhill will take his seven sons into partnership, and a company will be incorporated to be known as the Touhill Iron Works. As soon as possible work will be started on getting the buildings in proper condition for operation as a foundry.

Means, Fulton & Co., who recently purchased the plant of the Portsmouth Foundry & Machine Works, Portsmouth, O., will dismantle it and remove the machinery to Birmingham, Ala.

The Piqua Mfg. & Foundry Co., of Piqua, O., has been organized to take over the old plant of Poorman Bros., which has been idle for some time. The new company plans to enlarge the plant and carry on a general foundry and machine business.

Edwards Bros., of Leipsic, O., has decided to take up the stock of the American Foundry Co., thus gaining full control of it. This foundry is one of the principal industries of Leipsic.

The Bessie Ferro-Silicon Co., Columbus, O., is now repairing and remodeling the Bessie furnace at New Straitsville, O., and will put on the market in the near future its well known brand of Bessie silicon iron. The company expects that the improvements now under way will, when completed, put it in a position to furnish a better quality of iron than has ever been produced at this furnace. The ferro-silicon will be from 10 to 14 percent silicon. The company expects to take orders within a month.

The Alberger Condenser Co. announce that they have opened a branch office in Chicago, in Room 316 Home Insurance Building, 205 La Salle St., which will be in charge of Mr. H. M. Montgomery.

The Cleveland & Barr Foundry Co., of Chicago, Ill., has changed its name to the Barr & Cummings Foundry Co.

Mr. P. C. Webb, of Hutchinson, Minn., has started his new foundry and reports that he has all the work that he can do.

O. S. Cross and Dr. C. W. Young have leased the Allegan Foundry & Machine Co.'s plant at Allegan, Mich., and will continue the business under the same name.

The pipe foundry of the United States Cast Iron Pipe & Foundry Co., at Superior, Wis., has been opened and has quite a large amount of work on its books. Mr. D. C. Dixon will be foreman at the plant and Mr. Frank Britts superintendent. It is hoped that the plant will have work enough to keep it busy at least until fall.

The foundry of the American Brake Shoe & Foundry Co., Bloomfield, N. J., which was closed some time ago and the business transferred to Mahwah, N. J., is to be reopened to make malleable iron castings for the company's own use.

The Perth Amboy Foundry & Machine Co., of Perth Amboy, N. J., recently incorporated with a capital of $100,000 to do a foundry and machine shop business, has secured a large tract of land and buildings, where it is installing machinery and making preparations to begin work.

The first steel was poured at the new plant of the Baldt Steel Co., New Castle, Del., April 10. It is expected that the entire plant well be in operation at an early day.

The Thole-Phillips Mfg. Co. has been incorporated with a capital of $50,000 at Florence, Ala. This company succeeds the Thole Stove Mfg. Co., whose plant was recently removed to East Florence and enlarged. The officers are Henry H. Thole, president; Thomas J. Phillips, secretary and treasurer.

The Frictionless Metal Co., Richmond, Va., will remove from that city to Chattanooga, Tenn., as soon as a foundry building can be completed in the latter city. C. E. Buek, of Birmingham, is president of the company. The plant which will be erected will be 150 x 100 ft., two stories.

The Jones-Terry Foundry & Machine Co., of Lynchburg, Va., has been incorporated with a capital of $25,000. The incorporators are: C. S. Adams, president; Chas. E. Jones, vice president and general manager; R. G. Terry, secretary and treasurer.

The Daniel Bros. Machine Co., of Tuscaloosa, Ala., which has been incorporated with a capital of $5,000, will for the present do a machine repair and blacksmith shop business, but will later add a foundry to their business.

Mr. L. C. Heminger, of Bowling Green, Ky., has sold his foundry and machine shop to Chas. Roemer. The trade does not go into effect until Jan. 1, 1906. Mr. Roemer served his time in this establishment and understands the business in every detail. When he takes possession he will remodel the plant throughout and equip it with the latest and best machinery and appliances.

Warren Heaton, of Neosho, Mo., has purchased the foundry and machine works in that city owned by J. A. Rogers. The plant was established in 1879 by Van Riper & Rogers, and in 1896 Mr. Rogers purchased the interest of Mr. Van Riper. Mr. Rogers has moved to

Joplin, Mo., where he will look after the business of the Rogers-Conklin Mfg. Co.

The Freeman Foundry & Machine Co., Joplin, Mo., is extending its business into Mexico. Several car loads of machinery have recently been shipped to Torres, Sonora, Mex. A large number of these mine cars have been shipped to Kansas, Indian Territory and Arkansas. Some new equipment is being added by the company.

The new plant of the Simmons Hardware Co., of St. Louis, Mo., is to be erected at Sioux City, Ia., and will cost at least $300,000. The contract for its erection has been awarded to Mr. Frank B. Gilbreth, of New York and Boston. Messrs. Gordon, Tracy & Swartwout, of New York City, are the architects.

Arnold & Jack, of Athena, Ore., have purchased an interest in the Zeigler & Mays' Machine Shop, of Pendleton, Ore., and will rearrange the shops at once.

The Ben F. Slack Brass Mfg. Co., of Denver, Colo., has been incorporated with $20,000 capital. The incorporators are Ben F. Slack, Frank J. Rees and W. H. Owen.

R. M. Churchman will erect a foundry and machine shop at Felsenthal, Ark.

The Walker Steel Range Co., Ltd., has removed from Windsor, Ont., to Grimsby, Ont. The company has been granted a loan of $15,000 by the city of Grimsby for a term of years and has purchased a large foundry property there, and will increase facilities in every way so that it will be able to take care of the large business which it has booked.

Smith & Wilby expect to start a foundry at Toronto, Canada, for the manufacture of steel castings. They will probably use the buildings at 340 East Front street.

The Honolulu Iron Works, Hawaiian Islands, which competed with foundries in the United States for the installation of sugar plants in Mexico and other Central and South American countries, has secured the contract to erect a 12-roller mill for the Hawaiian Sugar Co.

The Hope Metal Co., composed of Mr. Frank J. McGrail and others, has just started a new brass foundry at Kingsley avenue and Eagle street, Providence, R. I. Mr. McGrail formerly worked for the Gorham Mfg. Co.

Thomas F. Fallon & Co., of Lawrence, Mass., have just started a brass foundry at the rear of 156 South Broadway. Mr. Fallon was until recently foreman at the Frederick Byrom brass foundry.

The Innes-Demarest Stove & Heater Co., Binghamton, N. Y., has been incorporated. Capital, $200,000. The incorporators are: J. K. Innes, John Damarest, John Hull Jr., all of Binghamton.

Only the office and supply house of the Jackson Foundry & Machine Co., Paducah, Ky., were destroyed by the recent fire. The machine shop, foundry and pattern departments, across the street from the office and supply house, were not damaged at all by the fire. The company is erecting a new building near the machine shop, and in this expects to have a supply house and office.

The Niagara Foundry Co., Niagara Falls, N. Y., recently incorporated with a capital of $10,000 has taken over the plant formerly occupied by P. H. Tuohey and others, known as the Niagara Falls Foundry. There are several directors of the new company, as follows: W. E. Burleson, D. E. Nicklis, O. E. Acker, D. F. Bentley, George M. Tuttle, Harris Lumberg and W. W. Denner. The officers are: President, E. E. Nickles; vice president, W. E. Burleson; secretary, W. W. Denner; treasurer, D. F. Bentley.

The Johnstown Foundry, Machine & Car Co., Johnstown, Pa., and the plant of F. W. Leitenberger, Johnstown, Pa., have been merged into one concern under the active management of Mr. Leitenberger. The new concern will be the Johnstown Foundry Machine & Car Co., and the business of both plants will be continued as heretofore, although both plants will be overhauled and considerable new machinery will be installed. The Johnstown Foundry, Machine & Car Co. was organized some months ago to take over the plant of the Cambria Foundry & Machine Co., bankrupt. The company has made a specialty of mining cars and railroad equipment. The Leitenberger plant has done a general machinery and electrical business.

The Niles-Bement-Pond Co. report that they have purchased the property at Nicetown, Phila., Pa., formerly owned by the Cresswell & Waters Co., and will operate it in connection with their Philadelphia plants. It will be used as a foundry for their works at Twenty-first and Callowhill streets, and also for the Niles Crane Works branch.

Notice has been sent out of the dissolution of the partnership lately existing between Philip C. Smith, Harris Tabor and Howard C. Williams, doing business under the name of the Vulcan Facing Co., of Easton, Pa. The partnership was dissolved on April 10, 1905, by mutual consent. All debts owing to the partnership are to be received by Howard C. Williams, Easton, Pa., and all demands on the said partnership are to be paid by him.

Mr. Philip C. Smith, formerly of the above company, announces that he will continue to carry on the facing business personally under the name of the Vulcan Facing Co., at Easton. Pa.

The Sterling Steel Foundry Co., Pittsburg, Pa., was not seriously inconvenienced by the recent fire in its plant. A new roof has been put on the pattern storage house, and the plant is in operation as usual.

Geo. S. Tillotson, manager of the Sterling Emery Wheel Mfg. Co., Tiffin, O., has started on a trip to Europe, and upon his return the company will erect a foundry building.

The United Foundry Co., Cincinnati, O., has been incorporated with a capital of $25,000. Incorporators are: J. W. Malloy, H. W. Mueller, Frank Grieme, George Laible and Christian Hasecoster. This company will succeed the Johannigmann Foundry Co. The business will be continued about as heretofore.

The Dayton Pneumatic Tool Co. has been incorporated in Ohio with a capital of $50,000 for the purpose of manufacturing pneumatic tools and all kinds of air appliances. It has taken over the business of the Chicago Tool & Supply Co., and will manufacture the "Green" pneumatic hammers in its factory at Dayton, O., where its principal offices will be located.

The Wauseon Foundry Co., of Wauseon, O., has its plant in operation. It will manufacture castings for the Red King wind mills, tank heaters and feed coolers. Later it expects to manufacture furnaces.

Pickands, Brown & Co., and associates, will break ground for a new blast furnace in Chicago this spring which will be modern in every particular. The location has been decided upon, but they are not prepared as yet to make it public.

The Allis-Chalmers Co. is moving its offices from Chicago to Milwaukee. On and after May 1, 1905, the general offices of the company will be located at the Reliance Works, Milwaukee, Wis. The vice president and general manager, the comptroller, assistant treasurer, office counsel, accounting and credit departments, and also the managers of the power, pumping engine, mining and crushing machinery, flour mill and saw mill departments, will all be located in Milwaukee.

The district offices of the company in Chicago, together with the electrical department (the Bullock Electric Mfg. Co.), will be removed from the New York Life building in Chicago, Ill., to the First National Bank building of that city.

The Champion Brass Works, of Coldwater, Mich., have secured the plant formerly occupied by the Knott-Van Arnum Co. The new company will be conducted by J. L. Curtis, of Gloversville, N. Y., and Casper Schwertzer, of Chicago, Ill.

The Pilling Air Engine Co., with headquarters at Detroit, Mich., has succeeded the Pilling Air Engine Works, formerly of Bucyrus, O.

The Platteville foundry, Platteville, Wis., recently purchased by C. C. Mathey, of the Galena Iron Works, Galena, Ill., was put in operation last week, with Edward Moore and Eugene Mathey as managers. A specialty will be made of mining machinery.

The Enterprise Foundry Co., of Detroit, Mich., has elected the following officers for the ensuing year: President, Frank Smith; vice president, Emil Zanwanseele; secretary and manager, Charles W. Carolian; treasurer, George S. Cuddy.

D. E. Youmans, of Midland, Mich., has purchased the business and leased the plant formerly occupied by the Cass City Foundry Co., of Cass City, Mich., and will carry on the business in future.

The Riverside Foundry, Newark, N. J., has been incorporated with a capital of $125,000. The incorporators are: Robert H. Ireland, Bellville, N. J.; Thomas Malcolm, of Delawanna, N. J.; J. Smylie Kinne, Jas. M. Smylie, Porter S. Kimm, Paterson, N. J.

Mortimer Griffin has purchased the interest of the stockholders in the Georgia Foundry & Machine Works, Rome, Ga., excepting the interest of Reuben Towers. Mr. Towers and Mr. Griffin are now the sole owners of the plant.

The foundry of the Edgar Skinner Iron Works, of Sumter, S. C., has just started up. They will do a general jobbing business and later on will manufacture woodworking machinery and engines.

The Arizona & Sonora Mfg. Co., of Nogales, Ariz., is planning to spend $20,000 in increasing the capacity of its works. It will install suitable new machinery, both in the machine shop and foundry. It reports that it has a large number of orders on hand and is very busy.

THE FOUNDRY

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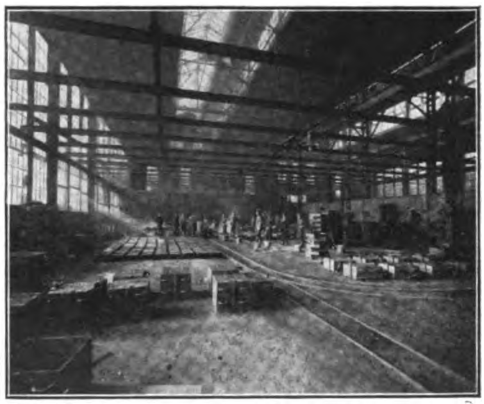
Foundry Department of the Imperial Works of the Oil Well Supply Company, Oil City, Pa.

The development of the oil industry in this country has given rise to a number of different lines of manufacture which were formerly unknown. Some idea of the equipment necessary for this industry may be had when we consider that the Oil Well Supply Company has plants at Pittsburg, Oil City and Bradford, Pa.; Oswego, New York; Parkersburg, West Virginia; Van Wert, Ohio and Poplar Bluff, Missouri. The Imperial Works located at Oil City is one of the most complete plants of the kind in the country. No very heavy machine is built at this plant, but there is a large variety of light machine fittings, etc., including pumping rigs for oil wells, steam and oil engines, drilling rigs, and other oil well equipment. The works are located on the bank of the Alleghany river about one mile above Oil City. The general plan has been made to conform to the ground upon which the works are situated, and so the ends of the principal buildings which abut the river form a crescent. This arrangement allows a spur or switch from the railroad to enter each building without passing through any other, as shown in the plan. Each building is also capable of enlargement by extending it at the end away from the river. The shipping department and gray iron foundry are placed between the general switch system and the railroad tracks along the river, as both of these buildings have to do with the work in many other departments. The central power station

STORAGE SHED.

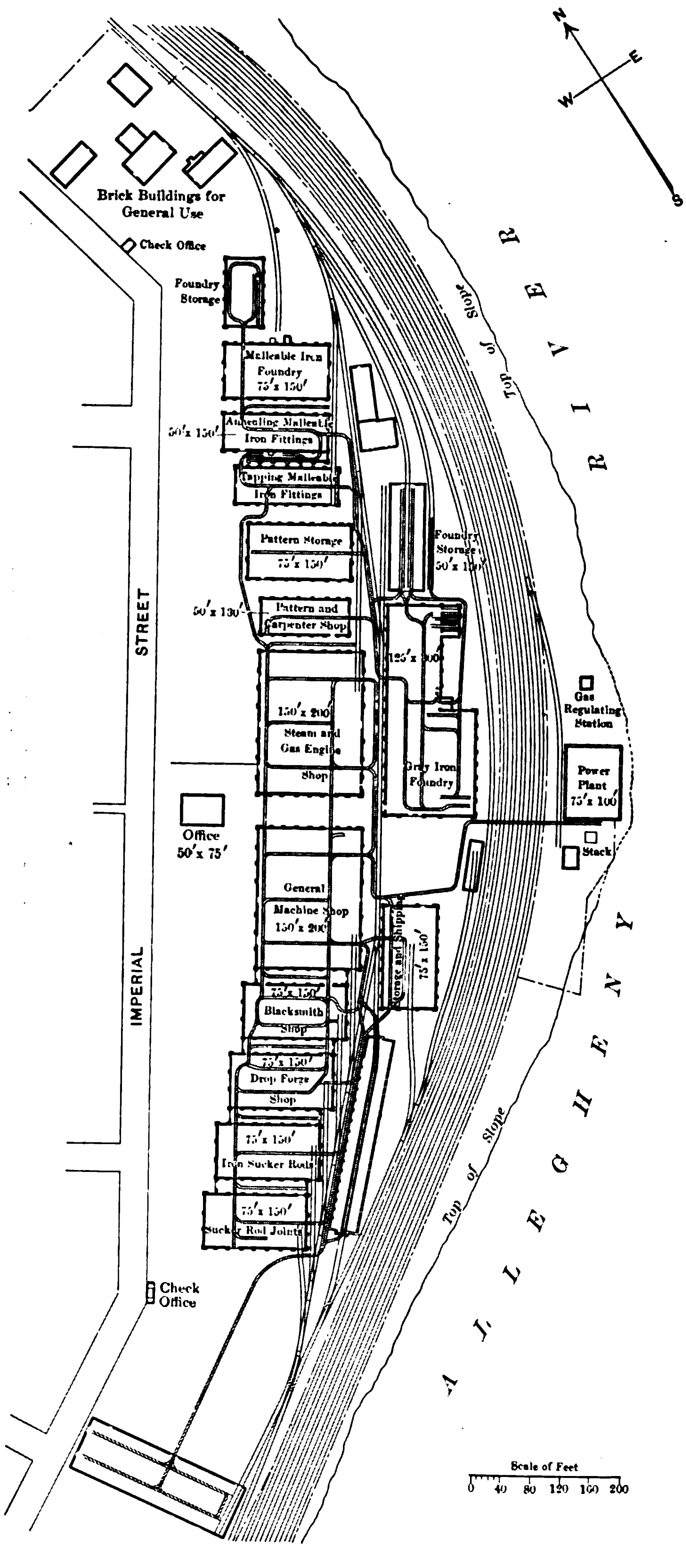


MOLDING MACHINE DEPARTMENT.

is located at the bank of the river where it can obtain abundant supply of water for boiler and condensing purposes. The main lines of the Pennsylvania, Lake Shore & Michigan Southern and Erie roads run between the power plant and the other buildings, thus affording ample transportation facilities. The trackage system in and about the works, however, is owned and operated by the company. For switching on the standard gauge system, they have a regular locomotive and for use on the industrial railway a gasoline motor truck. The portion of the plant in which we are especially interested in this article comprises the gray iron and malleable foundries.

Gray Iron Foundry.

The gray iron foundry is located in a build-



ing 125 by 300 feet, with a foundry storage 50 by 150 feet at the end. It consists of a central bay devoted to heavy work. This bay is spanned by a traveling crane running the entire length of the foundry and having a capacity sufficient to handle the largest work they make. The crane also runs over the cleaning department at one end, and in front of the core department at the other. The traveling crane has a 15-ton capacity with a 5-ton auxiliary. Joining the heavy work floor there is a light work floor devoted to snap flask work, or light floor work.

In addition to this there are a number of jib cranes equipped with air hoists. The core department is located at one end of the room and is equipped with a core machine for making stock cores, the necessary benches and boxes for special cores and both large and small core ovens. The core ovens are fired with natural gas.

The cupolas are located about the middle of the length of the foundry and consist of two Whiting cupolas, one 75 inches, and the other 50 inches inside the lining. There is also a 33-inch Collieu cupola. One of the cupolas is arranged to tap either into the main bay, or at right angles into a side room.

The cleaning department is located at one end of the foundry and extends across the entire width of the building. Between the cleaning department and the cupolas there is arranged a large lean-to building or bay, used entirely for machine molding. There is one

MAIN BAY OF GRAY IRON FOUNDRY.

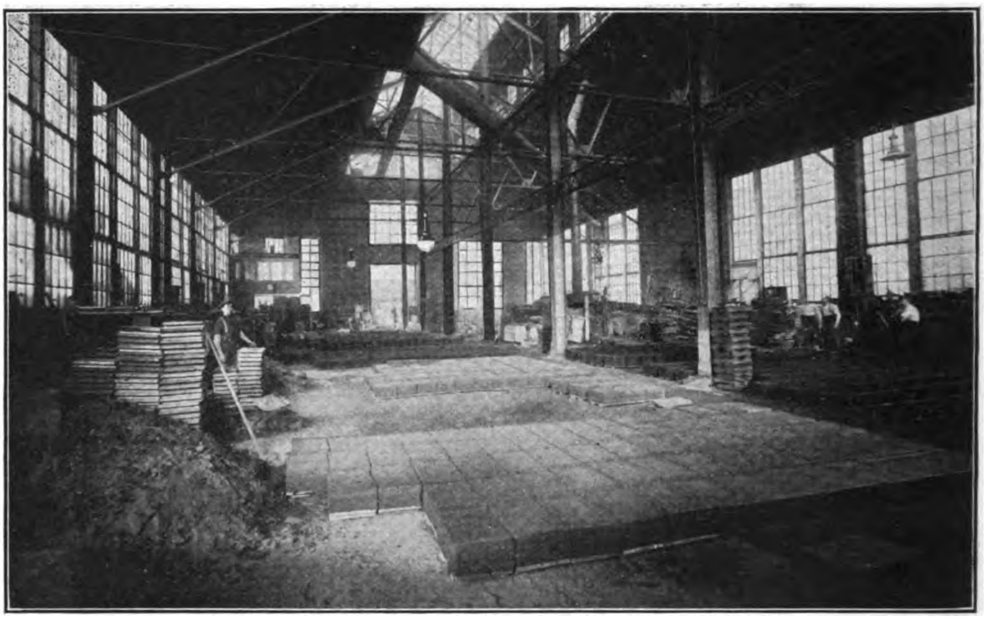
Berkshire automatic molding machine used for small work and a large number of small machines of various types and makes for standard work. In this department there is one feature that is certainly novel. Some of the stripping plate machines are arranged upon long timber foundations at the sides of the building. Trolley tracks are run clear across the building from one machine to the other, and each track is equipped with a large and a small air hoist. One of these is of 800 pounds capacity and the other of 2,500 pounds capacity. The machines on opposite sides are fitted up so that one will make the drags and the other the copes. The heavy hoist places the drags on the floor and the lighter hoist is used in placing the copes. After all of the molds are closed, the large hoist on the next track is swung over, hitched to one of the molding machines and the machine lifted under the next line of trolley track. The hoist then passes to the opposite side of the room and shifts that machine. Both machines are immediately put in operation making copes and drags, and another line of molds across the room completed. The large hoists are also used for pouring, which is accomplished by bringing in a truck ladle on the industrial railway and then lifting it with the heavy hoist and carrying it along over a line of molds. Of course the pneumatic squeezer machines cannot be shifted in this way, but with the stripping plate machines used for heavy work the method serves very well indeed.

The entire foundry is well lighted by side lights, sky lights, and monitor roof.

Storage Provisions.

The pig iron, scrap, etc., together with the larger proportion of the iron flasks not in use are stored in the yard near the cupolas.

One of the most interesting features of the entire plant is the storage building located at the end of the foundry. This is arranged with a standard gauge railway track through the center, a narrow gauge track on each side of it, and a traveling crane above. Suspended from the traveling crane there is a skip or box, and the material as it arrives is loaded into this, hoisted to the top of the bins, and dumped into a movable hopper which can be set opposite any one of the bins. In this way the bins on both sides can be filled with

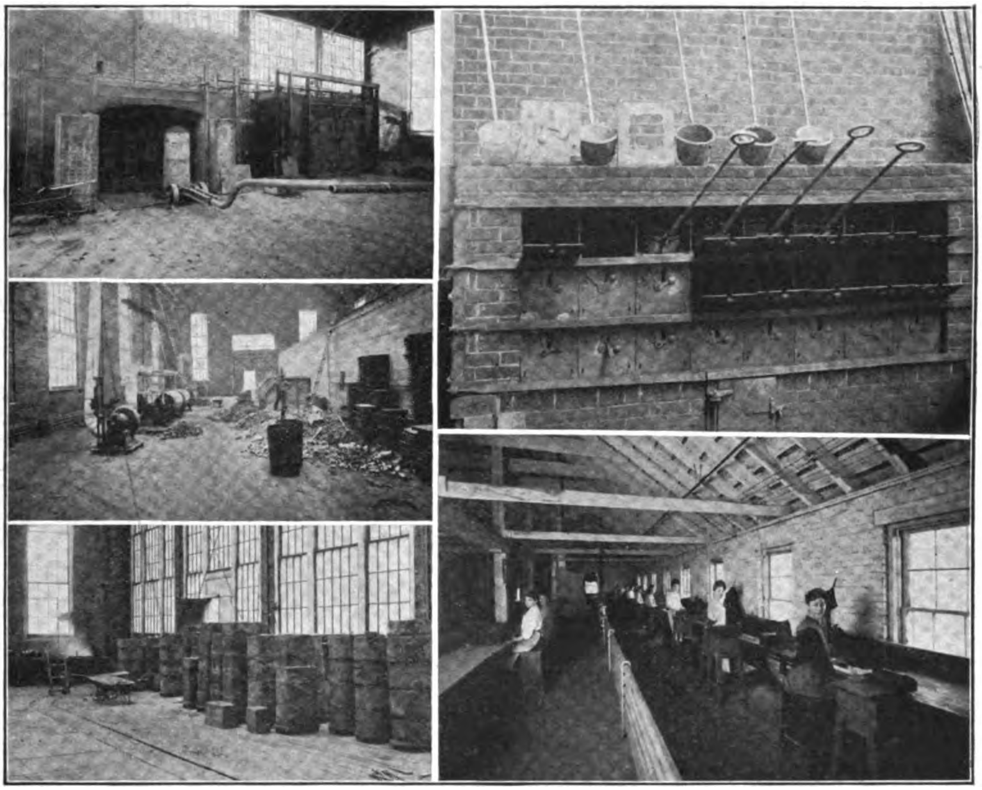


MALLEABLE FOUNDRY.

any material for which they are intended. The material can then be drawn out into cars on the industrial railway track in the center or into cars running along on the outside of the building. On the outside of the building there is an elevated track on one side from which material can be loaded directly into the bins. The bin capacity is sufficient to store an entire winter's supply of molding sand, sea coal, facing, coke, etc.

Malleable Department.

As this company requires a large amount of malleable fittings and other castings for use in connection with their business it was decided that it would pay to install a malleable iron foundry. This department occupies several buildings. The malleable foundry proper occupies a building 75 by 150 feet and is equipped with one 20-ton air furnace of the ordinary top charged type, such as is generally used in connection with malleable plants. The foreman's office is located in one corner and elevated at such a point that he can look over the entire floor. Under the office is located the metal pattern repair shop, fully equipped for replacing gates and doing any other work necessary for the repair of metal patterns. Adjacent to the metal pattern repair department there is the heating furnace for drying and warming hand ladles, which is certainly a well designed piece of equipment. The construction is plainly shown in one of the illustrations, in which it will be seen that the furnace is simply a rectangular brick structure with some angle irons running lengthwise and some spacing bolts arranged vertically so as to divide the furnace into small rectangular units. A series of plates may be laid in on the angles to form seats for the ladles. One of these plates is standing on top of the furnace and it will be noticed that four small semicircular openings are cut out about the sides to allow the hot gases to pass up about the ladle. The front of each compartment is closed by a casting with a small cast latch which can be swung down over the ladle shank. The furnace can all be taken down and re-assembled in a very few minutes. In the case under consideration a natural gas fire is arranged along the bottom, but there is no reason why the same construction could not be used with a coke or hard coal fire with equally good results. Such a furnace as this would be found very handy in any foundry using a large number of hand ladles. Adjoining the malleable foundry is the hard cleaning room, which is equipped with a battery of exhaust tumbling mills. The castings are then taken to the annealing department which is located in a building 50 by 150 feet. There are five annealing furnaces, all fired with natural gas. The pickling tanks are located in one end of the annealing depart-



1. CHARGING ANNEALING OVENS. 2. HARD CLEANING ROOM. 3. PACKING ANNEALING POTS. THE PICKLING DEPARTMENT CAN BE SEEN IN THE BACKGROUND. 4. LADLE DRYING FURNACE. 5. SMALL CORE DEPARTMENT IN MALLEABLE FOUNDRY.

ment. Adjoining the annealing department is the soft cleaning room, which is equipped with tumbling barrels and other machinery necessary for cleaning soft castings. Such fittings as require galvanizing are taken to the galvanizing department, which is located near the malleable foundry and is equiped with pickling tubs, zinc pot and all the other apparatus necessary.

The cores for malleable fitting constitute a large proportion of the expense necessary for the production of this class of work. For making these cores a very carefully arranged core department has been fitted up in one of the brick buildings which was on the site at the time the present company purchased the old oil refinery property. On the first floor of the department there is located a sand mixing department in which all of the sand is prepared. Many of the heavier cores are also made on this floor. The core ovens are sectional ovens fired with natural gas and are arranged along one side of the building. All of the work on the first floor is done by men and boys.

For making the cores for the smaller fittings girls are employed. They work on the second floor, the core sand being brought up by means of an elevator, and their racks of finished cores being placed on a special elevator which runs continuously. The cores are removed by men on the lower floor and placed in ovens. The plant is so arranged that the girls have a separate entrance to the grounds and no one but their foreman has any business on their floor except those who work there. The room is neat and light.

The entire malleable department shows careful thought in planning and laying out the work so that it can be done to the greatest advantage.

The Mesta Machine Co., of Pittsburg, Pa., has plans prepared for an addition to the big plant at West Homestead which will double its capacity.

METALLOGRAPHY APPLIED TO FOUNDRY WORK.

PART II.

BY ALBERT SAUVEUR.

DEVELOPMENT OF THE STRUCTURE OF POLISHED SAMPLES OF CAST IRON.

When samples of grey cast iron, polished as described in the first installment of this article, are examined through the microscope, numerous, small, irregular cavities are revealed which mark the spaces once occupied by the small particles of graphitic carbon always present in this grade of iron. Most of these graphite particles are removed by the polishing operation but the small cavities which remain indicate accurately their former location and shape. Fig. 1 shows under a magnification of 56 diameters, the appearance of a sample of grey cast iron after polishing. The irregular cavities just referred to, whether they still contain their graphite or not, appear as so many black areas. It will readily be inferred that the appearance of the magnified image of this polished sample of grey cast iron should convey at least as much information concerning the physical and chemical characteristics as the examination of the fracture, or in other words that these properties must be closely related to the number of the graphite particles revealed by polishing, to their size and shape, their distribution, etc. I shall have occasion to show that very valuable information may indeed be obtained from the microscopical examination of polished samples of cast iron without subjecting them to further treatment, but it will be noted that in these samples the structure of the metallic part is not revealed. The polishing operation has imparted the same appearance to the various constituents of which this metallic mass is composed: they have all assumed a mirror-like aspect, reflecting the light to the same extent, so that it is not possible to distinguish them from each other. In order to make these various constituents visible under the microscope it is necessary to impart to them unlike appearances through the action of certain treatments affecting them differently. These treatments generally consist in subjecting the polished samples to the action of acids or of some other reagents which attack certain constituents to the exclusion of others or with varying degrees of intensity: they are generally known as "etching treatments."

FIG. 1. GRAY CAST IRON POLISHED BUT NOT ETCHED. MAGNIFIED 56 DIAMETERS.

FIG. 2. WHITE CAST IRON POLISHED IN RELIEF. MAGNIFIED 100 DIAMETERS.

Polishing in Relief.—In the case of white cast iron two constituents are present (to be described later) which differ much in hardness and if the tripoli and rouge polishing be continued for a sufficiently long time, and especially if it be conducted on a soft, yielding backing, a pronounced relief effect is produced resulting from the greater wearing of the soft constituent. The difference in level of the two constituents, obtained in this way, differentiate them under the microscope without further treatment.

Fig. 2 shows the microstructure magnified 100 diameters, of a sample of white cast iron polished in relief. The presence of two constituents is clearly brought out. The soft constituent appears dark because being somewhat depressed, each particle of it pertains, microscopically speaking, of the nature of a shallow cavity. The differentation is further assisted by the soft constituent assuming a marked appearance, while the hard component retains its specular aspect.

While such relief polishing makes it possible in the case of white cast iron to observe some features of the structure without further treatment and while it is occasionally valuable, it seldom reveals structural details which are not better brought out by an etching or some other developing treatment.

Etching Methods.—Many reagents have been recommended for etching polished samples of iron and steel, but I shall only describe here those treatments which, so far as my experience goes, yield the best results.

The structure of cast iron may be made apparent by etching polished samples with one of the following solutions: (1) Nitric acid in absolute alcohol, (2) picric acid in absolute alcohol, (3) concentrated nitric acid and (4) tincture of iodine. I have named them in the order of my preference.

Etching with a Solution of Nitric Acid in Alcohol.—A solution should be prepared containing 10 percent of concentrated nitric acid (1.42 sp. gr.) and 90 percent of absolute alcohol. A small amount of this solution should be poured in a small beaker or dish and the polished sample immersed in it for a very short time (seldom exceeding 10 seconds). It is generally better not to leave the sample in the solution for more than five seconds and to repeat the treatment if it be found that the etching was too slight. When the sample is taken from the etching bath, it should be quickly washed in alcohol and carefully dried, preferably by means of an air blast followed by gentle wiping with a soft cloth; or lacking a blast, altogether with a soft cloth.

A piece of chamois leather may also be used to advantage for wiping the specimen, after drying it, immediately before examining it under the miscroscope. To that effect it is convenient to nail a small piece of the leather on a piece of wood and to rub the specimen over it once or twice. This block should be kept carefully covered to prevent any dust from settling upon it.

The etched specimen is now ready for microscopical examination.

Etching with a Solution of Picric Acid in Alcohol.—A solution should be prepared containing 10 percent of picric acid and 90 percent of absolute alcohol and the etching conducted exactly as described for the treatment with nitric acid in alcohol.

Etching with Concentrated Nitric Acid.—The polished samples should be dipped in concentrated nitric acid (1.42 sp. gr.) and immediately held under an abundant stream of running water. When iron is immersed in concentrated nitric acid it assumes what is known as the passive state, i. e., it is not affected by the acid. As soon as the layer of concentrated acid which covers the polished surface, however, is diluted by the running water, it attacks the iron vigorously, but for such a short time (since the water soon removes all traces of acid) that there is very little danger of etching too deeply. One such treatment is generally sufficient to bring out the structure sharply and clearly, but if the sample be found insufficiently etched the etching should be repeated in exactly the same manner.

Etching with Tincture of Iodine.—Some tincture of iodine, such as may be obtained from pharmacists, should be diluted with the same amount of alcohol. A little of this solution should be applied to the polished surface, conveniently by dipping a finger's end in the tincture and gently rubbing the specimen and repeating the treatment until the surface appears dull or slightly tarnished. The sample should then be washed in alcohol and dried.

Heat Tinting Method.—This method consists in heating the polished sample gently and gradually in contact with the atmosphere by holding it over a Bunsen flame for instance, or placing it on a hot plate or in some other suitable manner. The different constituents assume, in rapid succession, but with varying velocities, different shades due to the formation of light films of oxides, in such a way that at no instant of the heating are two components colored alike. This method has been applied extensively and with much success to cast iron by Mr. J. E. Stead and I shall have occasion to again refer to it.

FOUNDRY COSTS.*

BY RALPH BOWMAN.

In analyzing production and in ascertaining the cost, the proposition "per se", is the same with all foundries; but the method must differ with each individual foundry. This is caused by the difference in castings and the varied nature of each foundry's business. "One man's meat being another man's poison" often holds good.

There are three divisions in foundry cost to be considered:

1. The material, or metal, composing the cupola charge.

*Paper read by Ralph Bowman before meeting of Buffalo Foundrymen's Association, March 21, 1905.

2. The general expenses and supplies.
3. The actual molding time of the molder.

The first and third divisions, the material and molding labor, show in themselves what they are. The second division, consists of overhead charges, such as taxes and insurance, or rent, improvements and repairs; contingent or sinking funds to cover depreciation; losses through bad debts, etc., direct charges, such as foreman's wages, wages of cupola tenders, core makers, cleaners, general roustabouts, and the molders' time cutting sand and pouring metal; and also the supplies, sand, facings, riddles, shovels crucibles, flasks, etc.

These divisions having been made and the cost ascertained, the cost of castings may be found in the following manner:

The three divisions are added together and from this sum is deducted the value of the scrap, etc., recovered in gates, spruces and pig-bed. Into this remainder is then divided the total number of pounds of good castings, and the result is the cost, per pound, of the product.

On the other hand, the first two divisions, (that is, the cupola charge and the general expenses and supplies) may be added together and the value of the scrap recovered, deducted from their sum. This remainder may be divided by the number of pounds of good castings, giving, thereby, the cost, per pound, of the metal in the castings. The cost of each individual casting is then found by multiplying its weight by the metal rate, per pound, and adding to the result the molding time of the molder spent on the casting.

Small and light castings would quite likely take the first method, while large, ponderous and heavy castings would very likely take the second.

Therefore, the rules for figuring foundry costs cannot be laid down in a hard and fast manner, a foundry's individuality and the information it desires, necessarily qualifying the method and the form of analysis.

And again, it is debatable to what exact account many items of foundry costs should be charged. General officers' salaries, for instance, may be considered a part of the selling expense. Plant depreciation may go into general expense; or, it may be deducted from net profit (the result being called actual profit). This scheme is frequently all right for a big manufacturing plant; but generally it proves quite wrong for a jobbing foundry. Depreciation may also be taken care of by a sinking fund. I might say here that depreciation is an item which many times lacks consideration and that its disregard cannot be too strongly condemned. Depreciation should be taken care of at every closing of the books. Plants will deteriorate and machinery, kept even in the best order, will become obsolete sometimes, by reason of improvements. The owner, therefore, who does not take this item into account, gives his business at one time credit for more than it is actually doing and, at another time, is unjust to it, when the loss falls in one lump. While on the part of a corporation it is manifestly unfair to ask future stockholders to assume such burdens which a portion of the former dividends should have been retained to cover.

Other overhead expenses, such as losses through bad debts, also deserve consideration and should be arranged for much in the same way as depreciation.

Under direct charges, while new flasks are quite properly charged to Plant Improvements, repairs to flasks, or flask renewals, although taken care of to a certain extent, by depreciation, ought to be charged to the metal. They are really supplies, for flasks are used up like files, some portion being taken by every casting. Again, it may be correct to charge the flask directly to the job for which it is made.

Another debatable item is core-making. As a rule, however, the cost of cores is put into general expense, for it takes a very expensive core indeed to make an appreciable showing.

It is a matter of actual molding, theoretically, the labor should be charged directly to the job, but this is frequently found impractical where the castings are comparatively small and of great variety. Dividing the castings into classes, such as light and heavy, or light, medium and heavy, and keeping track of the molding labor on each class frequently produces satisfactory results. The results from the latter scheme, though, should be checked from time to time by comparison with the cost of actual molding labor on individual castings.

This is the idea, in general, of figuring foundry costs; but, of course, any business analysis cannot end with costs. The question of profit and loss is to be considered.

The cost of the product being known, the cost of the sales is therefore known. The cost of the sales being deducted from the sales, the gross profit appears, and by deducting the selling expense from the gross profit, the net profit is shown.

There is also much to be said of the value of foundry's analysis outside of the bare knowledge of the cost of its product. The results of different formulas of cupola charges, for one thing, are read like a barometer. The labor must account for itself. The expenses tell their own tale. The coke shows how many pounds of metal each pound of it is melting. The leakages appear. Defective castings cannot be hidden. All kinds of molding comparisons are made. Patterns come in for criticism and are sent to the pattern-shop for more draught, to have corners rounded, to be shaped differently and parted in another way so as to save cores, and for all kinds of repairs and improvements. (I know of one case where a pattern was remade and the parting of it differently saved the making of ten cores).

It is not speaking too strongly to say that a foundry manager can sit at his office desk and learn from analysis what is going on even better than if he stood out in the foundry.

To sum it all up, where Foundry Costs are ascertained, "gesstimating" is changed into estimating.

LINING A CUPOLA.

Seeing that you devote considerable space to cupola notes, I thought you would like to hear the way I keep my cupola in repair. The last time the cupola was lined, which was over a year ago, the mason tried to get the boss to line it with a double row of bricks and another row faced against the casing that would give it about an eleven inch lining and 60 inches inside. He thought that way it would make it easier for me to keep it in repair, so the boss asked my opinion of it, and I said it would be too weak a lining for in a short while the inside row would be all broken by the charging and it would not be safe. The way it is lined now there is a face brick against the casing and a wall of bull heads or key bricks put in end ways which gives a good solid lining of 12 inches, but what the mason had said set me thinking, and as it began to burn at the melting zone and below the tuyers, I began to chip away enough to allow me to set bricks in. I call it facing the cupola and so I kept on doing as it got burned out higher up. My object was to see how far I could face it with safety and still give a good solid lining and a good clear drop and perfect satisfaction all through the heat.

At the present I have it faced five feet above the tuyers or seven rows of bricks. The upper four rows last for six weeks running daily melting from 10 to 30 tons. The three rows just over the tuyers have to be replaced after running two weeks and the bricks below the tuyers will last for three months, or in other words I am running the cupola at a saving to the company of 1,000 bricks every three months over what were used in the meantime to keep it built up at the melting zone, but where the saving comes is when we reline it. We will start at the top of the facing or five feet above the tuyers. What is behind the facing is a good lining of 9 inches and is good for years. In this case it is a saving of 3,000 bricks or enough to keep it faced for nearly six months, and they used to reline it that far up every three months.

I think this is what the foundrymen are looking for—something to lower the expense of the cupola and at the same time give perfect satisfaction right along. This one melts 10 tons an hour and has kept up that rate right along since last lined over a year ago, that is, whenever the heat runs to 15 tons or over, and we have run as high as 50 tons and got it down in five hours from the time the wind went on. If you think this is of any interest and wish for further particulars, I would be pleased to give them. We also have a small cupola that was made especially for testing pig iron. It is only 12 inches inside lining and stands five feet over all from the floor. We ran 100 lb. of iron out in 20 minutes from the time the wind was put on, and we took four different tests out in succession by charging after each was run out.

JOHN RICKETTS.

The C. H. Wheeler Condenser & Pump Co., Philadelphia, Pa., has succeeded the Barr Pump Co., of that city. Clifton H. Wheeler, the former president and general manager of the Wheeler Condenser & Engineering Co., of New York, is now identified solely with the C. H. Wheeler Condenser & Pump Co., of Philadelphia.

The name of the Diamond Drill & Machine Co., Birdsboro, Pa., has been changed to Birdsboro Steel Foundry & Machine Co. Since the erection of the company's steel casting plant it was decided to change the name.

The Bloomsburg Car Mfg. Co., of Bloomsburg, Pa., has been absorbed by the American Car & Foundry Co., and will henceforth be known as the Bloomsburg department of that company.

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CONTENTS.

TRADE OUTLOOK.

For a number of months there has been a race between the blast furnaces and the consumers in which the consumers have been ahead and stocks of pig iron have been constantly decreasing. The strenuous efforts on the part of the blast furnace operators, however, have at last won out, and in the past month stocks have increased. This condition and the added fact that the foundry tonnage is not increasing rapidly have tended to reduce prices for raw materials, and No. 2 Southern foundry iron may now be had at $13 at the furnace, while the same grade of Northern iron is sold at $15.50 at the furnace. This is about 50 cents a ton less than was quoted a month ago.

Few of the large melters have placed their orders for the second and third quarters yet, and all seem to feel sure that prices will not advance and may yet be lower. On the other hand, furnacemen do not look for any radical change. A number of furnaces have been blown out for relining, and this will have some effect on the amount of stock on hand at the end of the next month. Coke is now selling at $2.50 for foundry coke at the ovens in the Connellsville region. Some of the jobbing foundries thoughout the country report an increase of business, but the gray iron foundry business in general does not seem to have picked up much. The steel foundries for the most part are working at full capacity. The steel mills are all running full, but mostly on old orders.

Ship building on the Great Lakes is going on at a rapid rate and at present the American Ship Building Co. has eleven boats to build next year. This is a greater number than it has ever before had contracts for so far ahead. The railroads are continuing to place orders for new equipment and building is active throughout the country, calling for a large and increasing tonnage of structural steel. Prices of finished iron and steel are generally steady, but with some tendency to shade on the lighter finished forms.

AMERICAN FOUNDRYMEN'S ASSOCIATION CONVENTION IN NEW YORK.

Judging from the large number of letters which we have received concerning the annual convention of the American Foundrymen's Association Convention to be held in New York, June 6, 7 and 8, we feel that there is some misunderstanding among foundrymen concerning those who are welcome at this convention.

The American Foundrymen's Association was organized for the betterment of of the foundry trade, and its object has always been educational. All who are interested in the foundry trade are welcome at the meetings, including owners, foremen, or any one connected with the trade in any way who desire to co-operate for its betterment. It now looks as though there would be a very good attendance, but there is one point which Dr. Moldenke has asked us to call to the minds of all who intend to come, and that is, to remember that the special reduced rates are on the certificate plan and that when purchasing your ticket it will be necessary to secure a certificate from the ticket agent. When this certificate is countersigned in New York, it will entitle the holder to the purchase of a return ticket for one-third fare, thus making the round trip for 1⅓ fare.

The Murray Hill Hotel, Forty-first street and Fourth avenue, is to be the headquarters during the meeting and everything looks favorable for an exceedingly pleasant meeting. The number of papers to be read contain some which are exceedingly interesting. The following are the titles of the papers now in the printers' hands and it is expected that a number of others will be ready before the time of the meeting.

Dr. Moldenke wishes us to request all who are coming to come prepared to discuss any of the papers mentioned, or if they have any other points which they wish discussed, to send in the same or come prepared to bring them up.

The session on Wednesday, at Columbia University, will be an especially interesting session and several of the papers will be illustrated by stereopticon views. The excursion on Thursday to visit the foundry of the International Steam Pump Co. will also be full of interest, as this is one of the largest and best of the foundries which have been constructed recently. Every progressive foundryman in the country should be present, or at least be represented by his foreman.

One very interesting fact is that the patternmakers are taking considerable interest in their section and that there will be several papers on patternmaking subjects.

The following is a list of the papers now in the printers' hands in addition to which there are several others now in preparation.

A Simple Method of Molding a Propeller Wheel, by A. M. Loudon, Elmira, N. Y.

Notes on Some Retort Coke Melting Ratios, by C. M. Schwerin, Milwaukee, Wis.

Blowers, Piping and Cupolas at the Plant of the Michigan Stove Co., by W. J. Keep, Detroit, Mich.

Making a Molder, by H. M. Lane, Cleveland, O.

Care and Storage of Patterns, by H. M. Lane, Cleveland, O.

Melting Steel with Cast Iron, by R. P. Cunningham, Holyoke, Mass.

Things Needed in the Foundry, by David Spence, Chicago, Ill.

Needed in the Business, by Benj. J. Fuller, Allegheny, Pa.

A Successful Foundry Combination, by Arch M. Loudon, Elmira, N. Y.

Some Thoughts on Modern American Foundry Practice, by John C. Burns, Plainfield, N. J.

Practical Brass Founding, by C. Vickers, Milwaukee, Wis.

Accounting—An Influence towards Lessened Costs and Increased Efficiency, by Kenneth Falconer, Montreal, P. Q.

Cost Keeping for the Foundry, by R. W. McDowell, Uniontown, Pa.

Notes on Pipe Foundries and Suggestions on Metal Mixers for Foundry Purposes, by J. B. Nau, New York, N. Y.

The Effect of Manganese in Low Silicon Cast Iron, by H. C. Loudenbeck, Wilmerding, Pa.

A Modern Method of Venting Cores, by Jas. A. Murphy, Franklin, Pa.

The Use of Plaster of Paris in the Foundry, by Edward B. Gilmour, Peoria, Ill.

The use of Thermit in a Railroad Shop, by Jas. F. Webb, Elkhart, Ind.

Foundry and Pattern Shop Standards, by Wm. H. Parry, Brooklyn, N. Y.

Report of Committee on Standard Methods of Determining the Constituents of Cast Iron.

The Prose and Poetry of Progress, by S. H. Stupakoff, Pittsburg, Pa.

Better Conditions in the Pattern Shop—An Experiment that Succeeded, by J. L. Gard, Denver, Col.

SKELETON PATTERNS.

BY H. J. M'CASLIN.

As the building of complete pattern for large irregular castings such as nozzles, saddles, etc., is not always practical, the form of pattern commonly known as skeleton or frame pattern is resorted to. This practically consists in the construction of a skeleton or frame, the interior and exterior form and the thickness of which correspond to the required casting. The pattern work can be made more or less elaborate, according to the manner in which the molder desires to proceed in order to construct the mold, and upon the ability of this individual the evenness of the casting to a great extent depends, as the skeleton gives an outline only and a partial guide for the strikes.

Three views of one section of a cast steel nozzle weighing about 19,000 pounds are shown in Fig. 1, two of these castings being bolted together at A and subsequently riveted to the shell. While there may be several ways in which a skeleton pattern for a casting of this description may be constructed, the one under discussion has proved very satisfactory.

The completed skeleton is shown in the reverse position to that in which it is built and cast in Fig. 2. The contraction of steel castings of this description and size being uncertain, and in most cases will not contract, the usual allowance of 3-16 per foot, an allowance

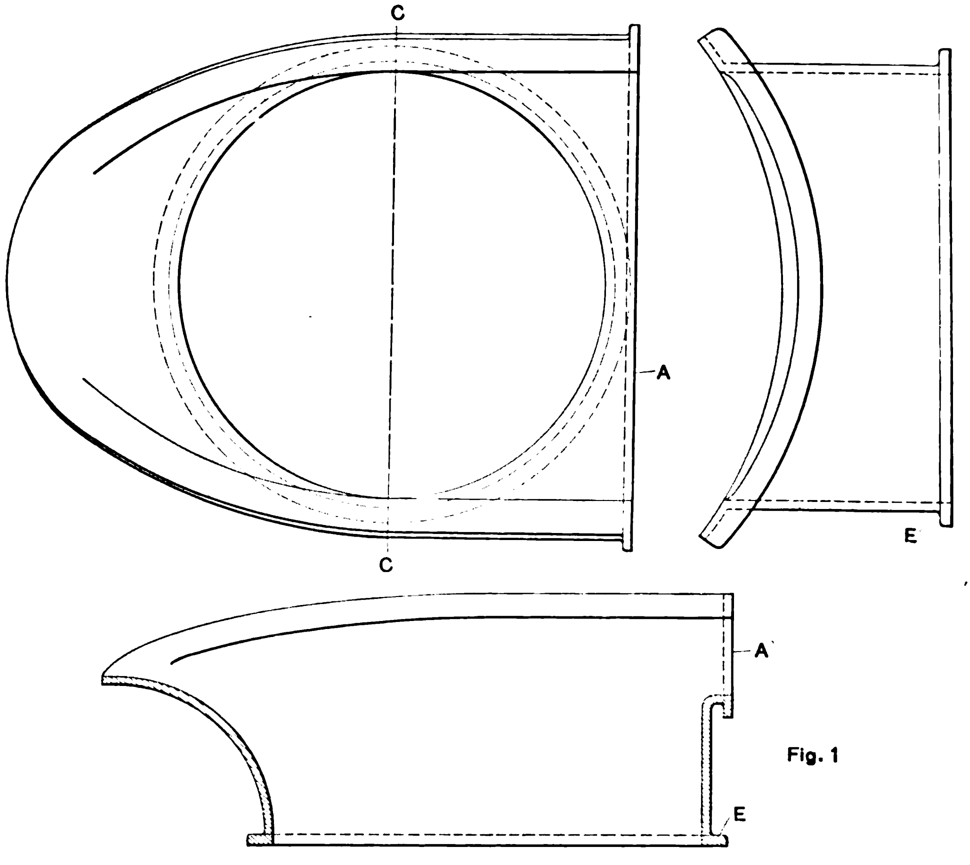


Fig. 1

of 1/8 of an inch per foot, with an extra allowance for finish for exact dimensions will generally be found sufficient.

CONSTRUCTION OF THE SKELETON.

Following the general practice of laying out the required full size sections, the building of the concave flange B is the first part of the work to be undertaken. To facilitate this operation, a form can be lagged up as shown in Fig. 3, conforming to the concave surface of the flange and upon which the flange is laid

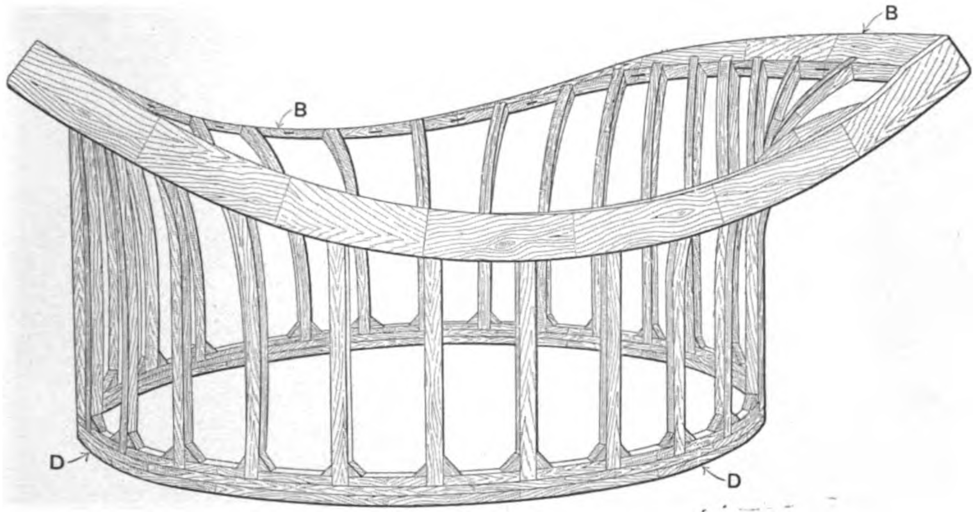


Fig. 2

out and built ¼ at a time. The segments for the flange are fitted, dressed to thickness separately and then tongued together as shown. A number of forms as shown in Fig. 4 are next gotten out and lined and leveled up on the floor, taking care to see that they are securely braced. The four quarters of the flange B are located and fitted together over these forms and secured to one another.

To facilitate the handling and storing of the pattern, if desired a joint can be made on the lines C C. Fig. 1, and the two halves screwed

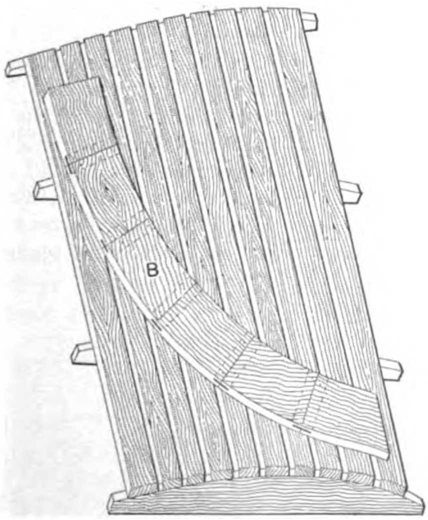


Fig. 3

together. The ring D, Fig. 2, forming a part of the skeleton and to which the ribs are secured is built up of segments turned to size and then elevated and secured with suitable supports and braces in its proper relation to flange B. It is next necessary to space off and locate the ribs. To facilitate the cutting out of the ribs, material about ⅞ of an inch thick can be used, each piece being fitted in place and gotten out as a templet and later when the templets have been dressed to form they are reinforced on both sides for strength and replaced in position as ribs. This method results in a saving, both of material and time. As the only sections shown by the draftsman are those illustrated in Fig. 1, it becomes necessary without developing the section at each rib, to work from one section to another. The templets for one-half of each end are gotten

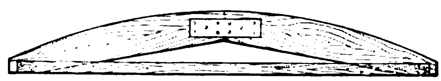


Fig. 4

out with the outer edges, sawed roughly to form. They are then placed in position and temporarily secured, with the aid of a flexible strip and the eye. The outer edge of each templet is dressed to form, working from one section to the other. The templets for the opposite half of the end are now marked from those already made and tried in place. The templets are then reinforced for the proper thickness, after which the metal thickness or interior form of the skeleton is laid off on each rib and they are dressed to the proper thickness. They are then returned to place and secured in position. It will be observed that no provision is made on the skeleton for

FIG. 6.

the flange E, Fig. 1, this flange being made up during the molding operation by using segments.

MAKING THE MOLD.

A hole is first dug in the floor to the required depth and two of the forms shown in Fig. 4 which were used for supporting the skeleton while it was being built are used for striking up a bed upon which the skeleton may rest. The forms are then removed and the skeleton set in position upon the bed. The core is then rammed up. To facilitate this operation and to prevent the sand from ramming out through the openings, boards can be set up to the openings and braced from the walls of the pit. The gates are arranged as shown in Fig. 6, and the runner prepared as the ramming progresses. After the core has been rammed up the boards surrounding it are removed and the core or body of sand dressed and slicked to the shape of the outside of the skeleton. The exact form and evenness of surface will depend to a large extent upon the molder's ability and judgment. The cope or cheek is then rammed up upon this outer surface. In order to do this, the parting is prepared, the flask placed in position and rammed up in the ordinary manner. The depression forming the upper flange E being made with the aid of a segment representing a section of the flange and at the same time a seat for the covering cores is swept off on each side of the segment.

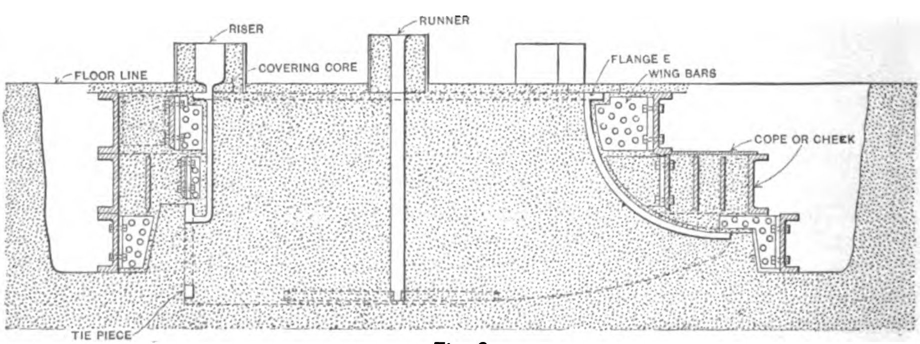


Fig. 6

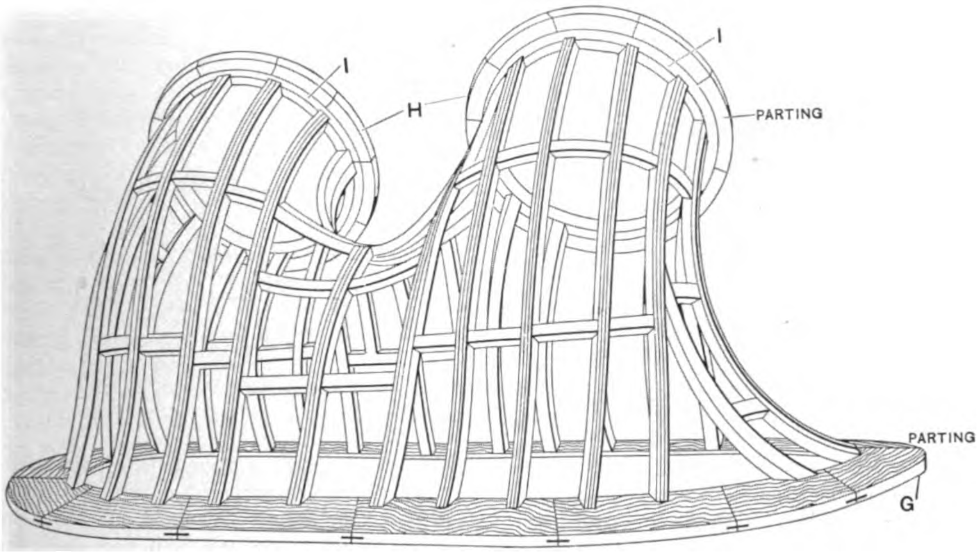


Fig. 10

The cope or cheek is now lifted off, blocked up and finished in the usual manner.

The sand between the ribs of the skeleton which represents the metal thickness of the casting is now removed from the core and the skeleton lifted off. The accompanying half tone, Fig. 5, shows a view of the mold at this stage. The core is now dressed to form, after which it is dried. The various parts of the mold are next assembled, the cope or cheek lowered into place, the covering cores to form the upper face of the flange E set, and risers prepared, and the space between the walls of the pit and the flask firmly rammed with sand. The mold is then weighted down ready for pouring. A cross section of the complete mold is shown in Fig. 6.

A DOUBLE NOZZLE PATTERN.

Three views of a steel casting for a double nozzle are shown in Figs. 7, 8 and 9. This differs considerably from the one already shown and brings out some different principles in molding A plan of the nozzle is shown in Fig. 7. A section on the line A-A, Fig. 7, is shown in Fig. 8, and a section on the line B-B in Figs. 7 and 8 in Fig. 9. The pattern is parted upon the line B-B. A view of the completed pattern in the position in which it is built is shown in Fig. 10.

In building the pattern the required sections are first laid out full size. The building of this skeleton is similar to the mold already described. The lower flange G is gotten out and built up over a form. The two upper flanges H-H are built up and turned with the lower half left loose, so that these two half flanges may be drawn separately. The rings I are secured by supports and braces in their proper relationship to the flange G, after which the ribbing of the skeleton is proceeded with. To assist in getting out the ribs forming the parting of the skeleton, a form may be lagged up corresponding to the parting, the outline of the rib laid out upon this convex surface and the rib built up in segments. After one rib has been built in this way, the one on the opposite side of the parting may be made to

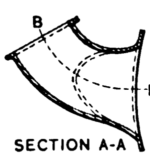


Fig. 8

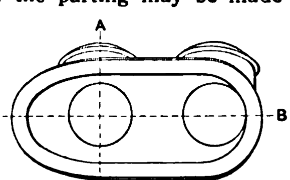


Fig. 7

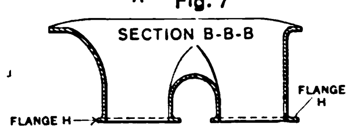


Fig. 9

fit it. The location and building of the other ribs is similar to that already described.

MAKING THE MOLD.

The molding of this skeleton differs from the one previously described in as much as it is cast upon its side, and with the aid of a core

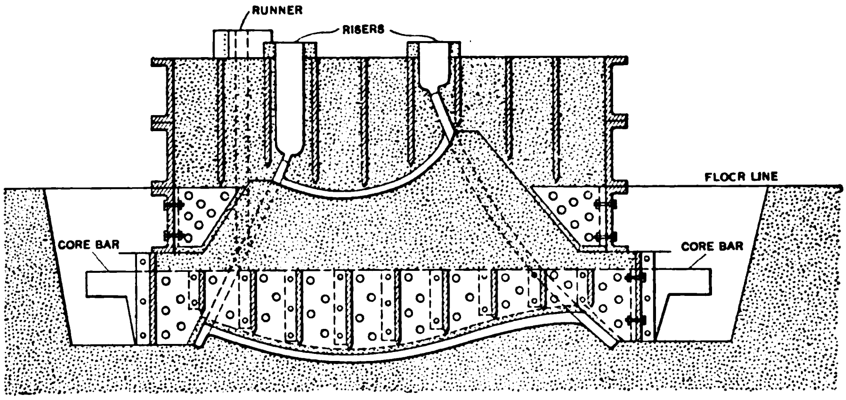


Fig. 11

bar the core or inside is lifted out. This necessitates the preparation of a seat for locating and supporting the core when it is returned to the mold. A hole is first dug to the required depth and the drag half of the pattern is bedded in to the thickness of the ribs. The inside is then slicked and dressed to form and the seat for the core prepared as shown in the cross section of the mold, Fig. 11. The core bar is next placed in position and the drag half of the core rammed up. The parting outside of the skeleton is prepared and the cope half of the skeleton placed in position, after which the ramming of the interior is proceeded with. Owing to the angle on which the flanges are set, the faces of the flanges from the parting line down are formed by the core as shown in the cross section of the mold in Fig. 11. In other words, as far as this portion of the flange is concerned, the core forms an intermediate part for the mold. When the core is left out, the lower portion of the flanges are exposed and left free to be drawn. When the ramming of the upper half of the core for the interior of the skeleton is completed, this portion of the skeleton is lifted off and the core slicked and dressed and paper applied, after which the skeleton is returned and the openings between the skeleton filled with sand and slicked off so that it will form a body upon which the cope is rammed in the usual manner. When the cope is completed, it is lifted off, together with the cope half of the skeleton. The cope is then blocked up, the sand between the ribs removed and the half of the skeleton pattern drawn. With the aid of the core bar, the core is then lifted out, blocked out, and the sand between the ribs of the lower or drag half of the skeleton removed and the skeleton lifted out. The drag portion of the mold is then finished, the runner and risers are prepared during the ramming up of the mold. The mold and the core are then dried, assembled, and prepared for pouring in the usual manner.

LABOR SAVING IN STOVE MANUFACTURE.

BY JOHN MAGEE, BOSTON.

It is remarkable how few appliances the stove industry has that are primarily labor-saving and that are new enough to be of interest. A little thought naturally separates our subject into two divisions: (1) Labor-saving machinery and tools, and (2) Labor-saving shop methods. We are largely limited in the stove business by the fact that it is nearly impossible to devise automatic machinery which will prove profitable, due to the fact that there are few articles of manufacture which require so many distinct and different operations as does the ordinary cooking range. The performance of any one operation averages a limited number of times in any one day; and no automatic machine can be made to pay unless it can be kept reasonably busy, so that the interest, depreciation and other charges of the costly machinery will not eat up the profit. In some few cases it has been possible to construct machines that will perform several operations on one piece, or the same kind of operation on several pieces of varying character, as in the automatic polishing machine. But such examples are rare and most of the profit-makers in the labor end of a stove factory are trivial in themselves; it is the total of many such that counts.

Beginning at the foundation of all our profit.

*From a paper read before the National Association of Stove Manufacturers at Chicago, May 10, 1905.

and incidentally much of our trouble—the foundry—we find the molding machine gives greatest promise, although not in any way entirely satisfactory as yet. To get best results it should be installed with automatic sand tempering and riddling machinery, conveyors to deliver and remove the sand, and with methods of doing all lifting and handling by power. Each of these individual problems has been fully worked out for classes of work other than stove plate, but as yet unconsolidated into a complete system to produce high grade castings. Some genius also has a large field before him in the production of a machine which will print-back faced work and obtain as good results as by hand.

From the molding machine we pass naturally to a consideration of the flask question, and it is astonishing how little thought this important detail seems to have received. Iron flasks are decided labor savers and in many cases can be used with economy of handling far surpassing that of a wooden flask. The carpenter shop also will feel the pressure of repairing less. Snap flask work is hardly known in some shops, particularly in the East, and very few firms understand the labor that might be saved by their molders, as well as flask makers and yard men. In larger sizes, with detachable bars, which are either left behind when the flask is removed or withdrawn from the mold just before, labor-saving results may be obtained, particularly when used in connection with match plates of large size. Whether it be wood or iron flasks that are used, the yard men can gain time if every mold board is marked with the size of flask and clamps required, flasks and clamps themselves being marked to correspond.

Every modern shop should have either a track or a trolley, and if possible should have both, the trolley being best for delivering melted iron to the floors if so desired and the track surpassing for other purposes. If a track is to be installed it should, of course, connect with both yard and charging platform.

For handling material on and off the cars, as well as for use in other places, general favor now seems to be given to the pneumatic hoist of motor block type in connection with proper traveling cranes, although electric hoists may also be used. This class of equipment is well known to all and hardly requires mention, yet, many of those foundries which, in addition to their stove work, make furnace and boiler castings, are wofully out of date in economy of handling bulky and weighty material. A rubber pipe connected to the compressed air system is taking the place of the time-honored bellows and in some places a pneumatic vibrator attached to the molding benches will save rapping the patterns and consequently decrease the labor of repairing breaks in the iron pattern shop. Water pipes to the molders' floor is a labor-saving device that costs little for the return it gives.

The core department of a stove foundry is generally of no great size, but is worthy of attention, as some of our factories are now including boiler work as a side issue. An automatic mixing machine has been found to give uniform results in this department and for fitting cores cast iron files cut quicker as well as cost less than steel ones. The ovens themselves are important. Design should be carefully considered and oil used for heating on account of the slight attendance required, particularly when thermostatic controlling is used.

The mounting shop has little new to offer that is of particular note; but there is a growing tendency to install what little machinery there is that can be used to advantage, and it is common now to see some kind of a conveying system for handling ranges from mounter to fitter and so on until finally landed in the storehouse. Work of this department is being facilitated by a profusion of emery wheels, drilling lathes, etc.; in fact, in some shops each man is given a complete equipment instead of using some machines in common with his neighbors.

Drilling being one of the larger mounting expenses, several plans have been tried to save labor in that direction, the use of tins to cast holes being well known. Some progressive firms are drilling with the aid of a complicated set of jigs and templates for which much is claimed.

Water fronts are almost the only pieces of stove casting upon which automatic machine labor can be satisfactorily expended, and it is now possible to procure a multiple drill which will work on eight water fronts at one time.

A few years ago the automatic polishing machine came into prominence and since then it has made considerable saving for those who use it, although producing work of doubtful quality, except in cases where the castings are especially designed to facilitate the operation. In this department polishing belts are superseding the old type of wheel for certain work and when wheels are used those composed of compressed cotton buffs cut rapidly and give wonderful results when used with some of the newer abrasives. On some classes of polished work hand labor on small castings has been almost entirely eliminated by the water polishing barrel.

In the nickel room a saving of labor may be made by placing the work on wire trays or baskets to be washed or otherwise treated. The basket hangs by an air hoist from a trolley and is lowered into the successive tanks.

In the cleaning room air hammers and pneumatic drills fitted to operate emery wheels and cleaning brushes are used in removing fins, gates and burnt sand from furnace and other castings of large size,

There is very little machinery of construction novel enough to warrant mention in our pattern shops, but a type of lathe with reversible head to admit the swinging of large work away from the lathe bed is of value; and the benches should be equipped with steam heated glue pot and with gas lamps for melting wax—trivial features and not new, yet generally lacking. In the iron pattern shop a large blow torch driven by gas and compressed air is essential for straightening warped patterns, brazing, etc., and in this department one up-to-date concern has attached a file to the reciprocating part of a pneumatic hammer and is using it for filing.

Our shipping department sees great possibilities in the automobile as a labor-saving device in the place of unsatisfactory horse equipment, as the work of handling goods on and off trucks can be done by the same force that moves the machine, but as yet the large first cost has deterred almost everyone from adopting it until well out of the experimental stage.

Taking the second division of our topic, we find the greatest field for saving of labor to be in our shop methods, and foremost in the field is the use of an office system by which all accounts can be handled by a card catalogue reaching every corner of the works for all possible desirable information. The time clock is important as the clock cards themselves can constitute the pay roll when properly filled out. A billing machine should be used to make out shipping orders and can be adapted to make as many copies, either wholly or in part, as may be required. If so desired it will also make charge slips, car labels, railroad receipts, customer's bill, addressed envelope and such records as may be required for the office books, with one operation.

Our system must also contain provision for a record of every tool in the factory and in whose possession. This, in connection with suitable charges to workmen for tools lost, will soon save its cost in labor alone, as each man can be counted on to have his tools in their proper places where they can be found when wanted. Every pattern should also be catalogued, with size of flask, place that flask can be found and all other desirable information. All raw material in the stock room should be followed up by means of cards containing full information in regard to each article carried, so that it can be instantly located, and no goods should leave the room without an order suitably signed by both workman and his foreman. Much could be written in detail of the card system alone, as applied to a stove foundry, but only the salient points can be touched upon here on account of lack of time.

Proper design of goods before leaving the drafting board will often save time for all of the direct manufacturing departments and although thought is spent on ornamental design, etc., practicability of manufacture is sometimes overlooked. The draftsman can economize for the pattern makers and prevent mistakes by making a working drawing of each piece separately, although this is not generally done. Detachable nickel and similar devices, when properly designed on the drafting board, can save labor in the polishing, nickeling, mounting and packing departments.

Racks for castings should be carefully considered and should be placed in the center of the building, or where the light is poorest, instead of around the walls near the windows, and in similar places of value for the most economical application of labor.

Light is essential if labor is to be applied to best advantage and may be secured by as many windows as possible, rising from floor to ceiling with upper sashes of prism glass which must be kept clean. Proper ventilation and heating should be thought of, as labor always works to poor advantage in a vitiated atmosphere or improper temperature.

The location of all raw material should also be studied with a view to storing it near its place of use.

Systematic inspection of the plant once each month will discover defects in the building, machinery, etc., which can then be repaired with less labor than at a later date. In this connection it should be remembered that "stitch in time saves nine" and proper care of buildings at the proper time will soon pay for the labor incident to the maintenance of a separate department of repairs. Certainly not the least important of shop methods is the necessity of co-operation among all heads of departments. As much waste of labor can be caused by two departments pulling in different directions, harmony should be secured at any cost. We all know, too, how important is the arrangement of departments with reference to one another for economy in handling goods, and how, in making changes, consisting of new buildings, etc., immediate wants are often short-sightedly consulted rather than the requirements of the future.

Lastly it should always be borne in mind that in these days of sharp competition the greatest saver of all, in labor, as in all other details of trade, is system.

MAKE YOUR PLANT A SUCCESS.

BY DR. EDWARD KIRK.

But few managers of manufacturing plants seem to have the proper ideas or take the proper course in the management of such plants. They fail to realize that they have it fully in their power to elevate the moral standard of their workmen, and by so doing completely overcome many of the annoyances and losses they are continually subjected to.

Such as men failing to report for work, drunkenness among their employes, poor mechanics, strikes, etc., and by so doing assure the success of their plants.

They do not take advantage of the resources at their command to overcome these objectionable features in manufacturing plants, but take things as they find them. Wage a continual warfare for the existence of the plant, and after years of struggling find themselves but little better off than when they began, which is due in many cases to the drinking habit of their workmen, strikes, etc., and the continuous warfare waged between employer and employe, and the lack of interest in the success of the plant by the latter.

This should not and would not be the case if the management of every manufacturing plant made it their aim to improve the morals of their workmen, by giving employment only to sober, industrious workmen, whose aim it was to own their own homes and raise their families in a respectable manner.

Such men have an interest in the success of the plant, for if it fails their employment is gone and the value of their property is depreciated by the loss of its business to the town, and they would do everything in their power to prevent strikes and losses to the plant.

A few such men among a shop full of men who have no interest in the success of the plant or town and are ready at any moment to pack their trunk or move their families, are helpless to effect these results, but let the shop be filled with them and the success of the plant is assured, so far as the workmen are concerned.

It should be the aim of every manufacturing plant to elevate the moral standard of their workmen, be they mechanics or laborers. This may be done by paying fair wages for amount of work done, and treating all workmen fairly. By doing so the plant is given a good name among workmen. Desirable workmen are attracted to it when seeking employment, and a better class of workmen may be obtained.

Men who frequent saloons after working hours, or drink to excess after pay day, should be quietly called into the private office and informed that if they do not stop this their services will be no longer required. If this does not reform them discharge them at once. If they stop these habits for a short time and then fall back into them again give them another talking to and another chance. If this does not prove effective discharge them at once, and let it be understood that when you talk to a man in this way, you mean what you say. But do not make the mistake of trying to reform him and others at the same time, by giving him a temperance lecture before his fellow workmen, for this humiliates him, rouses the spirit of get-even, and only makes him and others worse. Do not try to enforce prohibition, for the workman who only takes an occasional drink, is not objectionable. It is the man who frequents saloons, and induces others to drink, that demoralizes the working force of plants, by creating or spreading the drinking habit among them. Such men should be ferreted out and promptly reformed or discharged, for such men may in a short time induce the greater part of his fellow workmen to frequent saloons during or after working hours.

Do not have rules in reference to the drinking habit printed and hung up in or about the shop, for such habits should not be permitted among workmen of a shop and require no rules.

Men who are constantly talking to other workmen and finding fault with working hours, tools, wages, foreman, management of the shop, etc., are mischief makers among workmen, and should be promptly discharged and quietly informed what they were discharged for. If this is done they will not be discharged from many plants before they learn to mind their own business and may become desirable workmen.

The selection of apprentice boys is the most important point of all to be looked after, for from the apprentice boys come the mechanics of the future. If the apprentice boy belongs to a drinking family in which the filling of the beer kettle during the day or after working hours is considered one of the necessities of life, he, of course, contracts the drinking habit from his infancy, and cannot be made to see any harm in it, and when he becomes a mechanic with money of his own frequents saloons and induces other young men of the shop to do the same, and when he marries, brings up the family in the same way. His sons may learn the father's trade with the same habits and in this way the drinking habit is perpetuated among mechanics.

If the boy is one of the bad boys or toughs of the town he may settle down during his apprenticeship and reform, but the chances are that he will find kindred spirits among the men of the shop for the management that would accept such a boy as an apprentice must have a poor opinion of the mechanics in the trade he is to learn, and may have a shop full of such men, and the chances are that he will retain his boyhood characteristics until late in life or even through life. In which case he is neither a desirable apprentice or mechanic, for he is sure to impart these characteristics to other workmen and make trouble for both employer and workmen.

Besides these objections the employment of such boys as apprentices has a demoralizing effect upon the boys of the town, who are led to believe that no matter how bad or tough they are, when they get old enough they can become an apprentice at the manufacturing plant, learn a trade and earn good wages when men. And in some cases the inducement to become an apprentice is a desire of a boy to join the gang of toughs that are employed at the manufacturing plant.

When a boy applies for an apprenticeship his family and history as a boy should be looked up. He should be required to belong to a good family, the father of which is a temperate, industrious man, and a good citizen. The boy should be required to be a graduate of a high school and to be known in the town as a good boy. If these requisites are found to be satisfactory he should be put to work for a few weeks or months doing general work about the shop and if found satisfactory at this work made an apprentice.

The managers of many manufacturing plants will no doubt say that these rules are all right, but that they cannot be carried out in their town for the good boys and the graduates of high schools are all brought up to be clerks, bookkeepers, etc., and to think it a disgrace to be a mechanic and only the rougher element of boys apply for the apprenticeship, or want to be mechanics.

There is no doubt some truth in this assertion, but whose fault is it that they have been brought up in this way? No one's but the management of these plants, for by employing workmen that frequent saloons every night and after every pay day are seen drunk and boisterous on the streets, perhaps for days, have permitted the impression to be made on every sober and industrious father and mother in the town that to make their son an apprentice at the manufacturing plant was to consign him to a drunkard's grave. How different this would be if only sober, industrious men were employed in manufacturing plants, whose aim it was to work steady, own their own homes and place themselves and families among the leading families of the town. The sons of the workmen would then, not only be desirable apprentices, which in many cases they are not at the present time, but the sons of the best families of the town would be taught that it is more profitable to become a mechanic than a clerk or bookkeeper, and the management of the manufacturing plant would have at their command the pick of the boys of the town for their apprentices, and could select only the brighter and more likely boys to become expert mechanics. Let these rules be adopted by every manufacturing plant in the country and the drinking mechanics will rapidly disappear, and in 20 years from now, when the apprentices taken under this rule have become the mechanics, there will not be a drinking one among them.

This system of managing working men and apprentices is no idle theory, for it has been tried in numerous plants and found to work well, for some 10 years ago when visiting some foundry plants, foundrymen frequently complained to me that they could not get sober, industrious molders, and seldom run a full heat owing to their molders having been drinking at night and unfit for work the next day, and after pay day they were generally compelled to close down for one or two days. I outlined the foregoing system to them and it was at once adopted by a number of them. I had occasion to visit one of these foundries a few weeks ago in which were collected at that time as drunken a lot of molders as were probably ever collected in a foundry. The majority of them only worked when out of money and credit to get drink. The foundry was idle about half the time, a full heat was seldom run, the firm was on the verge of bankruptcy and ready to try anything that promised an improvement to their condition and at once adopted this system. They first discharged every molder and closed up the foundry. They then advertised at distant points for molders, when a sufficient number was secured, the foundry was put in operation with an entire new force of molders. Each one of which was quietly given to understand that the frequenting of saloons and drinking habit would not be tolerated.

The old molders who had families and remained in the town after being discharged were taken back after they had been idle a sufficient length of time to see the folly of what they had been doing. From that time on the foundry was a success and today is the leading industry of the town. The manager informed me that they had not had a strike or any trouble with their men since the system was adopted, although they had a union and the shop was run under strictly union rules, which he had not found to be objectionable, and, in fact, preferred to settle any dispute that arose with the shop committee to settling it with individual workmen.

They did not have a drinking molder in the foundry, many of whom were the leading men of the town and not only owned their own homes but other property besides.

Now, if this system was a success in that plant, as it certainly proved to be, it can be made a success in any plant; for ten years ago they certainly had the worst lot of molders I ever saw in a foundry. To make this system a success a limited amount of detective work should be done outside the plant and this should always be done by a man not employed in or about the plant, and only when a man fails to report for work or is found incompetent to do his work, from drinking, or is surely known to be leading others in the shop to drink and injuring the reputation of the plant, by frequenting saloons, should he be talked to or discharged for the drinking habit.

PRODUCING SOUND CASTINGS.

Under the above heading, I have read the very interesting article in the March issue of *The Foundry*, and consider what is said about the careful selection of the molding sands and the manner in which different molds should be dried, good practice, but in the third paragraph the writer states as follows: "Pouring the castings with dull iron is apt to give sounder castings than with very hot metal, as the latter keeps in disengaged gases which may be held under the skin."

My experience teaches me that to produce a sound casting it must be poured hot, and the hotter the better. I hardly see any benefit in holding the gases spoken of under the skin of the casting, unless one was making brakeshoes or sash weights, as in producing machinery castings the gas bubble, as I suppose we may term it, if there is such a thing in good iron, would be very likely brought to light, and the only way to satisfy consumers of castings is to strive to eliminate these defects instead of covering them up.

Dull iron will produce a dirty casting in a clean mold, while hot iron will always make a clean casting in a clean mold.

With reference to the fourth paragraph of this article, where the writer states, pouring from the bottom with whirl gates gives cleaner iron than top pouring, a fact readily seen in roll making. For the benefit of those not familiar with foundry practice, I wish to state that pouring from the bottom is not always productive of good results, while in the case of a roll it is undoubtedly the best method; but let us consider the questions of the cylinder bushings, laundry rolls and other cylindrical castings.

It has been proven that the best results have been obtained by gating these molds on the top in preference to the bottom. With reference to the cutting action of the stream being severe when pouring from the bottom, will say that the wear on the mold is greater when gated at the bottom than when gated at the top.

The fifth paragraph informs us that when we must have at least 2 percent of silicon and as little manganese as possible in our metal. I will agree to the 2 percent silicon but see no objection to the manganese, in fact, to produce iron with good wearing qualities I would prefer a pig iron ranging 1 to 2 percent manganese in a mixture with at least 60 percent machinery scrap regardless of silicon. While this mixture would not produce the softest castings, it would produce castings that could be machined easily and would wear well. In using a high manganese iron it is possible to carry more steel in the mixture without being troubled with shrinkage cracks.

The writers object in criticising this article is simply to create more discussion on the subject which may be instructive to other readers as well as himself.

The gist of the article in question is contrary to facts that have been demonstrated in my daily experience in the foundry and if I am on the wrong track I want to know it.

P. R. RAMP.

MOLDING MACHINE PRACTICE.*

BY F. W. HALL.

This month I will show a machine casting mounted on two different types of molding machines, viz., a hand draft split pattern machine and a drop pattern machine. The casting under consideration is not a difficult piece to make or to fit up for one skilled in the art, but there are a number of points on it which to many will probably be rather puzzling. It will be noticed that the parting line drops and rises

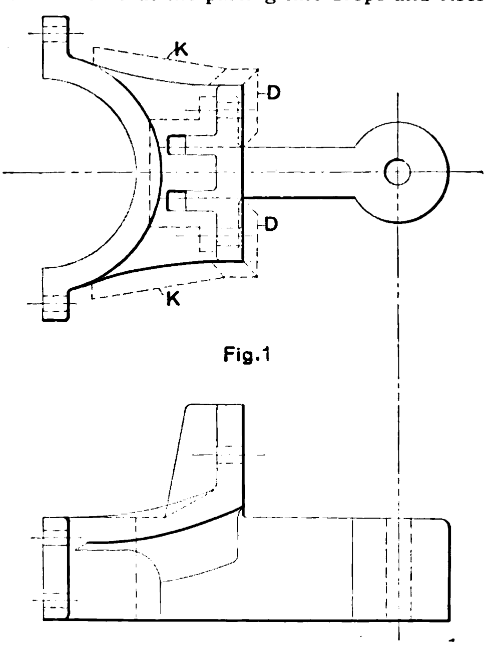


Fig.1

below or above the general parting line of the pattern in places, and this of course adds complications to fitting up the machine.

When a machinist undertakes to mount a pattern he sees at once how to do the machining of the stools, strippers, etc., but the making of a perfect match between the cope and drag in the case of an irregular parting will require some special work. On the other hand, a molder would find less difficulty in this point, but would be lost when he came to do the necessary machine work, hence some knowledge of both arts is necessary in fitting up a molding machine. Of course there are other methods by which this pattern could be mounted and give good results, but the two methods shown serve to illustrate the fitting up of each class of machine. Frequently, after a skilled man has fitted up the job he will see some better method by which it might have been done, and it is only by practice in this line that the greatest amount of skill can be attained.

The mere drawing of a pattern through the stripper out of the sand does not always signify that the mold is all right, for you may find it impossible to remove the sand from the machine, especially when there is a large green sand core formed in the interior of the pattern. The weight of this core will sometimes be so great that the sand will stay on the strippers when the flask is lifted off. In such cases as this it becomes necessary to use nails or a crab for supporting the green sand core and binding it to the other parts so that it will lift properly.

In the ordinary method of molding such a piece on the floor without a machine the large green sand core will be placed in the drag, where it would remain all right, but in all classes of molding machines except the roll over type, it is necessary to cope off both pieces, and one of them is then turned over for the drag.

In mounting this casting upon a split pattern machine, it would of course first be necessary to determine the parting line and then split the pattern on that line.

The pattern shown in Fig. 1 may be mounted on a machine, as shown in Figs. 2 and 3. The drag portion of the mold is shown in Fig. 2, the section being taken through the pattern.

It will be noticed that about the center of the pattern there is a projection which extends below the general parting line as shown at A-1 and also at the point T, there is a place

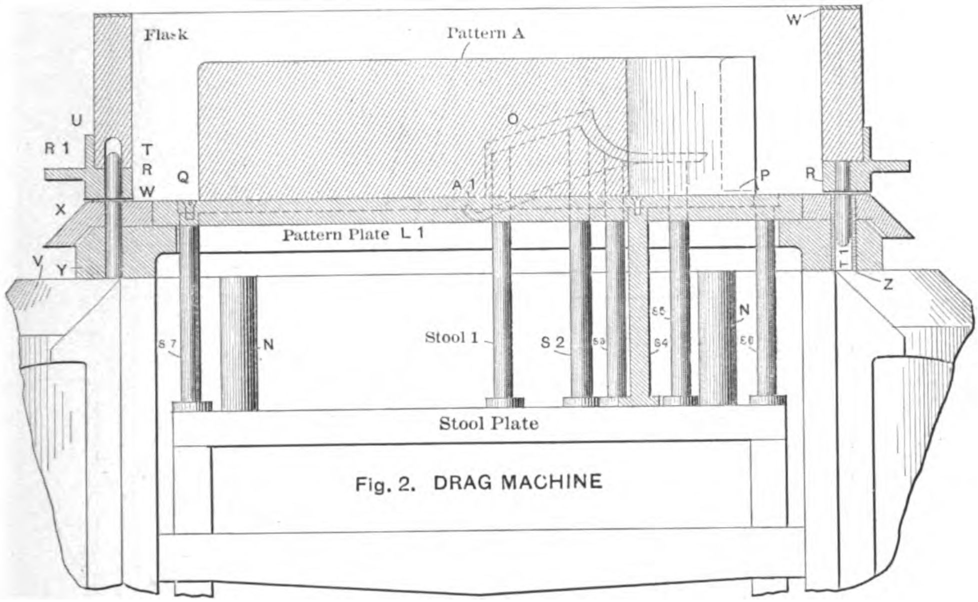


Fig. 2. DRAG MACHINE

where the parting line rises above the general surface of the plate Q.

A forming block must be made of the same size and shape as the cavity at A-1, which corresponds to the projection at C, Fig. 3. A stripper must also be made of the form shown at D, Fig. 3. This stripper fits up against the face of the pattern at C so as to bring the parting line to the proper point above the pattern plate L. The location of pattern D, Fig. 3. should be determined by laying out the center lines upon the plate L, placing the pattern in its proper relationship to these, and securing it to the plate by means of screws, the pattern being made of iron. The outline of the pattern V should be scribed on the plate L, the pattern removed and the strippers about the portion B carefully laid out, one of these being shown at K. The general outline of the strippers K and D are shown by dotted lines about the pattern in Fig. 1. The place for the strippers in the plate L must be cut down to a depth of ¼ inch. This can be done very advantageously upon a vertical milling machine. The stripper K is made out of sheet brass shaped to fit the cavity which it is to fill. On the upper surface of the stripper K the piece D is secured. First, however, it will be necessary to secure the stool S-8 in place. It will be noticed that the strippers are carried upon the stools S-8, S-9, S-10 and S-11. These stools are made from pieces of 1-inch cold rolled shafting turned down so that the bodies are ½ inch in diameter. They should all be of the same length. The deep pocket C, Fig. 3, can be cast in the plate, as can also the pocket A-1, Fig. 2. After the plate L is finished all over, the pattern A, Fig. 2, can be carefully located in the center of its plate. As this pattern extends a long way into the drag, it would be well to arrange stripping plates along all of the straight surfaces, as shown at Q.

The inside of the large end would also be provided with a stripper which would follow from the inside around both ends until it runs into the pocket A-1. Stripper D, Fig. 3 is the most difficult one to form, as its upper surface must also act as part of the pattern. This stripper is made about ⅝ of an inch wide, ¼ of an inch thick, and the end that comes in contact with the edge of the pattern must conform to the exact outline of the pattern. After the stripper D is in place the recess A-L in Fig. 2 is cut about ¼ inch deeper than the form D, Fig. 3, would require. The recess for the stripper Q is also cut by the milling machine. In fact, stools must be provided for these strippers to hold them rigidly when the work is resting upon them. The part P, Fig. 2, must also be built up and secured to the stripper plates, as shown in Fig. 2. The patterns are then removed from the plates and a hole at least ¼ inch in diameter drilled through the plate L-1 opposite the bottom of the hole A-1. Several small holes must also be drilled in the bottom of the hole A-1 and nails driven into them so that their heads

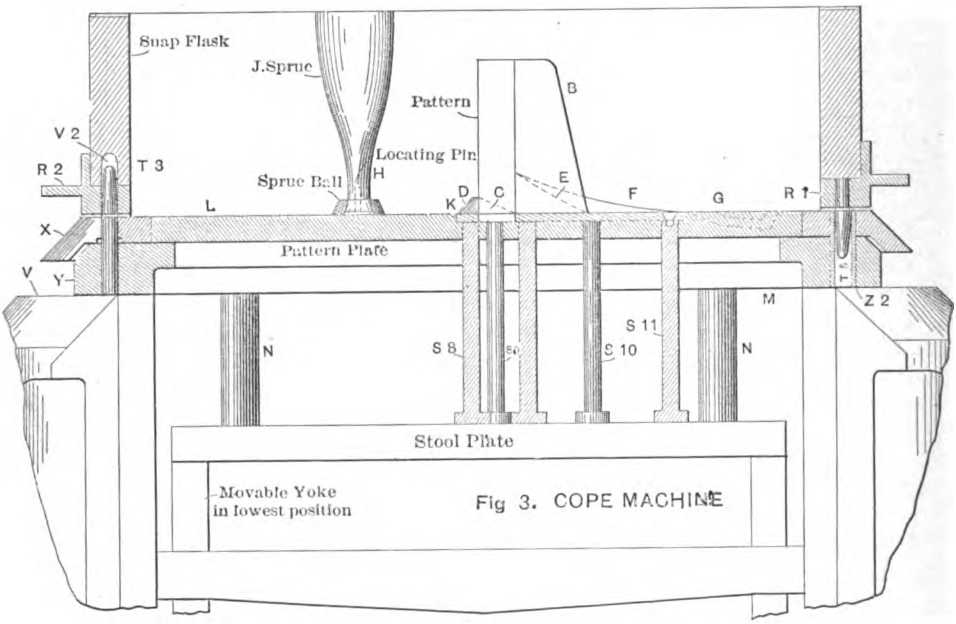


Fig 3. COPE MACHINE

project a little less than 1/8 of an inch. Care must be taken to see that when the two plates are placed together none of the nails touch the blocks C and D on the plate L, Fig. 3. The two plates are then placed together face to face, clamped in position and some Babbitt metal run in through a 1/4 inch hole opposite A-1, in plate L-1 in Fig. 3. When cold, the plates are separated, when it will be found that the Babbitt forms a perfect match from the projections C and D in Fig. 3. In like manner the opening at G, Fig. 3, is babbitted to fit the projection P, Fig. 2.

Now, as both the cope and the drag patterns have been completed, it is necessary to make the gate and the sprue as shown in Fig. 3, which completes the mounting of the piece upon a split pattern machine.

To mount this piece upon a drop pattern machine, the drag section of the pattern must be split on the same parting line decided upon for the previous method. The general arrangement of mounting for this style of machine is shown in Fig. 4. The pattern is to drop down through the plate M-5. For this reason it is necessary to add extra material on the lower face of the pattern to build up the space between the plate L-2 and the upper surface of the plate M-5. For a short distance, usually about 1/4 inch below the surface of the plate M-5, the pattern is made full size, but below this point it is reduced or cut back 1/8 of an inch all around, so as to reduce the amount of surface to be removed by filing. When the wood patternmaker is fitting up the drag pattern A-3, Fig. 4, he should cut the groove A-1 in the pattern for the stool strippers, provided it is decided to use these.

These strippers are used when it is desired to make absolutely certain of the strippings of this portion of the pattern. In many cases, however, these portions of the pattern are simply given ample draft and the sand lifted without the aid of strippers.

The patternmaker should also cut the pocket A-2 for babbitting purposes. The plate M-5 is made rather heavy with the rim 1 1/4 inches thick about the outside and beveled as shown. The center of the plate is 1/2 inch thick and at the stripping edge it is cut back 1/8 of an inch to within 1/4 of an inch of the upper surface. The points corresponding to A-2 and P-1 in the plates for this method are babbitted as in the case already described.

It will also be necessary to make the plate L-2 for supporting the pattern A-3. This is called the pattern plate and is about one inch thick upon the outside edge and 1/2 inch thick in the center. Directly beneath the surface of the pattern a pad 1/8 of an inch high is cast for supporting the pattern. Of course, the necessary finish must be allowed on the wooden patterns to provide for finishing all surfaces, which require machining. If stools are to be

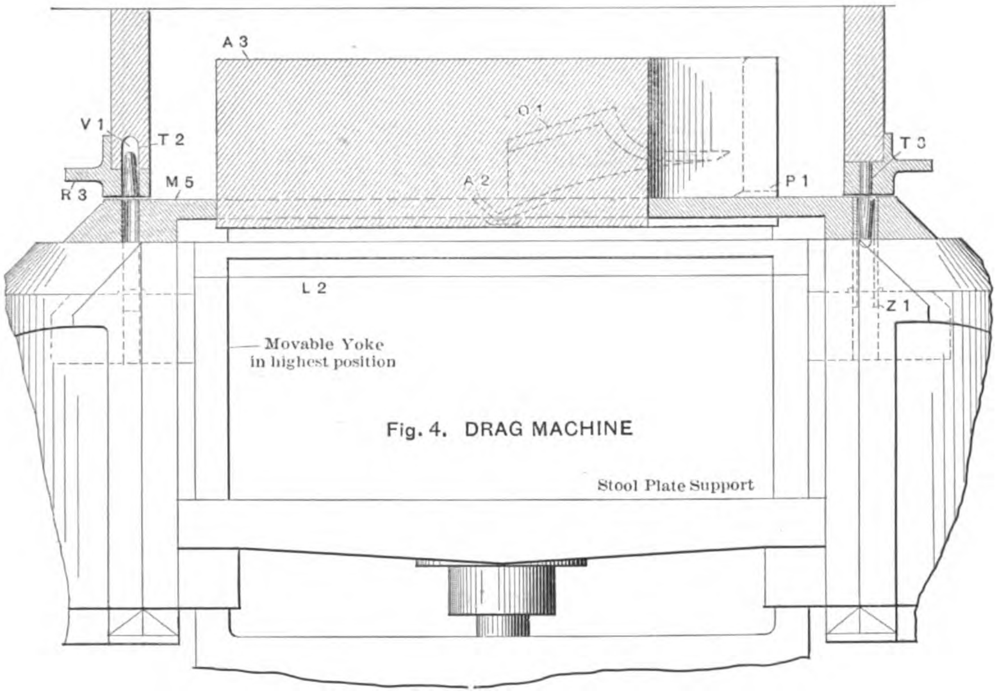


Fig. 4. DRAG MACHINE

used for the part O-1, Fig. 4, it will be necessary to make a pattern and from it a casting for the required stool plate.

After the castings are received from the foundry, they are machined to the proper thickness and then center lines laid out on the plate M-5. From these lines the pattern A-3 is located. The flask pins and bushings are also located as shown in Fig. 4. It is also necessary to drill the screw holes for clamping the plate M-5 to the drop of the molding machine. The pattern A-3 is secured to the plate M-5, and after the base of the pattern A-3 has been machined to shape it is laid on the plate M-5 true with the center lines and its outline scribed. The edges of the opening in M-5 are then filed or milled to the proper form.

If stools are to be used for stooling at the portion A-1, they are made as described in connection with the other style of machine. The babbitting for points A-2 and P-1 is also done in the manner already described. The plate M-5 is secured to the machine and the plate L-2 secured in position and located by dowel pins. The pattern is slipped through the plate M-5 on to the plate L-2, its location marked out and it is then secured to the plate L-2 by screws, three being usually sufficient. Care should also be taken to see that the flask pin holes are in line with the holes in the lugs on the movable yoke of the machine. The pins and bushings P-2 and Z-1, Fig. 4, are fitted into place as shown in Fig. 3. The short pin D-3 is placed on one side as shown in Fig. 3. This method of placing flask pins allows them to be stripped as the pattern is. The advantage of this will readily be appreciated by any one who has had experience in molding machine operations. The cope plate and pattern are equipped in a manner similar to the drag pattern.

The flask for this job can be made either of wood or iron, and the same flask will work on either type of machine. The flask pin fittings are special fittings made for the molding machine, the general style being shown in the sectional views, Figs. 2 and 4. The projection R-1 serves as a lifting handle for the flask.

The difference between the split pattern and the drop pattern machines is that in the split pattern machines three special plates L-1, X and Y, Fig. 2, and four posts N for connecting the stool plate with the plate X are required. When using the split pattern machine it is lowered four inches or more according to the draft of the machine. When stripping the pattern from the sand, the crank at the side of the machine is pulled over toward the front, causing the stool plate to rise, carrying the plate X with it, which strips the pins and leaves the flask as shown in Fig. 5. The stools 1, 2, 3 and 5 rise up through the pattern A,

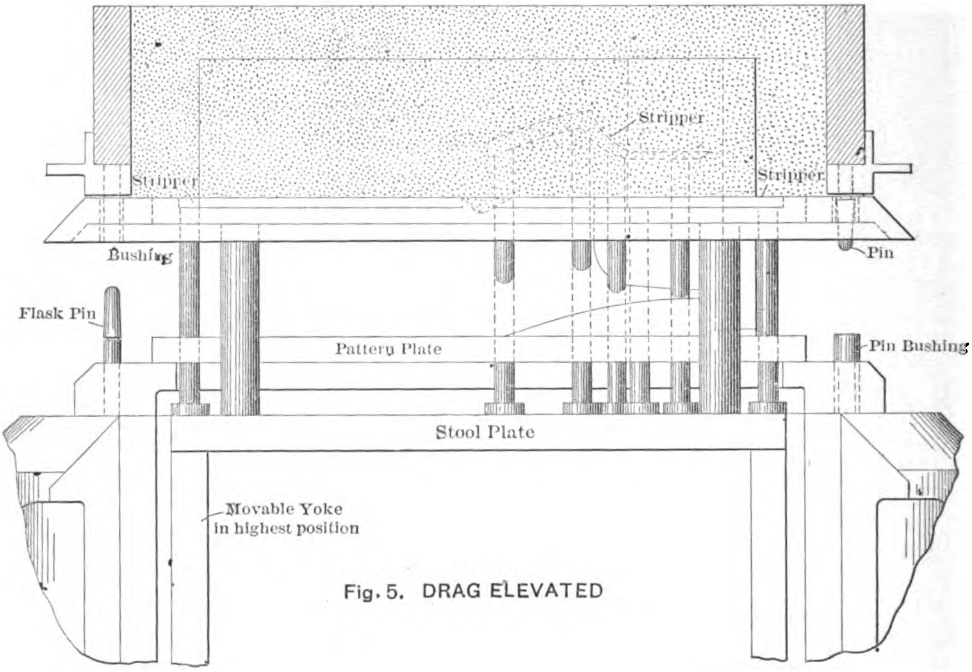


Fig. 5. DRAG ELEVATED

which sets down on the pattern plate. The cavity in the mold is indicated by the dotted lines.

To make a mold on these two styles of machines, the following procedure is necessary. First, on the split pattern machine, the drag, Fig. 2, is lowered, bringing the plate X to its proper position by means of the operating handle. The plates should all rest as shown in Fig. 2, especial care being taken to see that the flask is down on the top of the plate X. The flask is filled with sand, rammed and struck off in the usual manner. With the lever at the side of the machine the plate X is lifted up, as shown in Fig. 5. The drag is then lifted off and set on the floor. The cope is treated in the same manner, the sprue being formed either by cutting it with a tubular sprue cutter or by means of a regular sprue pattern, as shown in Fig. 3. In the case of the second type of machine shown in Fig. 4, the molding machine handle is thrown so as to bring the yoke into its highest position. The flask is then filled with sand, rammed, struck off, and the pattern A-3 drawn from the sand by stripping it down over the plate M-5 by means of the handle at the side of the molding machine. The stop nut on the machine is so adjusted that when the top of the pattern A-3 is flush with the part M-5, the parts will be brought to rest. After the drag has been formed it is lifted off and set on the floor, and the cope formed in the same manner.

It is evident that to mount this piece as shown in Fig. 4 requires a new plate M-5 for every job, while the machine shown in Fig. 2 requires a new pattern plate L-1. The form shown in Fig. 4 also requires a new pattern plate L-2 for every job, while the stool plate shown in Fig. 2 will generally fit several different jobs on the split pattern machine shown in Figs. 2 and 3. It is not necessary to drill the flask pin holes in all the plates for the machine, which reduces the work considerably. The mounting of the patterns in plates like those shown at L-1, with the use of small strippers on the ends of stools is usually cheaper than the expensive strippers M-5 required in connection with the form shown in Fig. 4. When a vertical milling machine is at hand, the cost of equipping the split pattern machines can be brought down to a very reasonable figure. It is true that not all patterns can be mounted to advantage on a split pattern machine and that the first cost of installation of a split pattern machine is very much greater than the other, but as a rule this will soon be made up by the saving in pattern expense so that in the long run the split pattern type will be found cheaper for general work. The split pattern type of machine can also be used in connection with an air ramming device, which will greatly increase the output. The piece shown in Fig. 1, mounted with a 12 by 18 flask on a Paxson-Hall machine could be molded by an average man at the rate of from 200 to 250 molds in eight hours.

SHOT IRON.

Inquiry.—In the April number of *The Foundry,* on page 65, I read with great interest Mr. Wooden's remarks on "Shot Iron."

This innocent and apparently "Not-worth-while-to-bother-with" subject is of very substantial importance, and the vast sums that have been lost by neglecting it during past years is astonishing.

Mr. Wooden does not state what his use and treatment of the drop from the cupola was before the insertion of the Sly mill. It will be of great interest to me to know this, and I believe many other readers of *The Foundry* will also be interested. Please ask Mr. Wooden to advise us whether he "handpicked" any pieces of iron from the drop before it was thrown on the dump, and if so, about how much iron was recovered daily by such handpicking. In other words, we would like to know the amount of the net gain by use of the Sly mill. It is fair to say to all concerned that the writer is a great believer in the Sly mill, and has secured from friends some surprisingly good results by the use of these mills. The more data that can be brought to light on this subject the better for all concerned, and especially for the people who are responsible for foundry results.

W. S. MOREHOUSE.

Answer.

In the April issue of *The Foundry,* I perhaps did not make myself as plain as I should have done. In our old foundry, some two or three years ago, we used to rattle our cupola drop in one of our common stave casting mills getting some 600 to 800 lb.; heats about 20 tons per day. When we moved into our new place we were short on casting mills to clean our castings, so it was thought best (?) and cheapest to "hand pick" the drop; so it was hauled to the dump and one man put in about ¾ of a day picking it over and rolling it over the bank, this after it had been somewhat picked over at the cupola.

My heart sank within me as I walked about the dump occasionally "hand picking" it myself. This hand picking at the dump bringing in about 300 to 500 lb. per day—heats about 30 tons. Then came the installation of the Sly mill. The first six days of running the mill show the following weights of good clean shot iron: 1st day, 1,570 lb.; 2nd, 2,197; 3rd, 1,825; 4th, 1,638; 5th, 1,677; 6th, Saturday, (eight hours) 1,440. This shows about 1,000 to 1,200 net gain for the cinder mill at a cost of about $1.25 per day for operating the mill.

Am now picking nothing from the dump at the cupola but pigs and large clean scrap, hurrying the drop to the mill and getting clean shot iron about one ton per day. Heats are now running about 26 to 27 tons per day.

Would be glad to answer any question that I can or help any one in the advancement of the foundry business.

P. M. WOODEN.

CARNEGIE RESEARCH SCHOLARSHIP.

At the annual meeting of the Iron and Steel Institute held in London, May 11, 1905, a Carnegie Research Scholarship of $500 was awarded to Henry Cook Boynton, instructor in Metallurgy and Metallography in Harvard University. Mr. Boynton is the third American to be successful in obtaining this highly prized scholarship, two Columbia University men having received it in the past. Mr. Boynton was born in Plymouth 30 years ago and was educated in the schools of that city. In 1896 he entered Harvard University and received his A. B. degree in 1900, his S. M. degree in 1901 and his S. D. degree in 1904. His thesis for the doctor's degree dealt with the "Relation between the Treatment, Structure and Properties of Steel." Mr. Boynton has devoted considerable time to research work, mainly in the metallography of iron and steel, and has written several papers on the subject. The present scholarship will make it possible for him to carry on these investigations in the metallurgical laboratory of Harvard University.

The R. Watt Machine Works, Ridgetown, Canada, have been incorporated with a capital of $50,000. The company will conduct a foundry and machine, boiler and agricultural implement shop.

The Smith Stacker & Feeder Co., Hamilton, Ontario, has been incorporated with a capital of $40,000. The company will manufacture agricultural implements and carry on a general foundry business.

METALS IN FOUNDRY PRACTICE

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron. Steel, Brass and Bronze.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.

J. B. Nau, Metallurgy of Steel and Steel Castings.

Dr. Richard Moldenke, Malleable Castings.

C. Vickers, Brass Castings.

We have also made arrangements with several others to act as special contributors upon Brass, Bronze and other subjects. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

Strength of a 1-inch Test Bar.

We have in our establishment one of our testing machines for breaking ½ in. square by 12 in. cast iron bars.

In one of our heats this week the average shrinkage was .154 in. per foot and the breaking strength equaled 485 lbs.

Am I right in assuming that a testbar from the same iron 1 in. square and 12 in. long is equal to 1,940 lbs.

Answer.—If a ½ in. square bar was relatively no stronger than 1 in. square bar you would have 480 × 8 = 3,883 lbs. but the slower cooling weakens the one inch bar and for this reason you cannot use any formula. If you will look at Vol. XXV p. 899 of Transactions of the American Society of Mechanical Engineers you will find my charts for making this computation. By chart Fig. 450 you will find that a shrinkage of .154 in. of a ½ in. test bar indicates 2.20 percent of silicon. Now turn to page 901 and table 1 gives a divisor for a ½ in. square bar with 22% silicon of .1683 as 2.20% is ⅕ less than the difference between 2.00 and 2.25% and .1683 — .1648 = 35. ⅕ of 35 = 7, .1683 — 7 = .1676.

485 ÷ .1676 = 2894 the strength of a bar one inch square from the same iron as the ½ in. square bar 480 is a very high strength.

To Increase Capacity of Cupola.

Our cupola has a round shell 40 in. outside and lined to 34 inches diameter. There are eight tuyeres 2 inch high and eight inches wide. The distance from the top of the sand bed to the bottom of the tuyeres is 7 inches. We blow with a No. 8 Sturtevant blower having a 12 in. outlet reduced to a 10 in. pipe which is 85 feet long with three rather short bends. This 10-in. pipe then branches into two 6-in. pipes with quite short curves which enter the wind belt of the cupola. There are two 4-in. pipes leading from the 6-in. pipes entering the cupola 12 inches above the tuyeres. We weigh all charges. The bed consists of 400 lbs. Lehigh broken coal and 400 lbs. of Connellsville 72-hour coke = 800 lbs. We then charge 2,500 lbs of iron and then three charges consisting of 100 lbs. of coal and 100 lbs of coke and 2,500 lbs. of iron. This makes 1,400 lbs. of fuel and 10,000 lbs. of iron a melting ratio of a little better than 7 to 1. We melt from 2¼ tons to 2¾ tons per hour.

We cannot give the blast pressure but the fan is too large for the cupola and we run it at a high speed.

We wish to increase the size of our melt in the same time that we now use and we also wish to be able to make heavier castings. We propose to increase the distance from the top of the sand bed to the bottom of the tuyeres by adding to the lower end of the cupola. We would like to know if this is the right thing to do and whether you would suggest other changes.

Answer.—As it takes 30,000 cu. ft. of air to melt a ton of iron your No. 8 fan can supply air enough to melt over 12 tons per hour if you had a cupola lined to 60 inches. For your cupola the 10-in. pipe is plenty large enough even with short bends. Your tuyeres are large enough but I would change the shape at the inside end to 3 in. x 8 in. and at the end against the shell 2½ in. x 7½ in. and keep the upper surface level. If the openings in the shell are 2 in. x 8 in. plenty of air will be admitted. Eight tuyere openings 2 in. x 7½ in. would give 120 sq. in. area. The 10-in. blast pipe has only 78 sq. in. area.

Your two six inch pipes have only 58 sq. inch area and on account of curves—valves and contracted entrances into the wind belt it is not enough. While you are about it I would use 8-inch pipes from the 10-inch pipe to the cupola and if it is necessary to flatten the pipes when they enter the wind belt increase the size at that point so as to get a total inlet area of 100 sq. inches.

You can add as much as you think best to the bottom of your cupola, making the distance from the bottom of the tuyeres to the sand bottom 18 in. or 24 in. or even more.

The deeper you make it the more melted iron it will hold but the larger will be your fuel bed and the less your melting ratio.

You should at once purchase a pressure gauge that will register 18 ounces and change the speed of your fan so that your highest pressure during a heat shall be 14 oz. or 16 oz.

I would give up the use of coal as soon as you have made the change, also stop up the upper 4-in. tuyeres.

Take a ⅜-in. bar of iron and bend two feet at one end at a right angle then lower it down through the charging door until the horizontal part is toward the center and 18 inches above the top of the tuyeres, mark the point when the rod touches the bottom of the charging door and bend the upper part out so that the rod will hang in the door and the lower end project towards the center of the cupola. Start your fire two hours before you want the iron done and put on say 500 lbs. of coke. When the coke begins to be quite red on top and you are sure that the wood is all burned out charge on enough coke so that the lower end of the bent rod will lie on it when the upper end rests on the door sill. Weigh the coke that is left of the 1,200 lbs. and you have the weight of your regular coke charge. The first day I would throw on about 4 in. more coke. Now charge 2,500 lbs. of iron placing the pig iron uniformly over the coke and breaking the scrap so that no piece will be larger than a pig and that no spaces shall be left.

The first day I would make the regular charges 200 lbs. of coke and 2,000 lbs. of iron and about 25 lbs. of oyster shells. Next day if your iron was hot at the start you can use the regular bed charge and afterwards perhaps you can decrease it. You can also decrease the regular coke charge.

The more coke you take off the faster you will melt, but don't take off more than 10 or 20 lbs. of coke at a time.

When you get the coke charges as small as you can without dull iron, you might increase your blast a little and you will have reached the limit of your cupola.

In charging your cupola you had better place a slag hole in the rear about four inches below the bottom of the tuyeres and increase the oyster shells if needed to make the slag fluid. If you keep the slag below the tuyeres you can run the cupola a much longer time without the slag becoming chilled.

Your next change would be a cupola 72-in. shell and lined to 54 inches. The third change would be a 60-in. lining and a change to a 12 in. or 16-in. pipe with long bends.

BRASS FOUNDRY NOTES.

BY C. VICKERS.

CORES FOR BRASS CASTINGS.

Inquiry:—"We are experiencing a good deal of trouble with the cores we use in our brass foundry, which in some places are ⅛-in. thick and others 1¼-in. thick, on account of blow holes. The cores are all shaped and made in halves and then pasted together before they are dry. The paste we use is a mixture of boiled water and rye flour."

Answer:—Do you vent these cores? What mixture of sand do you use? "Flour sand" is very apt to blow when used on small cores for brass castings. If you have been using it, change, and try linseed oil or a core compound. If the cores are too small to vent as in the case of the ⅛-in. core, use glue for a binder in your sand, and mix only a little at a time. The trouble with the 1¼-in. cores is probably caused by using too much paste and allowing it to close up the vent. If you have your vents clean and do not allow the metal to enter them 1¼-in. cores ought never to blow.

MALLEABLE CAST IRON NOTES.

BY DR. RICHARD MOLDENKE.

SELLING PRICE AND STRENGTH OF MALLEABLE CASTINGS.

M. E. writes us again on the above subject. In making up his estimated costs, he bases them on the established cost of the Tropenas Process, which is 1.50c, adds a molding cost of 1c a lb. Then estimates the other foundry and general expenses to be from three-quarters to one cent a lb. more. Thus his cost price comes out to be three and one quarter to three and one-half cents a lb. Naturally M. E.'s selling price would have to be higher.

In reply we would say that the Tropenas Process is a very good but expensive steel process, and not used for malleable castings, except in an experimental way, in Europe, as we have heard. The cost of metal in the ladle for malleable castings should not be over 1c a lb. with present pig iron prices. Molding cost will vary from one-half to three-quarters of a cent per lb. and the other foundry expenses depend on many things. It is these things which enable a firm to produce either at 2c a lb. or far above it.

The figures above should not be taken to mean that foundrymen should ask for low prices—far from it—but that the costs should be closely watched, and if much above what I have given as the selling prices in the May issue of the Foundry, the proper inquiries instituted and corrections applied.

M. E. further gives some interesting figures on tests with malleable cast iron. The tension tests will be understood by every one. The torsional test is a rare one for malleable castings. No test on malleable, however, gives more striking results when made in the shop. For instance, every display of twisted and bent malleable castings contains a large wrench with several turns made in the body. This looks beautiful, but does not mean much, as the actual bend per inch of length is really very small. In the test given below, it is interesting to note the number of pounds it took to twist the specimen through the given angle in the given length.

TENSION TEST.

Specimen approximately sound as cast, not machined: Mean diameter of specimen, 1 in.; ultimate strength, 36,600 lbs. per sq. in.; coefficient of elasticity, 27,800,000 per sq. in.; elongation in length of 8 ins., 2¼%.

TORSION TEST.

Mean diameter of specimen, .72 in.; torsional strength, 2,550 in. lbs.; amount of twist in 11 ins., 252°.

TRANSVERSE TEST.

Distance to center of bearings, 13 in.; depth of section, 4.01 in.; thickness of web, .32 in.; equal flanges, each 1.96 in. wide x .253 in. thick; moment of inertia of section, 4.4691; between central loads of 8,500 lbs. and 18,500 lbs. the increment of deflection was found to be .002 in. per increment of 1,000 lb. of load; between these limits coefficient of rigidity, 5,121,000 lb.; skin stress point of rupture, 48,000 lb.

COMPRESSIVE TEST.

Under a load of 150,000 lb. increase in area more than 25%.

It is difficult to comment on these figures except for the tensile test, as the transverse test has been made on a specimen unusual in shape for testing purposes. I would consider the tensile strength somewhat low. For the specimen in question, it should run about 40,000 lbs. upward, with an elongation equally as good as the one given.

If M. E. would use the test bars current in America for malleable castings purposes, we could give him a better opinion on the matter. Our method, as standardized by the American Society for Testing Materials, is to use a one-inch square test bar, the tensile strength of which shall exceed 40,000 lbs. per square inch, with an elongation of not less than 2½ percent, measured in 2 in. The transverse test of the same sized bar (this being broken on supports 12 in. apart), shall show a strength of not less than 3,000 lbs. with a deflection of at least ½ in. before yielding.

I will add that these standards are those current for the ordinary grade of good malleable castings. Specially good iron runs much better. For instance, I have made thousands of tons of malleable castings, the tensile strength of which never ran below 50,000 lbs. per square inch, and the transverse strength at the same time running nearer 4,000 lbs. with a deflection of over one inch, in fact sometimes nearer 2½ inches. This metal, however, requires the closest of attention, and a capacity for enormous production with high class furnaces and materials.

SILICON IN MALLEABLE CASTINGS AND MIXTURES FOR THEM.

G. A. B. writes calling attention to the fact that published analyses give silicon ranging as high as 1.33% in good malleable castings, while this department has quoted 0.45 as the best composition. The answer is that the best quality of malleable castings depends upon the state of the carbon in the metal before it goes into the annealing oven. Now the state of the carbon is a function of not only the silicon content, the temperature of the pour, but also of the thickness of the casting. The physical structure of a piece of "malleable" just as it is taken from the sand should be such that on breaking, the fracture is crystalline white, with a few spots of mottling noticeable on close observation. Where much steel is added to the mixture, even these spots should not be there, but on the other hand not the slightest signs of gas holes in the rim of the casting should appear either. Now to get this structure in the iron as it comes from the sand, the composition of the bath, so far as silicon is concerned, must be regulated carefully in connection with the thickness of the castings to be made. Thus, take the heavy malleable casting, requiring at the same time the very best quality of metal, such as was formerly used for the malleable "car coupler." Here 0.45 silicon gave just the desired structure for the metal which ran up to 1½ in. in thickness in some places. All lighter castings made with the same metal were also good, though for very light work, requiring much time to pour, metal with so low a silicon content will give trouble. For lighter work, it is found that the silicon can be increased considerably, and yet hold the carbon, which means the fracture of the white iron just as wanted. Hence for the general run of railroad work, where the metal is no thicker than five-eighths of an inch, the silicon content should be 0.65. Were this iron with 0.65 silicon cast into work of 1½ in. the resulting fracture of the broken iron would approach grayness, with resulting ruin of the metal in annealing it. Carrying out the argument further, for very thin castings, the silicon can be run up to 1.00 and even higher and yet leave the metal, as it comes from the sand, white and of good structure for perfect anneal. But if this metal were cast into thicker pieces, they would come out rotten from the annealing oven.

Where, therefore, an analysis shows 1.33 silicon, it refers either to very light castings, or else the metal was not of good quality. G. A. B. states that a well-known concern near Detroit makes castings with 0.80 silicon. This is all right, as that well-known concern makes castings of which several hundred often go to the pound. It is the section of the casting which requires the proper silicon, and this once correct for the heaviest thickness, is all right for anything lighter that can be run with the same metal.

G. A. B. further gives an analysis of "malleable" before and after annealing, asking if it is good. Here it is:

Silicon in the hard 0.80,	annealed	0.80
Sulphur in the hard......0.09,	"	0.09
Phosphorus in the hard...0.16,	"	0.16
Manganese in the hard....0.30	"	0.30
Comb. Carbon in the hard.2.40		
Graphite	"	2.25

The carbons of the above do not count for anything, as only the total carbon of the hard casting is reliable, the combined carbon and the graphite of the hard as well as annealed casting varying so much from skin to interior, that an analysis is correct only for the particular spot the sample is taken from, and not for the rest of the metal. In the above the sulphur will be noted at once as entirely too high. Good malleable should not run over 0.05. However, for very ordinary castings it will pass, but too much must not be expected from them. The manganese is also a little high for the casting. I would rather have it below 0.20 in the casting.

G. A. B. asks for information concerning the change in composition due to annealing.

The melting loss is about 0.35 for silicon, the sulphur gains 0.01, and with bad coal may increase as much as 0.10 and over that even, for the air furnace. With the open hearth, and with the best coal in the air furnace, the increase of sulphur and phosphorus should be only that of concentration, the bath shrinking in weight some 8 to 14 percent during melting. The total carbon drops, of course, but were better lowered by adding steel scrap than by refining out the carbon as in the steel process of the open hearth. Metal below 2.75 in total carbon gives trouble in the anneal.

G. A. B. finally asks if an iron made in Sweden with the following composition can be used for malleable castings: Silicon, 2.33; sulphur, 0.017; phosphorus, 0.043; manganese, 0.97. Not alone, but with other irons low in silicon and manganese, this iron should give excellent results. Irons which will give a mixture as follows with the above iron should do very well. Silicon from 0.95 to 1.30, depending upon the class of work; sulphur not over 0.04; phosphorus not over 0.175, and manganese not over 0.60.

Mr. W. G. Austin, of St. Joseph, Mo., has arranged to sell his foundry to B. W. Kyle, of the same city, and Mr. Kyle is planning to manufacture his washing machine on a large scale, running the foundry to its full capacity.

The Tallerday Steel Pipe & Tank Co., of Waterloo and Lemars, Ia., the Tallerday Mfg. Co., of Dolgeville, Cal., and the Kelly Foundry & Machine Co., of Goshen, Ind., have effected a consolidation by which the Kelly firm becomes financially interested in the Tallerday plants and by which shipments to fill orders will be made from whichever plant can handle the work to the greatest advantage.

Emilo Gutierrez expects to establish a foundry in the city of Guadalajara, Mexico, which will cost about $70,000.

ASSOCIATIONS AND SOCIETIES.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care J. W. Paxson Co.

The 147th meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club, 1409 Walnut street, Philadelphia, on Wednesday evening, May 3, President Thomas Devlin occupying the chair. The secretary reported a balance in the treasury on April 5 of $2,190.12, and on May 3, $2,081.87, all bills being paid.

A letter was read from the American Foundrymen's Association in reference to the convention to be held in New York City on June 6, 7 and 8, inviting the Philadelphia Association to be present and to bring foundry friends to the meeting.

A communication from the chief of the Bureau of Manufactures, Washington, asking for general trade information, was referred to the executive committee.

Secretary Evans stated that at the June meeting the members would have the pleasure of hearing an address by a lady representative of the National Civic Federation.

The address of the evening was made by J. S. Robeson, of Philadelphia, who discussed "Some Core Binder Troubles." He referred to the various kinds of sands used in making cores, but particularly dwelt upon the binder and the characteristics it should have to produce the best results. The effect upon the efficiency of the binder produced by a change in sand was referred to and the speaker considered that many binders had been unjustly condemned because of variable results that had accompanied changes in sand. The paper in many of its features covered the same ground as the one which Mr. Robeson presented before the Pittsburg Foundrymen's Association at its February meeting. The speaker exhibited various samples of sand in use in foundries in Canada and the districts east of Pittsburg. The lantern slides were presented showing three cores: one made with rosin as a binder, another with a liquid binder, and a third with a dry binder. The paper was discussed at considerable length, particularly by foundry foremen present.

New England Foundrymen's Association.

Fred F. Stockwell, Secretary, care of the Barbour-Stockwell Co., Cambridgeport, Mass.

The regular monthly meeting of the New England Foundrymen's Association was held at the Exchange Club, Boston, on Wednesday, May 10, at 5 p. m., Vice President W. B. Snow in the chair. The routine business was disposed of in the usual manner and applications for membership were received from the United States Graphite Co., Saginaw, Mich., and Joseph Dixon Crucible Co., Jersey City, N. J. They were unanimously elected.

The chair appointed Messrs. Miller and Stockwell as a committee to look up the matter of transportation to the annual convention of the American Foundrymen's Association to be held in New York City on June 6, 7 and 8.

The quiz topics arranged for discussion were then taken up. Below are given some of the questions and answers:

Ques. What is the best and cheapest method for melting brass and bronze castings?

Ans. We use a Schwartz furnace and melt a ton of clean castings for less than a ton of coal. We do not have any trouble and our crucibles are good. We do not have trouble with blow holes any more than anybody else, and our percentage is not so great. We use a very light gate. We pour our machine work just the same as iron.

Ques. Do you use an oil furnace?

Ans. We do not think we could use an oil furnace and get out the work we do.

Ans. For our work we think the old crucible furnaces are better. We use a gas furnace for white metal and aluminum. With our gas furnace we melt aluminum alloy with 90 percent aluminum. We carry 15 molders all on piece work. The gas furnace we find is very easy to handle and it is very clean.

Ques. What is the best method for molding brass and bronze castings?

Ans. We are making considerable work on the molding machine. We get quite a good size gate of small work in a flask 10 x 18 for 2½c per mold. On core work in the same size flask we pay 3½c per mold, and for a flask that has 50 cores, 5c per mold. Our loose work is very difficult. That is, the general run of electrical work is crooked and we pay 9¾c. Our work is all piece work, and it must be perfect, first-class work.

Ans. We run machines on our valves and pay 3c per mold. Of course, the bigger the pieces are the more we have to pay. We melt in a Rockwell furnace. If there are no cores in the molds we turn out about 90 molds per day, sometimes 100. If we have cores we get 60 or 70, sometimes 75.

Ques. Have you any special method for drying ladles?

Ans. We use the old method of drying our ladles. That is, we burn wood fires in them. We have plenty of old wood in the yard that would otherwise be going to waste.

Ans. We have a large room behind the cupolas with a tramway between the cupolas, and the ladles are run in on this tramway. There is a special arrangement of a frame with an iron hood over each ladle which covers the same, leaving room, of course, for a draft for the fire, and this hood is connected to a smoke pipe that carries away the smoke, etc. We burn wood fires to dry the ladles and find they do it very quickly and satisfactorily.

After a short intermission the meeting adjourned to dinner, after which the chairman introduced as the speaker of the evening Mr. M. McNaughton, of the Joseph Dixon Crucible Co., who addressed those present on the subject: "Graphite and Facings." At the conclusion of his remarks a unanimous vote of thanks was extended to Mr. McNaughton.

Announcement was made that the June meeting would be an outing and that full particulars would be mailed to the members later.

Pittsburg Foundrymen's Association.

F. H. Zimmers, Secretary, care Union Foundry and Machine Co.

The annual smoker of the Pittsburg Foundrymen's Association was held at the rooms of the Engineers' Society of Western Pennsylvania, Pittsburg, on Monday evening, May 1. The affair was well attended, urgent invitations having been sent to the foundry foremen and superintendents and pattern shop foremen to be present. Efforts are being made to organize a local association of the foremen and superintendents and the Manufacturers' Association of Pittsburg has given them the privilege of its rooms for meetings. The smoker was arranged by F. H. Zimmers, secretary, and the entertainment and repast were up to the high standard he has maintained in affairs of this kind. The following program of toasts had been prepared under the title "Confessions," and the responses proved the foundryman's capacity for unbending when other than severely technical matters are under discussion.

"Inside History of the Roll Industry," J. S. Seaman; "How to Manufacture Charcoal Iron Car Wheels without Charcoal Iron," A. W. Slocum; "How to Operate a Foundry in a Hay Loft," B. D. Fuller; "How to Finance a Program Committee," F. H. Zimmers; "Inside Reasons Why I Favor the Blower," William Yagle; "Guiding the Water Wagon," W. H. McFadden; "A Continuous Performance Foundry," S. D. Sleeth; "Philanthropy—Or Why I Give My Profits to the Foundrymen," J. S. McCormick; "The Molecular Antithesis as Affected by the Atomic Theory and its Application to the 'Molders' Delight'," H. E. Field; "Pyrometric Determinations of a Molder's Cranium 'the day after'," S. H. Stupakoff; "How I Developed the Southern Foundry Iron Industry," E. A. Kebler; "Picking Strawberries by the Wayside and My Trip to the Moon," D. J. Thomas.

Cleveland Foundry Foremen.

W. H. Nicholls, 608 Gordon Avenue, District Vice-President.

The first annual banquet of the Cleveland Club of Associated Foundry Foremen was held at the Hotel Euclid, Cleveland, Saturday evening, May 6, and was attended by nearly a hundred members of the club and their friends, including foundry owners, patternmakers, supply men and pig iron salesmen. The club has been in existence only a year, but has already accomplished much to advance the interests of the members and their employers. After cigars had been lighted at the completion of the menu, the president of the club, A. L. Hott, of the Interstate Foundry Co., called the meeting to order and after a few words of greeting, introduced Secretary W. H. Nicholls, who read an invitation to all connected with the foundry business in Cleveland to attend the annual convention of the American Foundrymen's Association, to be held in New York, June 6, 7 and 8. President Hott presented Mr. H. J. Boggis, of the Taylor & Boggis Co., Cleveland, as the toastmaster of the evening. Mr. Boggis introduced the speakers with a few well-chosen words.

Dr. Richard Moldenke responded to the toast "The A. F. A. and Its Work." He extended hearty congratulations to the foundry foremen of Cleveland on the successful inauguration of their club. He said that back of all such efforts in organization lies a dominant idea: the desire for more knowledge. "Let this be in lines social, technical, or financial; we simply must know all we can get hold of in our business; of each other's personality and character, and finally of those great movements of the day, all intimately tied up with finance." He declared that owners should welcome every movement on the part of all of their employes based upon the honest desire to acquire knowledge, for the owners are the chief gainers. The foreman who has arrived at the time when ambition no longer impels him to climb to the next step, the management, and then the acquisition of an interest, will soon be ready for permanent retirement, and in an up-to-date foundry concern quickly lands there. "Long before you expect to enter into ownership, it would pay you to watch the iron and coke markets," said Dr. Moldenke, "and to compare the contracts your firm has with those of others. Much is to be learned of the movement of these fundamental materials of the industry by keeping track of things, especially from the pages of a first-class trade journal. The temptation is always a strong one to charge the highest price to the man who is not posted. Not only should you watch pig iron, scrap and coke, but also the supplies, such as structural steel, sand, cement, etc., for on going into business it is best to do so just before a rise is due. You thus get the lowest figures to buy, and when the plant is up, you can take work at the highest figures of the time, instead of vice versa when you build at the top notch. I advise you to get hold of specialties, to keep the shop a-going, whether times are brisk or dull. There is much comfort in knowing that even if the income is no more than the pay roll, a steadily increasing pile of stock stands ready for the first resumption of good times. Our industry has a wonderful fascination and few that have made castings themselves take to other lines entirely out of the industry. I believe our good friend Sercomb, of Milwaukee, who at last accounts is making soap, still regrets the change, though doubtless he makes more money cleaning humanity. When you take it all into your reflections over a tired year's work, you will agree with me in feeling that our effort is one of constant progress. Next week we expect to know more than we do today, or at any rate should do so. It is this feeling that has led to the formation of foundrymen's associations. It has led to the formation of your own society. It will lead to the formation of others. For the sake of our nation's progress, we wish them all Godspeed, and we try to help them along with good hard work and investigation. Had it not been for the concerted work of our metallurgists in the American Association, we would not be buying nearly all our pig iron under chemical specifications, nor would our better posted foundry foremen write out mixtures at their desk without worrying how they will turn out.

"I am repeatedly called in on expert work in foundries, and have always found the foremen most anxious to learn the simple little trick of arithmetic by which a mixture can be figured out from the stock piles, the analyses of which are known. The effect that such calculations have on the buying of the iron is seldom realized by the owner. As just an instance of this, I will quote from my own experience. Where formerly the works in question had all the way from 10,000 up to 17,000 tons of pig iron in stock, as many varieties had to be carried to mix from. After I had mastered the principles involved in the work, that stock was cut down to less than 3,000 tons, and oftentimes I had to worry about the iron due for a week to follow, when delays by rail will occur. Just think of the interest on the former investment saved. How much more could be said on the subject of the foundry and our particular hobbies in it. We get together and think we have threshed it out so dry that nothing worth talking about is left, and behold, when we come together once more, it is—Have you seen this or that shop, and the way they turn out those propeller castings? Or a new instance of how the pattern shop did the foundry that time, or vice versa. If there were not so much new constantly turning up, how could we have such bright trade journals as the *Foundry* and the *Patternmaker?* Our conventions seem to teem with interesting matter, and I take this occasion to extend to each and all of you, as well as all foundry Cleveland, a hearty invitation to join with us in New York City next month, when we hope to have a most interesting gathering of foundrymen from all over the country. May the good work go on here. May you become thoroughly acquainted with each other; learn to value and respect the earnest efforts and good citizenship which will be found in our industry. I greet you again as fellow-foundrymen, on the right road to progress, success, and that prosperity which we all strive for with American pluck, American ability, the American perseverance."

John A. Penton, of the Penton Publishing Co., spoke on "Early Reminiscences of the A. F. A." He told of the first meeting in Philadelphia of a few men interested in the foundry business to organize a local association of foundrymen, and how from that small beginning the national organization grew. Mr. Penton made a strong plea for the organization of foundrymen, saying that it is based on the desire of men in the same business to be associated with their fellow men and is absolutely necessary for the highest success in the business world. He said that if a man were not entirely in harmony with the plans and methods of an organization, that was no reason for his refraining from becoming a member. He ought to go into the organization and exert his influence to have it changed to conform to his ideas.

N. S. Calhoun, of the Johnson & Jennings Co., responded to the toast, "Cleveland as a Foundry Center," making a speech abounding in humor and giving the guests a few solid facts on which to reflect. Other speakers were: "Cleveland Club of Associated Patternmaker Foremen, Its Object and Work," J. Nall, of the Ajax Mfg. Co.; "Proper Relationship between the Pattern Shop and the Foundry," Alfred Hibbs, of the U. S. Cast Iron Pipe & Foundry Co., and "Making a Molder," H. M. Lane, editor of the *Foundry*. Mr. Lane spoke of the tendency towards specialization in the foundry which prevents a boy from obtaining a thorough knowledge of the whole foundry business He urged the importance of an apprentice knowing something about the machine shop and patternmaking as well as about molding, and outlined a plan for the establishment of a shop school, which he believed would result in turning out a much higher grade of molders than can now be found. He said that the product would be a well-developed mechanic instead of a man trained in some special feature of the foundry trade.

Buffalo Foundrymen's Association.

The regular monthly meeting of the Buffalo Foundrymen's Association was held in its headquarters, 23 Builders' Exchange, on Tuesday, May 16. President Hubbell, 28 members and several visitors attended. After the regular order of business was disposed of the chair introduced Mr. Daniel Upton, Supervisor of Manual Training, Buffalo Public Schools, who, in a very interesting talk, explained the advantages of manual training offered at the Mechanic Arts High School to the young men of this city. This school has an excellently equipped pattern shop, 18 wood-turning lathes, a cabinet shop with 24 work benches, a shop equipped with 20 forges, and several draughting rooms. One of the basement rooms has been fitted out as a molding room where the boys take lessons in molding before they enter the pattern-making classes. The machinery is driven by electric motors. The branches of industrial training are as follows: First year, cabinet work and wood turning; second year, molding and pattern making; third year, iron forging, brazing, tempering, etc.; fourth year, machine shop practice. In each year the draughting conforms to the other work, the course as laid out consisting of free hand and mechanical branches; the latter takes in machine and allied subjects in the last two years. The aim is not to produce specialists in any line, but to develop the whole man by educating the hand and mind to work together. The boy is, therefore, better fitted to enter a larger field of usefulness. At present about 150 boys are taking the technical course though it has been established only about two years. It was the unanimous sentiment of those present that if our boys are educated in this school our manufacturers will in a few years have a better grade of mechanics.

The Associated Foundry Foremen.

Frank C. Everett, Secretary, 2113 Third Ave., New York, N. Y., care the J. L. Mott Iron Works.

Milwaukee Foundry Foremen.

Thomas Glasscock, Dist. Vice Pres., care Pawling & Harnischfeger Co., Milwaukee, Wis.

Erie Foundry Foremen.

W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

PHILADELPHIA FOUNDRY FOREMEN

W. P. Cunningham, Secretary, Pencoyd, Pa.

NEW YORK FOUNDRY FOREMEN'S ASSOCIATION.

S. M. Williams, Dist. Vice Pres., 221 Third Street, Elizabeth, N. J.

CHICAGO FOUNDRY FOREMEN.

David Spence, Dist. Vice Pres., 142 Bunker St.

INDIANAPOLIS FOUNDRY FOREMEN.

W. H. Holmes, Dist. Vice Pres., care American Foundry Co.

HAMILTON, ONT. FOUNDRY FOREMEN'S ASSOCIATION.

A. Chase, care Sawyer & Massey Co., Secretary and Treasurer.

A. E. Stevens, Sioux City, Ia., is organizing a company to engage in the manufacture of cast iron and brass products. The concern will be known as the Western Brass & Iron Foundry.

AMERICAN SOCIETY FOR TESTING MATERIALS.

Dr. Richard Moldenke delivered an address upon "The Object of the American Society for Testing Materials" before the Civil Engineers' Club of Cleveland, on Friday, May 5. The speaker first reviewed the organization of the societies for testing materials in Europe, which resulted in the formation of the International Society for Testing Materials with divisions in each country. He noted the fact that the object of the societies in this country and Europe is radically different. In this country the prime object of testing and of the Society for Testing Materials, is to arrive at standard specifications for material used for manufacturing purposes, while in Europe the prime object of testing materials is for scientific research, and the making of specifications is a secondary matter. In many cases the European members of the society are government officials and they would have no authority to adopt standard specifications without special legislation on the part of their government. The engineering departments of each of the European governments have their own specifications and it would be very difficult for them to unite on any universal plan. In this country however, engineers feel the need of universal standards and specifications, and hence the American Society for Testing Materials, which is the branch of the International Society, was formed. This society has taken over most of the testing work previously done by various engineering societies, or it has worked in harmony with other engineering bodies, and from its work has resulted the adoption of standard specifications for many lines. There are now a number of committees working upon the subject.

Dr. Moldenke told of his visit to the International Congress held at Buda Pesth several years ago. There were only four American members present, and in the committee work he acted as interpreter between the various divisions. The proceedings of the International Congress for Testing Materials are conducted in three languages, French, German and English, there being two translators always on the platform, and just as soon as the speaker makes a few statements, each translates it into his own language for the benefit of his fellow-countrymen present.

After pointing out the importance of the work already done by the American Society, Dr. Moldenke made a plea for all engineers to support the work of the society by becoming members, taking part in the discussions and assisting the work in any way that they could.

MEETING OF THE IRON AND STEEL INSTITUTE.

The annual meeting of the Iron and Steel Institute opened at London, May 11, with Andrew Carnegie presiding. In his farewell speech, and before introducing his successor, R. A. Hadfield, who was vice president of the Institute, Mr. Carnegie said he appreciated the honor of being the first American president of the Institute. Later he subscribed $25,000 to the research fund as a parting gift to the Institute. One of the features of the meeting was the reading of a paper by James Gayley, of New York, on "The Application of the Dry Air Blast to the Manufacture of Iron." R. A. Hadfield, the new president of the Institute, was formerly master of Sheffield, is director of the Sheffield Gas Co., the Sheffield District Railroad, and several other companies. He is the inventor of manganese steel, a member of many scientific and industrial organizations, including the American Institute of Mining Engineers, and among the prizes he has received is the John Scott medal, a premium of the Franklin Institute of Philadelphia.

ALUMINUM AS A PATTERN METAL.

BY H. N. TUTTLE.

There has been so much said against aluminum for metal patterns, that those who have never used the metal for that purpose would be naturally inclined not to give it a trial; whereas, if one has thoroughly investigated the matter, he finds merits in it, which make it the metal "par excellence" for many classes of metal patterns.

In the first place, its extreme lightness is a very valuable feature. The specific gravity of aluminum is 2.56, while that of brass is about 8.32, and zinc and tin alloy or antimony and tin about 7.25. From this will be seen that with a given size gate, aluminum patterns of three times the volume of brass or soft alloy patterns may be carded with only the same liability of breaking the soldered joint So. in considering patterns of the same size, carded with gates of the same size, the danger of breaking the joints of the aluminum card would be very much less than that of the other.

Molders like aluminum patterns on account of its being so much easier to draw a light pattern than a heavy one.

The cost of the metal is less than that of almost any other pattern metal. Aluminum costs about thirty cents per pound, and as its volume is three times greater than brass or other pattern alloys, its comparative cost is reduced to ten cents per pound.

It is sometimes said that the sand sticks to aluminum patterns more than to other kinds, but after examining about three hundred cards of various metals, to observe the amount of dirt remaining on the patterns after they were brushed off, and after talking with several of the molders who have used these patterns, it was found that it was not true, in this shop at least; there being no appreciable difference in this respect.

Aluminum finishes with the file, sand paper, scraper, etc., much easier than brass or the hard pattern metals, and casts smoother than the soft alloys. It is very stiff and will not easily spring out of shape nor be easily bent, making it better for light, flimsy patterns than the soft alloys; while, on the other hand, it is somewhat soft, so that it will not peen out of true from rapping, as flat, thin iron patterns do. Still, if an aluminum pattern be sprung slightly in casting, or in any way, it may be trued up by bending, though it will not bend so much as brass.

Of course, it is not claimed that aluminum is better for all classes of metal patterns, but for ordinary carded work for castings not requiring extreme accuracy or fine surface, such as agricultural and light machine work in general, and for single patterns too large to card, as gears, hand wheels, etc., it makes durable, cheap, and easily finished patterns.

Soldering Aluminum.

The objection most often heard to aluminum as a pattern metal is that "it can't be soldered," or that "it is extremely difficult to solder," or that "a good joint can't be soldered." Now it is proverbially hard to prove a negative, and it is especially true in this case. The chief difficulty in soldering aluminum lies in not knowing how. It is not generally known that a fair job of soldering can be done upon aluminum with common half and half solder, but such is the case. We have patterns which have been in use a long time upon which are shrinkage holes soldered with the common solder. It is only necessary to follow the directions given below for using aluminum solder, using no flux. Also, aluminum with 10 percent tin added will solder better with common solder. However, a special aluminum solder is much better, making a stronger job, and being easier to use. We have been experimenting and testing aluminum solders for several years, and have found the one below to be the best, considered from all points, for metal pattern work. It is slightly different in color from aluminum, which makes it useless for ornamental work, but it is cheap, easy to use, and very strong and durable. We have made test joints with it which have stood more strain than the aluminum itself, the casting breaking at one side of the joint, though, of course, this is not usually the case. The receipt for this solder is as follows, all parts to be measured by weight:

Aluminum	1 part
Phosphor-tin	1 part
Zinc	11 parts
Tin	29 parts

In making this solder, melt the aluminum first. Then add the zinc in small pieces, so as not to solidify the already melted aluminum Then add the tin, taking the same precaution not to solidify the metal, and lastly, drop in the phosphor-tin, stir well with a brass rod, and quickly pour into molds, which may be easily made in the open sand. Use a crucible in making this solder.

The reason for observing the above order of melting is that if the metal with the lower fusion point were melted first, and then brought up to the temperature necessary to melt the aluminum, the lower metal would be over-heated and partially vaporized, thus destroying the proper proportion.

In regard to using the solder, it is well to understand a few points about aluminum oxide. This oxide is a thin film or skin which forms upon the surface of aluminum immediately upon its coming in contact with the air. This oxide forms practically instantaneously, so that if a scraper or other instrument be pushed across the surface of the metal, the oxide forms before the bare metal comes in sight. It also forms upon the molten metal, and it sometimes happens in pouring, that the workman finds he is pouring his metal through a tube of oxide. It also sometimes happens that when he over fills his flask, and the metal runs over the side, in the case of heavy casting, a film will form around the overflow, and syphon quite an amount of metal from his sprue, unless he prevents it by breaking the skin.

The oxide is very durable and impervious, so that it prevents the air from reaching the inner metal, and thus further oxidization is very slow. In the case of iron, the oxide is, we might say, very porous, so that the first thin layer of oxide has little effect in reducing further oxidization.

It is the presence of small scales of oxide through the body of the casting, which renders the metal porous, and unfits it for pump work, upon castings which are subjected to hydraulic pressure.

Now solder will not adhere to any metal covered with oxide. In the case of brass, the oxide is removed by the flux, but there has been no flux discovered which will remove or dissolve aluminum oxide. However, the difficulty is overcome in a very simple way. The soldering copper, which should be a rather heavy one, and untinned, is heated to a dull redness, and then rubbed back and forth upon the surface to be soldered, melting the solder upon the hot copper at the same time. The surface becomes covered with the melted solder, which excludes the air and prevents further oxidization, while the point of the copper scratches off the oxide already there. Under these conditions the solder readily adheres to the aluminum, and the surface becomes "tinned." For filling shrinkage holes, or building up additions upon patterns, all that is necessary now, is to melt in the required amount of solder.

In case it is desired to solder two pieces of aluminum together, both surfaces should be "tinned," the pieces brought into position and the joint heated with a copper or blow-torch until the solder is liquid, then pressed into place and allowed to cool. Brass must be heated to 460° before solder will adhere to it, while aluminum must be heated about 200° higher, so it will necessarily be a little harder to solder aluminum than brass.

There is a certain stage during the cooling, just before solidification, when the solder may be worked into any shape, at will, like snow, when it is right for packing, or like the amalgam used by dentists. Of course this temperature is hard to maintain, but the temperature at which aluminum "tins" nicely, is nearly at the "wiping" temperature, as a plumber would say, and on this account there is time enough to "strike off" surplus solder, in simple cases.

As an example, suppose it is desired to "build up" a certain surface of a pattern, one-half inch. First "tin" the surface to be "built up." Then place a wooden frame around that part of the pattern, so that its upper edge is in line with the desired finished surface. Then melt in with the copper, enough aluminum solder to fill the frame "heaping full." After rubbing the copper over the bottom and around the corners, to be certain that the solder is melted into the "tinned" surface below, when the solder cools to just the right temperature, "strike off" by "patting" with a block of wood, using the top of the wooden frame as a guide. Sometimes the "striking off" can be better done with a piece of smooth steel, like a scraper.

Fillets may be "wiped" in corners with a common waxing iron with nearly as much ease as wax fillets. The corner, after being "tinned," has a little solder run in, and immediately followed by the waxing iron, which if done at the proper moment, presses the solder into shape, leaving it as smooth as glass, and requiring no further finishing.

These are merely simple examples of what may be done in the line of "striking" solder. In case of any large or complicated jobs, it is better to rig up some kind of heating table, so that the temperature of the casting may be maintained.

Sometimes additions may be more easily cast on than soldered and swept off. In this case the addition may be put upon the pattern in wood, wax, or in any convenient way and the pattern rammed up. After the pattern is drawn and the addition removed, the proper surface is tinned and the pattern replaced in the mold. After the mold is closed, the addition is cast on by pouring in melted aluminum solder at a high temperature. Gates which have been broken off are sometimes replaced in this way.

Casting.

Another objection to aluminum often heard is, that "it is hard to cast." However, it is only necessary to observe a few conditions to make the casting of aluminum as certain as that of any other metal. It should be borne in mind that aluminum melts at a higher temperature than soft alloys (about 1200°), is much lighter than any other pattern metal, and has the property of absorbing gases when over-heated, or when kept in a molten state for any length of time. On account of these properties, aluminum should be handled somewhat differently than the other metals.

The most important thing to remember is to use a large sprue and a large gate, so that as the casting chills, it may "draw" from the metal in the sprue, and thus not leave shrink holes in the casting itself. For this reason the gate and sprue must be of such size that they will remain in a liquid state, longer than any part of the casting proper. After a little practice, the workman will be able to judge how small a gate it will be safe to make for any given casting. However, it is better at first to be on the safe side with the larger gate, as it is cheaper to saw off a little more metal than to solder a shrinkage hole.

As a general rule, it is better to gate into the heaviest part of the casting, as this is the part which cools last. If it is difficult to do this, or if there be more than one heavy or enlarged part to the pattern, "risers" may be put on to feed in the shrinkage. It is absolutely necessary to put a riser on any heavier part of the casting, which is separated from the gate by a thinner section, to prevent a shrinkage.

On account of its lightness, an extra "head" is not of so much advantage as in other metals. From the same characteristic, top gating may be more often employed, as its lightness very greatly reduces the probability of "washing."

Pulley patterns, sprockets, small gears, etc., may be best cast by setting the sprue upon the cope print, or on the hub.

The form of sprue to be recommended for top pouring is shown in Fig. 1. This form gives a larger body of metal for the same size gate, than the ordinary shape. If, after the cope is lifted off, the sand is pressed or cut back as shown at C, the sprue may be broken off at the line A and B, without the use of a saw.

The sand should be tempered as dry as can be conveniently worked, as the metal is so light that it cannot overcome the steam pressure as well as a heavier metal, and blows are more apt to be caused from wet sand than in any other way. This is especially true in case of "pockets" of sand in the drag, surrounded by metal. This makes it sometimes necessary to vent down to the bottom board, to prevent a "blow." Another essential point is to pour the metal at the proper temperature. The rule is, "to pour at the lowest temperature that will fill the mold," which in most cases is but little above the melting point. The most convenient way for testing the temperature, is to place the end of a pig of aluminum about three-quarters of an inch into the molten metal, and allow it to remain there a short time. If the metal is "hot," its degree may be determined by the rate at which it melts the pig. If the metal is near its melting point, a little cup of the congealed metal will be formed around the end of the pig. After the pig is withdrawn, the time it takes for this "cup" to become remelted, will give a very accurate idea of its temperature. After losing a few castings by pouring too cold, the proper heat may be easily judged.

As the metal is poured at such a low temperature, it is always well to ram the sand as lightly as the mold will stand, to allow the easy escape of the air and gases, but should it be necessary to ram the mold hard, it should be thoroughly vented. Another reason for ramming lightly, is that the property called "hot-shortness" is very much in evidence in the case of aluminum. That is, the metal is very weak, just after solidification, so that in certain shapes, such as an open ring, if the sand is rammed very hard, there will not be sufficient strength to the casting upon shrinking, to crush in the sand; the result being a broken casting. The remedy lies in proper ramming.

For this same reason, it will be found safer in casting around cores of more than three or four inches in diameter, to use a soft baked core made of molasses water and molding sand. This crushes as readily as green sand. Also the castings should not be shaken out too quickly after pouring.

Since aluminum has the property previously mentioned, of absorbing gases when in a molten state, it should be poured soon after melting. It should not be allowed to remain in the fire and "soak," as the gases absorbed tend to produce blow holes.

The metal should be poured very rapidly, literally "dumped" into the mold. This will help fill the mold, when otherwise the metal might be too cold to run up into the cope corners.

For melting the metal, a gas furnace is the most convenient outfit. Catalogues describing these may be obtained at any gas company's office.

Coke makes a very good fuel, especially if there be much casting to be done at one time. Charcoal is inconvenient on account of its burning out so rapidly, though it is a very clean fire.

Soft coal is not to be recommended, as it is dirty and gaseous, but for a quick short job, it is very good. When it is used, care should be taken not to get any particles of the fresh coal into the melted metal just previous to pouring, as these make small blow holes, slightly below the cope surface. Though these generally remain below the depth of a file cut, they will show if the casting be finished in the lathe.

An iron ladle, or black lead crucible may be used, an iron ladle being rather more convenient, but burning out in the course of a few months' usage. In either case it is more convenient to use a ladle or crucible large enough to hold all the metal a man can handle. Also there should be a long sand-bin with a goodly quantity of sand, so that the patternmaker can ram up several molds, and pour all at once, immediately upon the metal in the large pot becoming melted. Of course this last applies merely to small shops.

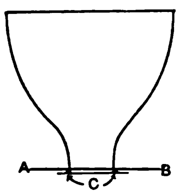


Fig. 1

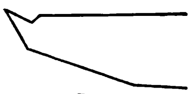


Fig. 2

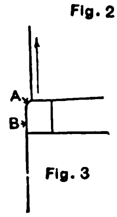


Fig. 3

Snap molds need not be jacketed in case of light castings, and seldom need weighting or clamping to hold down the cope.

If the castings be shaken out soon after they are poured, and a shrinkage hole should be found, which will be rare if the above rules are followed, it may be easily filled by rubbing a stick of aluminum solder upon the proper surface, while the casting is still hot enough to melt the solder. Yet the casting should not be too hot, as the solder will merely run into the casting itself.

A 3-16" shrinkage rule is the proper rule to use, though the shrinkage will vary from this slightly under different conditions.

The gates for aluminum patterns should ordinarily be made of rolled sheet brass, cast in as in soft alloy patterns. An anchor hole should be drilled in the end of the brass, as the aluminum will not weld to the brass. It is well to use brass about one-eighth of an inch thick for gates when possible. When very heavy patterns are gated, the aluminum sometimes melts the end of the brass gates, causing blows in the casting, and loosening the gate. This trouble may be overcome by using sheet phosphor-bronze in place of brass.

Finishing.

One of the greatest advantages of aluminum for patterns, is that it finishes so easily. A few points will be touched upon here. For sawing off sprues, which cannot be safely broken off, a common hack saw is generally used, but a fine tooth panel saw, about fourteen inches long, sharpened hack saw style, or like a wood rip saw, is much better, as it saws faster and more accurately. An old fine tooth circular saw is sometimes used where there is much sawing to be done. Regular metal cutting circular saws and metal cutting band saws may be bought which do very rapid work.

Aluminum files nicely, the scale not being appreciably harder than the inner metal. It has a slight tendency to "pin up" on the file, and scratch, this tendency varying much with the individual file, and with different castings, some files not "pinning" with any casting, and some castings not "pinning" with any file. This tendency may be overcome almost entirely by dipping the file occasionally in water. Some workmen say that this makes the file cut much faster, also.

There is a file made with a very oblique cut, which will not fill up with even the softest metals. This is a bastard cut file, the main cut being made on an angle of only 40° with the side. The second cut is made very light. This file works very nicely upon aluminum, and is generally used by the writer.

Much of the finishing may be done upon the disc grinder. Should there be none in the shop, a fairly good one may be made by covering a large wooden face plate with garnet paper, running at quite a high speed in the turning lathe.

For finishing inside cylindrical surfaces, such as journal bearings, sand-paper rolls may be made and used in the lathe. It is well to have several of these rolls of various sizes on hand.

By using the finest grade of Albany sand (Windsor Locks sand is often used) and taking care in the molding, very smooth castings may be produced, which may be very quickly finished well enough for common work upon the rotary wire scratch brush. This may be purchased for about ten dollars, and put upon an emery wheel arbor, and run at a high speed.

When using hand scrapers, or floats, and when drilling, tapping or turning, kerosene may be used as a lubricant. Of course water or benzine would be as good, but water rusts the machines, and benzine or naphtha evaporate rapidly and are unpleasant upon the hands.

The proper speed for turning is about the same, or a little less, than that for brass, while the tools should be ground with considerable rake and clearance, about the proper amount being shown in Fig. 2.

The top view of a very nice working lathe tool is shown in Fig. 3, in which the feed is in the direction of the arrow. The round corner A makes the roughing cut while the flat edge B, the finishing cut, both at one operation. By grinding tools this shape, 1-32 of an inch is about all the stock that is necessary to allow for turning. Turning tools should be placed at or slightly below the center of the work.

TROUBLE WITH THE FOUNDRYMAN.

I noticed recently a piece with the above title by C. E. W. I see no reason why his piece could not be made in the three-part flask. In the case of a large piece I think it would be perfectly safe to ram up the cheek and drag, remove the drag, take out his loose pieces, return the drag, roll over and finish the same without any fear of bad results from ramming his cope with the loose piece out. If there was any fear from this cause, however, he could roll back and take them out after the cope is rammed up. As he has no finish marks on it, it may be that it would be more simple to leave his other strips loose and then to ram level with them, take out the strips and lay on a flat core, thus making it a two-part flask. We have a similar piece, which is a heavier casting but has a smaller core, which we have made twelve or fifteen times.

W. S. SHATTUCK

TRADE PUBLICATIONS.

The Corrugated Grinding Wheel Co., of Philadelphia, Pa., has gotten out a circular illustrating its corrugated wheels and setting forth the advantages to be derived from their use. The catalogue shows a half tone from a photograph taken of a piece of cast iron ¾ in. thick, with a groove cut in each end of it. A groove was cut in one end by a wheel when not corrugated, and a grove was cut in the other end by a corrugated wheel, a specially designed testing rig being used to force the work against the wheel. The corrugated wheel did 140 percent more work than the other.

The A. A. Griffin Iron Works, of Newark, N. J., have gotten out a very neat little trade publication in regard to the Bundy traps, which is entitled "About Myself" and is supposed to be an autobiography of the trap. It starts out with a picture of the author and then describes its various uses. It is 3½ by 6 inches, and well illustrated.

Clum & Atkinson, of Rochester, N. Y., have gotten out a very neat publication, describing and illustrating the work of their brass, bronze and aluminum foundry. It is a pamphlet 6 by 4½ inches and contains a considerable amount of very interesting matter.

The Yale & Towne Mfg. Co., Stamford, Conn., has just issued two very neat little catalogues, 6 x 5 in. The first deals with the Yale & Towne blocks and electric hoists, showing the different types of hoists and the applications for which they are intended. In the back of the catalogue there is a map of New York City. The other catalogue deals with locks and hardware intended for railroad use. These two catalogues were gotten up for distribution at the International Railway Convention, which has recently been held in Washington, D. C.

The Bristol Co., of Waterbury, Conn., has issued another catalogue of its recording thermometers. The catalogue is gotten up in an exceedingly neat style, including illustrations of each class of thermometer with a description of the special service for which each is fitted. It also contains considerable matter of interest to all users of recording thermometers and to all who have work to do along this line.

One of the best gotten up trade publications that has come under our notice lately is that entitled "Cranes," which is sent out by Pawling & Harnischfeger, Milwaukee, Wis. It is the seventh edition of their catalogue. The book is 12 x 9 in. and contains 40 pages illustrating practically every form of hoist rigging used in modern manufacturing plants. These include traveling cranes of all types and for all classes of service, yard cranes, traveling jib cranes, standard and special jib cranes, extension cranes which are sometimes called rubber necked cranes, and power and other trolley cranes for all classes of work both indoors and outdoors. Any one interested in crane problems should have a copy of this catalogue.

PERSONALS.

Mr. J. A. Babcock, who has been foreman of the Lakeside Foundry in Muskegon, Mich., has gone to Lansing, Mich., where he will be employed as foreman at the Lansing foundry.

Mr. F. C. Myers, late manager of the Indiana Foundry & Machine Co., South Bend, Ind., has accepted the position of superintendent of the Illinois Foundry & Engineering Co., Granite City, Ill. The latter company has recently increased the capacity of its plant.

Mr. John McGregor has resigned his position as foreman with the Doherty Mfg. Co., of Sarnia, Ont., and has accepted a similar position with Bowes, Jamieson & Co., of Hamilton, Ont.

W. B. Chapman, formerly general superintendent of the Mashek Chemical & Iron Co., Escanaba, Mich., who left Escanaba two months ago, is now engaged as assistant manager of the New York office of the Morgan Construction Co., composed of engineers, founders and machinists, with headquarters at Worcester, Mass.

DEATHS.

Mr. Henry W. Miller, president of the Utica Pipe Foundry Co., of Utica, N. Y., died of heart failure in Chicago on May 10. Mr. Miller was 58 years old and has been prominent in the manufacturing interests of Utica for a long time. He was in Chicago receiving treatment for heart trouble.

Wm. Tod died at his home in Youngstown, O., April 27. He had been suffering from organic heart trouble for two years, and his death was not unexpected. Mr. Tod was a son of David Tod, one of Ohio's war governors, and was born at Warren, O., July 30, 1843. He received a common school education and in 1868 became connected with Homer Hamilton in the foundry business, later manufacturing the Porter-Hamilton engine for general power service and especially for the iron and steel trades. Mr. Tod became an important factor in this business. Associated with John Stambaugh Sr., Paul Jones and Homer Hamilton, the plant was built up and in time and the firm became known as Wm. Tod & Co. At a later date the business was incorporated as the Wm. Tod Co. Mr. Tod was elected president and the company became one of the most important engine builders in the country. Mr. Tod was also interested in the Brier Hill Iron & Coal Co., the Youngstown Steel Co., and other manufacturing concerns. He leaves two sons, David and Fred. David Tod is general manager of the cement department of the Struthers Furnace Co.

FIRES.

Fire broke out in the plant of the Stockton Iron Works, Stockton, Cal., April 19. The largest building of the company, valued at $8,000, was completely gutted, and a number of valuable patterns, the accumulation of 40 years, worth $50,000, were entirely destroyed. A small insurance was carried on the buildings. The company will rebuild as soon as possible.

Fire visited the plant of the Fagan Iron Works, Jersey City, N. J., last week, destroying the foundry, a two-story engine and boiler room and a four-story pattern shop. The older portion of the plant was saved, but a large number of valuable patterns and considerable machinery were destroyed. The estimated loss is $10,000.

The foundry building of Thos. Taylor, of Falls City, Neb., was destroyed by fire on April 20. The loss is between $3,000 and $4,000, with no insurance.

Fire in the warehouse and salesroom of the Illinois Malleable Iron Co., Chicago, May 3, caused a loss of $10,000.

The foundry and machine shop of Rittenhouse Bros., at Norristown, Pa., was damaged by fire to the extent of $35,000 on April 25. The fire started in the pattern room on the second floor.

The Plainfield Foundry Co.'s plant, of Plainfield, Conn., was destroyed by fire on May 3.

Fire destroyed the foundry and the entire works of the Desjardins shops at St. Andre, Kamouraska, Quebec, on April 26. The loss is estimated at $150,000, upon which there is some insurance.

The Gurney foundry at Toronto, Ont., was slightly damaged by fire on May 4.

The Chicago Foundry, of Spokane, Wash., was damaged by fire to the extent of $1,000 on April 12.

The Summit Stove Foundry, of Geneva, N. Y., was damaged by fire to the extent of $3,000 on May 4.

NEW CONSTRUCTION.

The Waterbury Farrel Foundry & Machine Co., of Waterbury, Conn., has let contracts for two additions to its plant which will require an expenditure of about $35,000.

A building permit has been issued to the Pittsburg, Ft. Wayne & Chicago Railroad to build a brass foundry to cost $20,000, in Pittsburg, Pa.

The Reading Iron Co., of Reading, Pa., has let a contract for a new foundry building 180 by 230 ft.

The buildings being constructed by the American Steel Foundries at Chester, Pa., are rapidly approaching completion.

The addition to the foundry of the Macungie Brass & Mfg. Co., of Macungie, Pa., is nearly completed.

The Ajax Metal Co. will construct a new fire proof pattern loft at 52 Richmond street, Philadelphia, Pa. The loft is to be built of steel and the contract for it has been let to Mitchell Bros., of Philadelphia, Pa.

The Vulcan Foundry Co., Hamilton, O., has purchased land for the erection of a new foundry, and expects to be under roof by November.

The Ohio Pattern Works, of Cincinnati, O., is having plans made for a large pattern plant to be erected on Spring Grove avenue, in Cincinnati, O., the building to cost about $10,000. The plans are being prepared by Architect Martin Fisher.

The Southern Indiana railway shops, at Bedford, Ind., will be extensively improved, and plans call for the construction of a large foundry and improved machinery facilities.

A contract has been closed for the cement and some of the materials for the $400,000 plant of the Twin City Rapid Transit Co., of Minneapolis, Minn. Among the other large buildings there will be a foundry 60 by 200 ft.

The Olds Motor & Gasoline Engine Works, of Lansing, Mich., will erect a foundry 240 by 160 ft.

The Fagan Iron Works, Hoboken, N. J., are rebuilding their foundry which is 200 by 100 ft. and putting on an iron roof.

The Gray & Dudley Hardware Co. has completed arrangements to start a large foundry and hardware manufacturing plant at Nashville, Tenn., and has purchased a location of about 11 acres for this purpose. The company will manufacture a varied line of hardware and cast iron goods, and will employ about 150 hands.

Arrangements are being made for a number of improvements and additions to the Central Foundry Co.'s plant at Bessemer, Ala.

The Davenport Foundry & Machine Co., of Davenport, Ia., has had plans prepared for a new foundry 88 by 100 ft., by Architects Claussen & Claussen. It also intends to enlarge the main building of its plant, which is 42 by 125 ft. This building is at present only one story in height. The roof will be raised and another story added, which will be used as a pattern shop.

The Hawthorne Foundry & Machine Co. will move its plant to Des Moines, Ia., from Grinnell, providing a suitable location can be found. The railroad facilities at Grinnell were inadequate.

John T. Carmody, of Cedar Rapids, Ia., is improving his new foundry plant by adding a new office building, constructing some cement flooring and making other improvements that will facilitate the work.

Emrick Bros., of Hastings, Neb., have repaired the damage which was done by fire recently and are once more ready for business.

The United States Radiator Co., Dunkirk, N. Y., has just completed an addition to its foundry which will give an increase of about one-third of the former capacity.

The United States Cast Iron Pipe & Foundry Co. is increasing the capacity of its plant at Buffalo.

The Gleason Co., of Rochester, N. Y., is constructing several new buildings, including a foundry 308 by 110 ft.

Wesley Patschke, of Lebanon, Pa., has commenced the erection of a new foundry. Mr. Patschke is a well known molder and has several others associated with him in the business.

The Dent Hardware Co., of Fullerton, Pa., has been making additions to its plant which will greatly increase its output. The company expects soon to enlarge its foundry building.

The Conway Steel Range Co., Toledo, O., recently incorporated with a capital of $100,000, will erect a building 30 x 120 ft. A finishing shop will be erected, and also a foundry, the dimensions of which will be 70 x 200 ft. The company's present structure in Auburndale, where ranges have been manufactured for the past year, will be enlarged 80 ft. so that the building will be 40 x 140 ft. Work on the improvements will be begun in a few days.

F. E. Myers & Bro., of Ashland, O., are preparing to build another foundry as an addition to their plant, which will greatly increase its capacity.

Leo Schwab, president of the Toledo Safe & Lock Co., of Toledo, O., is preparing plans for a foundry addition to his plant at Glassboro, O.

The American Brake Shoe & Foundry Co., of Chicago Heights, Ill., has awarded the contract for a 2-story office building and for an extension to its steel foundry plant.

The Canedy-Otto Mfg. Co., of Chicago Heights, Ill., is making extensive additions and improvements to its plant, including a foundry building 60 x 80 ft.

The John C. Born & Bros. Machine Co., Belleville, Ill., which operates a machine shop, has purchased a plot of ground and will erect a plant of larger capacity. A foundry will be added to the plant.

The Detroit Steel Casting Co., of Detroit, Mich., has purchased additional land adjoining its present plant and is planning to erect a modern steel casting plant, the building being 165 by 400 ft. It is planned to install both open hearth furnaces and converters so that both processes of making steel can be followed. The improvements will double the capacity of the plant.

The Clayton & Lambert Mfg. Co., Detroit, Mich., will erect an addition to its foundry, 34 x 50 ft., and a 2-story boiler house, 34 x 60 ft.

The Beloit Machine Co., Beloit, Wis., has let the contract for the construction of a new pattern shop, which will cost about $25,000.

The building belonging to the Public Service Corporation, at Elizabeth, N. J., is being dismantled and the material will be used in the construction of a foundry which the company is building at Passaic, N. J.

The new plant of the Tennessee Stove Works, Chattanooga, Tenn., has been completed, and the first stoves were made this week. The new plant consists of three substantial brick buildings, electric power plant, stock and finishing, and foundry departments. The electric power plant will have a capacity of 80 h. p., and an engine made by the Harrisburg Foundry & Machine Works, Harrisburg, Pa., has been installed. The foundry building is 165 x 125 ft.

The Anniston Foundry & Machine Co., of Anniston, Ala., is to erect an addition 85 x 1,000 ft. for the manufacture of gas service boxes, soil pipe and fittings.

J. J. McDougal, of Mitchell, S. D., has purchased a site and will begin the erection of a machine shop and foundry building 50 x 80 ft.

The Iowa Malleable Iron Co., of Fairfield, Ia., expects to build an addition to its foundry and annealing room during the coming summer.

The Fremont Foundry, of Fremont, Neb., is being enlarged by an addition 20 x 40 ft.

H. E. Olbrich, of Cedar Falls, Ia., has his new foundry nearly completed.

G. W. Schmidt & Son, of Iowa City, Ia., are building an addition to their foundry and iron works.

The Pease Furnace Co., of Toronto, Canada, have taken out a building permit for a new foundry building to cost $25,000.

GENERAL INDUSTRIAL NOTES.

A company has been formed in Worcester, Mass., for the purpose of leasing the Arnold & Pierce foundry plant for a term of years, and operating it as a general foundry. The members of the company are: Alexander Hall and Alexander Rankin, who have been connected with the Holyoke Machine Co. Plans for opening the plant have been under way for about two weeks.

The Waterbury Farrel Foundry & Machine Co., of Waterbury, Conn., has acquired a controlling interest in the Waterbury Machine Co., of the same city.

Thomas A. Edison is sending out some very interesting matter concerning the cement made at his new cement plant at New Village, N. J. (Postoffice address, Stewartsville, N. J.) When Mr. Edison commenced the experimental work preparatory to the erection of his plant, he decided to try and make the best possible cement that had ever been produced. He claims that at least 85 percent of his cement will pass through a 200-mesh screen, as compared with about 75 percent of other brands. This means that a barrel of his cement contains 10 percent more of available active material than would be found in a barrel of ordinary cement. Accompanying the matter sent out by Mr. Edison there is a chart showing the curves obtained from actual tests of various classes of cement. The curve for the Edison cement was from nearly 1,200 tests during 1904. The results of the other tests are taken from the work of the Philadelphia Department of Public Works and include a large number of tests. In the chart referred to the curve for the Edison cement was well above all of the others.

The Kings County Iron Foundry, of Brooklyn, N. Y., has been incorporated with a capital of $75,000. The directors are Edward A. Calahan, Henry H. Schmittmann, Theodore L.

Herrmann and Margaret A. Loughran, of Brooklyn, N. Y.

The Crist Valve Mfg. Co., New York, is looking for a site with adequate shipping facilities and other inducements for the manufacture of a full line of brass gates and other valves for steam, water and gas. The machinery and tools have already been selected.

The Josiah Ross Mfg. Co., of Buffalo, N. Y., has been incorporated with a capital of $50,000, to carry on a general foundry and manufacturing business. The incorporators are Josiah Ross, Flora B. Ross, John Ryckman and John C. Kingston, of Buffalo.

The McKinney foundry, at Oberlin, N. Y., is again taking on a full force of men, and will operate its plant to its full capacity.

The Forest City Brass Mfg. Co., of Cleveland, O., has been incorporated with a capital of $75,000. The incorporators are John V. Kennedy, H. B. Sawyer, Geo. W. Shaw, Joseph E. Jackering and August G. Ilg.

The Norwalk Mfg. Co., of Norwalk, O., which two years ago succeeded the Norwalk Foundry & Machine Co., has in turn disposed of its foundry department to John Brooks. Aaron Townhill and Andrew Hamilton, of Cleveland, O.

The district offices of the American Steel Foundries, with plants at Pittsburg, Franklin, Sharon, Pa., and Alliance, O., will be moved from Alliance, O., to Sharon, Pa., on July 1.

The Columbus Machine & Foundry Co., of Columbus, O., at a meeting held May 10 elected the following officers and directors: W. C. Richards, president; E. T. Moore, vice president; A. Frederick, superintendent, and E. Hight, secretary. W. C. Richards, E. T. Moore, Joseph Donoghue, Walter Weaver and A. Frederick were elected directors.

Philip Metzger, who was foreman of the American Foundry Co., at Industrial Heights, Toledo, O., has purchased the interests of the various stockholders and will operate the plant.

The Dayton Pneumatic Tool Co., which recently took over the business of the Chicago Tool & Supply Co., is now located in its new plant at Dayton, O. Its present capacity is from 100 to 150 hammers per month though it expects to increase this in order to keep up with the demand.

The Champion Brass Works, of Coldwater, Mich., have commenced operations in a small way and expect to extend their business as fast as conditions warrant. They are fitted up to make brass, aluminum, copper and bronze castings, making a specialty of automobile work and plumbers' goods.

The Allyne Brass Foundry Co., manufacturer of goods for automobiles, has its new plant in Detroit, Mich., running full force.

The South Baltimore Steel Car & Foundry Co., of Baltimore, Md., which now has an authorized capital stock of $1,000,000, is planning to increase the capital stock in order to take care of its rapidly growing business.

Arrangements have been made for the consolidation of the Rock Hill Foundry & Machine Works with the Syleecau Mfg. Co., both of Rock Hill, S. C. The business will be carried on under the name of the latter company. Mr. G. A. Jones is the proprietor of the Rock Hill Foundry & Machine Works, and Messrs. W. S. Lee, Jr., J. B. Sykes and J. C. Cauthen are interested in the Syleecau Mfg. Co.

The Weatherford Machinery & Foundry Co., of Weatherford, Texas, has filed an amendment to its charter, by which it has increased its capital stock from $10,000 to $20,000.

The Gunther Foundry, Machine & Supply Co., of San Antonio, Texas, has filed an amendment to its charter changing its name to the Collins-Gunther Co.

The fire at the plant of the Stockton Iron Works, Stockton, Cal., April 19, was confined within the walls of the three-story brick pattern storage building, and did much damage to patterns. The remainder of the plant was not affected, and work in all other departments was resumed the following morning. The work of replacing the lost patterns will be pushed as rapidly as possible.

The J. W. Paxson Co., Philadelphia, Pa., manufacturer of foundry facings, supplies and equipment, celebrated recently its fiftieth anniversary. In 1855 the firm of J. W. Paxson & Co. was formed, and the business was successfully conducted under that name until 1897, when the J. W. Paxson Co. was incorporated under the Pennsylvania laws. At the present time the company manufactures almost all its foundry supplies and equipment, operates extensive molding sand banks and maintains a fleet of ocean barges for coastwise delivery. The officers are J. K. Bougher, president and general manager; Howard Evans, vice president; H. M. Bougher, secretary and treasurer; U. S. Hibbs, assistant general manager, and S. C. Bougher, purchasing agent.

Harry Haner, of Owego, N. Y., has installed a brass furnace in his iron foundry and is prepared to furnish brass castings as well as iron.

The Eaton, Cole & Burnham Co., of Bridgeport, Conn., maker of gas fittings, has been absorbed by the Crane Bros. Co., of Chicago, Ill. The plant will be enlarged and the working force increased.

The American Locomotive Co. announces that its general offices will be located in the Trinity building, 111 Broadway, New York.

Fuhrman Hardware & Plumbing Co., Elmira, N. Y., has been incorporated to manufacture hardware and hardware supplies. The capital stock is $25,000. The incorporators are: Harry K. Fuhrman, Burton Martin, W. W. Hervey, John C. Dyatt and Chas. S. Gary, all of Elmira.

The Benjamin S. Alder Co., New York City, has been incorporated to manufacture hardware, cutlery, etc. Capital stock, $20,000. The incorporators are: Benjamin S. Alder, 1162 Pacific street, Brooklyn, N. Y.; William W. Crowell, James Tongue, 37 Warren street, New York.

The Crest Valve Mfg. Co., New York City, has been incorporated to manufacture metals, valves, etc.; capital, $50,000. The incorporators are: William G. Green, William H. Bond, Brooklyn; Forbes J. Holland, New York City.

The Geo. A. Hogg Iron & Steel Foundry Co., of Pittsburg, Pa., has purchased several acres of land at Fourteenth street and the Belt Line R. R., Economy, Pa., and it is announced that the Vulcan Machine & Foundry Co. and the company above mentioned will unite and erect a new plant at Economy to cost in the neighborhood of $200,000. The merging of the two corporations has been completed and they will be among the first to locate at what has been planned as an industrial center.

Notice has been published that application will be made for a charter of an incorporation to be called the Urick Foundry Co., Erie, Pa., for the manufacture and sale of castings from iron or steel. The following persons are interested: Chas. H. Urick Sr., F. H. Dixon, Wm. J. Urick, Chas. H. Urick Jr. and Earle A. Urick.

The National Foundry Mfg. & Supply Co., of Williamsport, Pa., is moving into its new quarters, which were formerly used by the Larzalere Machine Co. The plant has been entirely remodeled and the size of the foundry increased by a large brick addition.

The W. W. Sly Mfg. Co., of Cleveland, O., are building a new shop on Train street near the Big Four tracks, which they expect to have ready July 1st. They report that they have booked as much work in the first four months of this year as they did in the entire previous year. Some idea of the work which they are doing may be had from the fact that they are now making tumbling barrels capable of cleaning castings weighing two tons each.

The Conway Steel Range Co., of Toledo, O., has been incorporated with a capital of $100,000, the incorporators being John Conway, John H. Fitzpatrick, Adam J. Ulrich, Grant L. Ulrich and Frank E. Ulrich. This company has been in business for some time and the incorporation is merely a change from a partnership to a stock company.

The Canton Stove Mfg. Co., Canton, O., recently incorporated, does not expect to begin active operations until early fall. The present expectations are that the company will adapt existing buildings to its purposes. The company has not yet made a complete schedule of its equipment, which will be similar to that of other modern plants for the manufacture of stoves. The company will manufacture a few special styles of stoves, which will be sold direct to the user. Earl V. Coulston, who will manage the business, has been for the past four years sales manager of the A. J. Lindemann & Hoverson Co., of Milwaukee, and previous to that was an assistant in the same line for the Cribben & Sexton Co., Chicago. His experience in the stove business began about 16 years ago at Royersford, Pa., where he served both the Buckwalter Co. and Floyd, Wells & Co.

Mr. A. P. Head, the London representative of the Wellman-Seaver-Morgan Co., of Cleveland, O., has just completed a tour round the world and has established the following subagencies for the Wellman-Seaver-Morgan Co. Melbourne, The Australian Metal Co., as Australasian agents, with the following branches; New Zealand, The Gilbert Machinery Co., Wellington; Queensland, James Stothert, Brisbane; N. Queensland, James Croker, Mackay; New So. Wales, W. R. Laidley, Sydney; So. Australia, James S. Fraser, Adelaide; W. Australia, A. E. Thomas, Koolgardie; Tasmania, Lindsey Tullock, Launceton.

In India the following agents representing the presidencies of Bombay, Bengal and Madras, have been appointed: J. Harper, Calcutta; Frank Harrison, Bombay; W. H. Oakes, Madras.

The National Furnace Appliance Co., Columbus, O., has been incorporated by M. S.

Seibert, E. S. Baldwin, G. F. Tinkman, L. T. Zimmerman and H. A. Clark. The capital is $25,000.

The Buckeye Foundry Co., of Cincinnati, O., is to be dissolved as a corporation and formed into a partnership by Wm. Gilbert and Chas. Lang, these two being the only remaining stockholders. The business will be conducted in future under the name of Buckeye Foundry.

The Mason Heater Co., of Bellaire, O., which has been in the hands of a receiver for some time, has its affairs straightened out and is to be reorganized with a capital of $25,000 under the name of the Mason Heater & Foundry Co.

The Electric Adding Machine Co., Cleveland, has been incorporated. The incorporators are: W. S. Rogers, M. R. Cox, C. W. Pattison, C. C. Wise and A. W. Mayers. Capital stock, $50,000.

The Loveland Foundry, Loveland, O., began operations recently with a force of fifteen men and expects to increase its capacity as the demand increases.

The Evansville Foundry Association, of Evansville, Ind., has been incorporated with a capital of $100,000. The incorporators are: Fred Eggert, Adam Jutzi and Chas. F. Diekmann.

The F. M. Hicks Locomotive & Car Co., Chicago, with plant at Chicago Heights, has purchased the plant of the Aermotor Co., of Chicago Heights, with the 20 acres of ground originally belonging to the plant and an additional 20 acres, giving ample room upon which to develop large car works. It is the purpose of the company to build and repair coaches and cars in the new plant, and enter more largely into the building and repairing of locomotives.

The Twin City Malleable Iron Range Co., of Urbana, Ill., is securing equipment for a foundry, so that it will be able to make all of its castings in Urbana.

The Commercial Club, of Menominee, Mich., is promoting a plan to sell $100,000 first mortgage bonds for the purpose of adding a steel casting plant to the works of the Prescott Co. in that city. There seems to be a good prospect that the bond issue will be subscribed by the people of Menominee.

The Capital Castings Co., Lansing, Mich., has been incorporated for the purpose of manufacturing castings and doing a general foundry business. The authorized capital stock of the company is $15,000, of which $8,350 has been subscribed.

The Lusk Foundry Co., Ltd., Grand Rapids, Mich., has been incorporated for the purpose of carrying on a general foundry and machine shop business. The company has an authorized capital stock of $10,000, of which $5,450 has been subscribed and $4,700 paid in in cash and $750 in property.

The Penn Foundry at Duluth, Minn., which has been idle for some time, is once more in operation casting pipe.

A. M. Sanders & Sons, of Reedsburg, Wis., have their foundry in good working order and are prepared to supply castings for local requirements.

At the annual meeting of the stockholders of the Joseph Dixon Crucible Co., Jersey City, N. J., the old board of directors was unanimously re-elected. The board of directors reelected the following officers: Edw. F. C. Young president; John A. Walker, vice president and treasurer; George E. Long, secretary.

The South Pittsburg Foundry Co., South Pittsburg, Tenn., maker of stoves, commenced operations on April 28. The officers of the company are: T. G. Garrett, president; A. A. Cook, vice president; and J. J. Bowers, secretary.

The Sheffield Cast Iron Pipe & Foundry Co., of Sheffield, Ala., has been organized with a capital of $500,000, $350,000 of which has been already paid in. The officers are: J. W. Worthington, president; W. U. Parsons, treasurer; J. G. Aderton, auditor; and J. W. Worthington, S. B. McTyler, and S. McGaughy, directors.

The foundry of the Hardie-Tynes Mfg. Co., of Birmingham, Ala., which was destroyed by fire March 12, has been rebuilt, with an increased capacity, and was placed in operation on May 1.

The New Bern Iron Works, of New Bern, N. C., has been incorporated with a capital of $20,000, by W. A. McIntosh, E. Williams and W. T. Brinson. The company intends to carry on a general iron foundry and machinery business.

The Johnson City Foundry & Machine Works, of Johnson City, Tenn., has been incorporated recently, with the following officers: G. W. Sitton, president; C. V. Cross, secretary and treasurer; and F. W. Baum, superintendent.

Ed. Hay, of Portage la Prairie, Manitoba, has sold his foundry to F. W. Clayton, and the latter has taken over the management of the plant.

Alphabetical Index to Advertisers.

THE FOUNDRY

Vol. 26, No. 5. *CLEVELAND, OHIO, JULY 1905.* *Whole No. 155*

Meeting of the American Foundrymen's Association in New York, June 6, 7 and 8.

The American Foundrymen's Association, with its affiliated branches, held its annual meeting in New York, June 6, 7 and 8, with headquarters at the Murray Hill Hotel. Most of the sessions were held in the Grand Central Palace, Lexington avenue and 43d street, though the morning and afternoon sessions on Thursday were held at Columbia University.

Business Meeting of the Associated Foundry Foremen.

The Associated Foundry Foremen as usual held their business meeting on the evening previous to the convention in the Grand Central Palace. This meeting was called to order by President Chas. H. Thomas, Secretary F. C. Everitt being in his place. There was an unusually good attendance and the business, including the adoption of the new constitution, kept the members busy until nearly midnight.

C. H THOMAS.

MINUTES.

The third annual meeting was called to order 8:45 p. m. June 5th, at the Grand Central Palace, President Chas. H. Thomas presiding.

The minutes of the last meeting were read and approved.

The president then appointed the following to act as a committee on nominations of officers for the following year: A. T. Williams, Philadelphia, Pa., chairman; W. S. McQuillans, So. Norwalk, Conn.; Geo. Martin, Ossining, N. Y.; E. B. Gilmour, Peoria, Ill.; S. M. Williams, Elizabeth, N. J.

The secretary's report was read and approved, after which, Henry M. Lane, editor of *The Foundry,* being perfectly familiar with the progress of the Foremen Patternmakers' Association, gave a very interesting report on the work of the Association during the last year, and stated that the prospects for a successful future were very encouraging.

The president then called for the reports of the local associations. Owing to the absence of five of the representatives only three reports were given, namely: New York, by S. M. Williams; Cleveland, by W. H. Nicholls, absent H. M. Lane, reported; Philadelphia, by W. O. Steele, all of whom reported excellent progress on the work of their associations.

The report on constitution was then given by the secretary in the absence of Mr. David Reid, chairman of the committee. A lengthy, but valuable discussion resulted in the adoption, with a few necessary changes, of the constitution as a whole, the construction of which was made to harmonize more with the object and transactions of the association. The report was then accepted and the committee discharged with thanks.

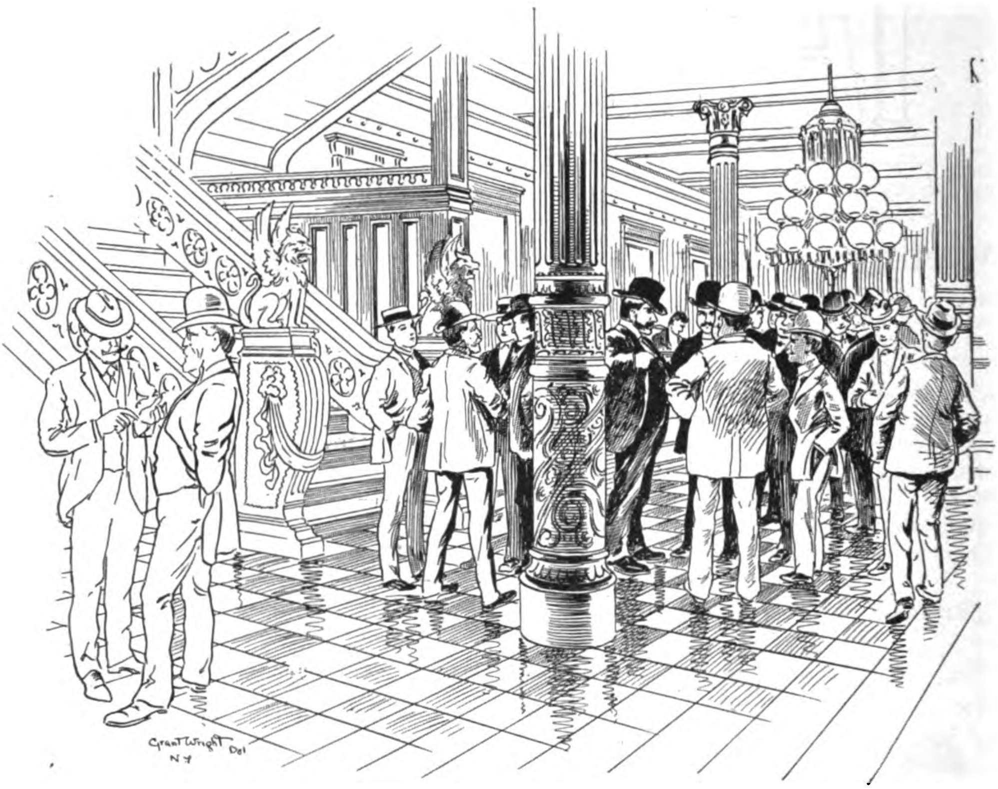
The report of the committee on charters was then read. Mr. Williams moved, and Mr. Gilmour seconded that the report be accepted and the committee discharged with thanks.

The report of committee on the "Henry Hansen Memorial" followed. Mr. Stickles moved and Mr. McPhee seconded that the report be accepted and the committee discharged with thanks.

Mr. McPhee moved and Mr. A. T. Williams seconded that the past presidents be elected to honorary membership. Motion carried. Mr. Arch. M. Louden, and Mr. C. H. Thomas being elected.

The report of the committee on nominations was then received and following officers nominated: President, Mr. David Reid, Canadian Westinghouse Co., Hamilton, Can.; first vice president, W. H. Nicholls, Hill Clutch Co., Cleveland, O.; second vice president, Hugh McPhee, Eaton, Cold & Burnham, Bridgeport, Conn.

Vice presidents for Erie Assn., W. F. Gru-



LOBBY OF MURRAY HILL HOTEL, CONVENTION HEADQUARTERS.

nan, Erie City Iron Works, Erie, Pa.; Milwaukee Assn., name to be furnished later; Chicago Assn., Mr. Thomson, Link Belt Co., Chicago, Ill.; Indianapolis Assn., W. S. Keller, Hetherington & Berner Co.; New York Assn., C. H. Thomas, New York City; Cleveland Assn., A. L. Hott, Interstate Foundry Co., Cleveland, O.; Philadelphia Assn., A. T. Williams, Enterprise Mfg. Co., Philadelphia, Pa.; Hamilton, Can., Assn., Frank Reid, D. Moore & Co., Hamilton, Can.; secretary-treasurer, F. C. Everett, The J. L. Mott Iron Works, N. Y.

Upon motion of the Association the secretary then cast the ballot and the above officers were elected.

On motion, the meeting adjourned 11:30.

Respectfully submitted,
T. C. Everitt, Secretary.

New Constitution of A. F. F.

The Constitution and By-Laws as amended and revised by the committee appointed by the Indianapolis convention, June, 1904, and adopted at the New York convention, June 5, 1905.

CONSTITUTION.

ARTICLE I.

Name.

Section 1. The name of this association shall be the "Associated Foundry Foremen."

Sec. 2. The object of this association shall be solely educational. The same to be accomplished by collecting such information as will be of benefit to its members and to general foundry practice, the presentation of papers on appropriate subjects for discussion and the publication of such literature as may be deemed expedient.

Sec. 3. The Society shall neither endorse nor recommend any product consumed in foundries. This does not interfere with the members expressing their opinion on such subjects as affect the trade in general.

Sec. 4. This Society will work with and aid the American Foundrymen's Association, in establishing uniform methods and actions among foundrymen, as far as possible.

ARTICLE II.

Membership.

Section 1. The membership in this society shall consist of the two classes—Active and Honorary.

Sec. 2. Any person who is, engaged as manager, superintendent, foreman or assistant foreman of a foundry, foreman coremaker or foreman patternmaker may become an active member. Any honorary member may become an active member on recommendation of the board.

Sec. 3. Any person who has held any of the above positions, or whose knowledge or service may be of value to this society may become an honorary member.

ARTICLE III.

Officers.

Section 1. The officers of this association shall consist of a president, two (2) vice presidents at large, together with a vice president from each local association, and a secretary-treasurer who shall jointly form the executive board of the association. The office of secretary shall be considered the headquarters of this association.

Sec. 2. The two vice presidents at large shall be elective officers and the presidents of the local associations shall be the remaining vice presidents.

ARTICLE IV.

Meetings.

Section 1. The annual meeting shall be held at the same time and place as the American Foundrymen's Association, arrangements for same to be made by the executive board, and the members notified at least three (3) months in advance of said meeting. Twenty-five (25) members shall constitute a quorum.

Sec. 2. Additional meetings may be called by the secretary at the written request of twenty-five (25) members, at the time and place stated by them.

Sec. 3. Meetings of the executive board may be called by the president or by any three (3) members of said board, and five (5) shall constitute a quorum.

ARTICLE V.

Amendments.

Section 1. This constitution and by-laws may be amended at any annual meeting by a two-thirds vote, by letter ballot.

Sec. 2. Notice of proposed amendments must be in writing and sent to the secretary at least ninety (90) days prior to the meeting. Such amendments will be printed and mailed to each member with letter ballot to be acted upon at the next meeting.

BY-LAWS.

ARTICLE I.

Election of Officers.

Section 1. The president, vice president and a secretary-treasurer shall be elected by ballot at the annual meeting, a majority of those voting being necessary to elect and will hold office for one year or until their successor shall have been elected or appointed.

Sec. 2. No member in arrears for dues shall be eligible for election.

Sec. 3. The officers elected shall assume their duties immediately upon receiving notice, by letter, of their election. In the case of a vacancy occurring in any office during the year, the executive board shall fill the vacancy within one-month from the time it occurs, to complete the unexpired term.

ARTICLE II.

Duties of Officers.

Section 1. The president shall have general supervision over the affairs of the society, preside at all meetings and perform such other duties as usually devolve upon a presiding officer.

Sec. 2. The vice president shall perform the duties of the president during his absence or in case of a vacancy in said office.

Sec. 3. The secretary shall be, under the direction of the president, the executive officer of the society. He shall conduct the correspondence of the society and endeavor to obtain such information for the members thereof as will further their interests. He shall keep a complete record of all members and the class of work in which they are engaged. He shall see that moneys due the society are carefully collected and transferred to the custody of the treasurer. He shall carefully scrutinize all expenditure and use his best endeavor to secure economy in the administration of the society. He shall notify any member who is in arrears to the society and furnish the president with a list of those who are three (3) months in arrears. He shall endeavor to give each vice president a complete list of members in his district, both active and honorary, and furnish at the annual meeting a written report of the year's proceedings.

For his services he shall receive such compensation as may be decided upon by the executive board. The amount of said compensation not to exceed 10 per cent of the annual receipts of the Association.

Sec. 4. The treasurer shall have charge of all moneys and pay all bills, which have been approved for payment by the secretary. He

GROUP OF A. F. A. AND A. F. F. MEMBERS AND FRIENDS TAKEN AT COLUMBIA UNIVERSITY, JUNE 7, 1905.

shall keep regular accounts of all receipts and expenditures, which shall be open to the inspection of the executive board at all times.

Bond shall be furnished, the amount and arrangement for placing said bond shall be left to the discretion of the executive board.

Sec. 5. The executive board shall manage the affairs of the society to the best of their ability.

ARTICLE III.

Admission to the Society.

Section 1. All applications for membership shall be made on a blank furnished by the society and addressed to the secretary, or the same may be effected through the respective local associations. It shall be accompanied by the amount of the annual dues.

ARTICLE IV.

Dues.

Section 1. The annual dues of active members shall be two (2) dollars, payable in advance.

Sec. 2. Honorary members shall not be subject to the payment of dues.

Sec. 3. No member will be entitled to the services of the society beyond the period for which his dues are paid.

Sec. 4. Every member shall, upon the payment of his annual dues, receive a certificate of membership, which will constitute an official receipt and be a primary guarantee of membership in the Associated Foundry Foremen. It shall state the date of expiration, at which time a new membership card shall be issued to the holder upon payment of his annual dues.

Sec. 5. The executive board may, for sufficient cause, excuse from payment of annual dues any member who from ill-health, advanced age, or other good reason assigned, is unable to pay his dues.

Sec. 6. Every person admitted to the society shall be considered as belonging thereto and liable for the payment of all dues until he shall have resigned, been expelled, or have been relieved by the executive board.

ARTICLE V.

Charters.

Section 1. The object of the charters is to have all local associations affiliate with and have each and every member of said locals members as individuals of the national body in order to increase the interest and concentrate the workings of the various locals to the sole object of the national association.

Sec. 2. The body of the charter is as follows:

This is to certify that the Foundry Foreman's Association of..........is a section of the Associated Foundry Foremen of North America and being members by right of this charter are entitled to all the benefits and privileges accrued therefrom, the same being controlled by the constitution of the national body together with all local by-laws set aside for their guidance.

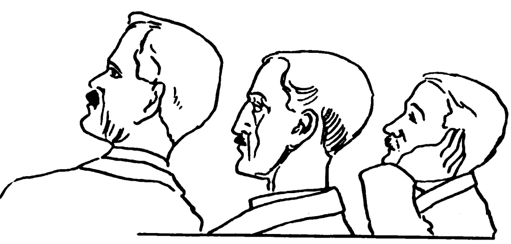
In testimony whereof are hereunto affixed the seal and the names of the president and secretary of the Associated Foundry Foremen of North America.

This........day of...................190..

No...... ....President

(Seal.) ....Secretary

Sec. 3. On application of five or more members to form a local association, a charter will be granted, said charter empowering said local to transact such business, in their respective localities, as will be of benefit to the progress of the society, and to examine and receive members. The names of said members to be forwarded with the regular fee, two (2) dollars, to the national secretary within ten (10) days.



AN INTERESTED TRIO.

Sec. 4. The charters will remain in force as long as the..........local affiliates, and its members remain in good standing with the national association.

ARTICLE VI.

Discipline.

Section 1. The executive board shall have power to hear and determine upon the conduct of its members for any infraction of its rules and regulations and for professional misconduct calculated to affect the good name of the society or interfere with order and harmony.

Their findings shall be laid before the society at the next meeting for final action.

ARTICLE VII.

Order of Business.

Section 1. The order of business to be observed at the annual meetings shall be as follows:

1. Reading of minutes of the last meeting.

2. Announcement by the president of special committees as follows:
   a. Committee of five (5) to nominate officers for the following year.
   b. Committee of three (3) to audit the accounts of the secretary-treasurer.
3. Reports of officers and standing committees.
4. Unfinished business.
5. New business.
6. Report of special committees:—No. 2 a and b.
7. Election of officers.

ARTICLE VIII.

Amendments.

Section 1. These by-laws may be amended under the rules stated in article 5 section 1 of the constitution.

OPENING SESSION OF THE A. F. A.

The tenth annual meeting of the American Foundrymen's Association convened at the Grand Central Palace on Tuesday morning, June 6. The association not being the guest of either the city or the local foundrymen, the usual opening formalities were dispensed with. President Chris J. Wolff called the meeting to order promptly at ten o'clock

President's Address.

"The most instructive and pleasurable of our public assemblies are those which engage all of our members in the association's common good. This being our tenth annual convention, we justly look back with pride on the vast strides that have been made in an educational way by our organization since its inception in Philadelphia in 1896. Among the advantages of this association to its members, and by no means the least, is the formation of agreeable acquaintance.

CHRIS J. WOLFF.

True, we have not obtained the highest desire of some, but no candid estimate of us by the outside world has fallen below excellent.

Our aim has always been to help educate the world as far as we can in our chosen field. The good work of this organization has not all been accomplished without criticism, for associations, like men, should not expect praise without envy until they are dead. The present time is one characterized by organization for mutual support in whatever direction this may tend. Only that organization which gives more than it receives will survive and really be useful to the State. In the foundry industry only those organizations which are founded on the wide open door principle, for interchange of thought and experience, will serve the country best. Our own association invites three factors in the trade—the owner, the superintendent or foreman, and the molder, patternmaker or other workman—into full membership, giving them all equal rights and the opportunity to get acquainted, to exchange views and experiences in the carrying out of every part of the foundry program. For that reason we invited the foundry foreman's organization to become part of us, and welcomed them as such, after we had satisfied ourselves that they were an educational institution only and had no ulterior motive antagonistic to this fundamental idea of ours. The results have been most gratifying It would be advisable for our association to let the foundry owners know by circular letter or otherwise of the foremen's association and have them encourage their foremen to join it. Every foundry owner who has taken the trouble to get where he can learn something relative to advanced ideas in foundry practice has added to the value of his plant as a producer. Every foreman who has opened his mind to what other people have found to be good becomes a better employe and loses the predilections tying him to the narrow views of the foundry floor. Every molder who wishes to learn the details of all parts of the foundry business puts himself in line for speedy promotion. We therefore invite every one connected with the foundry to join our organization and help to build it up on these lines. Especially we invite the foundry owner to get out of his shell and join on the common ground with his employes, where he can learn again what he has often forgotten since he himself graduated from the floor. He will find himself repaid by an increase of loyalty on the part of his employes through the feeling of mutual sympathy and interest engendered by the principles of our association.

"In my anxiety to respond promptly and fully to the confidence which you placed in me I urged such measures as the objects of the association provided for or conditions justified, and have ever stood ready to execute the will of the majority. It will be observed that, though the president is held responsible for every policy and act of the association, yet his authority is absolutely dependent on the support of the officers and committees. Differences of opinion or even disagreements on methods should not always be regarded as opposed to the association's interests, and in this spirit I most heartily appreciate the co-operation and assistance afforded me. My sincere thanks are hereby due and tendered to each of the officers and members for the earnest devotion with which you have supported my efforts."

Secretary's Report.

A very active year of Association work is now behind us. The foundry industry is truly waking up, and he who doubts it, may simply glance at the programme of the present meeting to satisfy himself that this is so. Nevertheless, this does not mean that we have received the support from the industry that is due our work and ideals. The disturbances of the foundry world have been frequent and severe. The changes in organization of the individual plants have been many. New blood is coming in everywhere, and with it a closer understanding of expense and income, good and bad methods of work, and a restlessness on the part of the buying public, which requires the closest study on the part of the gray iron founder, to overcome.

THE SECRETARY READS HIS REPORT.

Our steel casting and malleable plants are full of orders today, but the same cannot be said of the iron foundries. Hence attention is given in a greater measure than ever to improving the quality of the foundry output, and hence science is playing a greater part in our work than we might suppose.

Many of us will recall the discussion on the purchase of pig iron we had while in Buffalo. It was just the year of the turning from fracture buying to chemical analysis. Today what founder does not scrutinize the analysis cards of his shipments to satisfy himself that all is well, even if he holds to the old way of doing business.

The trade school question is coming up stronger and more persistent all the time, and well can we wish it success and that it may come quickly. The Government itself is waking up to one of its functions, and the Bureau of Standards promises to become a most important aid in helping to eliminate the uncertainties besetting details of manufacture, where all are concerned equally. Even today the question of standards, such as we have been preparing for the chemist and foundryman, is being studied by this splendid undertaking of the Government; and we wish it all success.

In view of the meagre support given our efforts to get out fuller transactions, the Journal of the Association had to be abandoned, and occasional issues of papers and discussions substituted therefor. No one regrets this more than your secretary, though the burden the Journal entailed on all that contributed so ably to its literary and technical success, was a heavy one.

Through the generous arrangement with the *Foundry*, whereby our papers are printed at cost, and can thus be distributed cheaply to the membership, we have succeeded in removing the debt of the Association, and the financial statement is now as follows:

Income from dues, sales, interest, and standardizing bureau		$2,208 85
Expenditures:—		
Debt of last year	$ 995 04	
Printing	52 20	
Postage	217 00	
Transactions	135 15	
Expense	5 00	
Secretary's office	400 00	
Standardizing bureau	337 52	
Total		$2,141 91

leaving a balance of $66.94 to our credit.

An analysis of the expense will show a few things of interest to us. First of all the cost of the transactions has been very low. This unfortunately also means that our members get much less than formerly, and hence the annual dues of the Association should be materially decreased. The experiment of giving a better Journal having failed through lack of support, and the fact that trade journals are giving much better material now than heretofore, precludes any attempt, or should do so, to go back to the old method again. There are today more journals devoting space to foundry matters than formerly, and they have the advantage of advertising matter to offset the printing costs, which is something we as an association should not go into. I would therefore strongly urge a reduction of the annual dues to even as low as $3.00, thus giving our present members a better equivalent, and also tending to increase our membership.

From the item of postage, it will be seen that with very little expense for the transactions, the correspondence has increased enormously. Your secretary's office easily reflects the waking-up process above referred to. If all the foundrymen who have requested advice, or wanted information could have been induced to become members, we would have a better showing in that respect than is the

MOREHOUSE AND FIELD TALK OVER THE FAN QUESTION.

case. It seems, however, that the idea of supporting an association which works hard for just such betterment of the industry, is considered secondary to the immediate gain derived by asking, and taking the chances of getting the information or advice for nothing. Such, however, is life, and only the ideals we subscribe to, of bettering the industry at the expense of our time and energy, whoever may profit thereby, hold us above discouragement and giving up the work in despair.

The bright side of the problem lies in the universal recognition of the work of the Association. England and Germany have organized similar associations, freely following our lines of endeavor.

Our membership today is 294, or 16 more than last year, which in spite of the drain on the resources of foundrymen demanded by other movements, speaks well for our loyalty to the cause. Even India is represented in our membership list. The Association, however, should be much greater numerically, for there are nearly 5,000 foundries to draw from, and surely most of them can stand a little more knowledge generously distributed about the place.

You will receive separate reports from the Foremen's and the Metallurgical Sections. These movements are now rapidly approaching a stage when they can act independently of us and we are proud to have assisted in interesting these branches of the industry in studying their field closely and finding betterment and success therein.

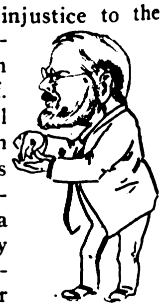
I would therefore recommend the continuance of the work as heretofore, by committees, the printing of the transactions under the favorable arrangement with the *Foundry,* the reduction of the dues, and a continued effort on the part of our members to assist the secretary in increasing the interest and support of the industry in our chosen work.

Respectfully submitted,

RICHARD MOLDENKE, Secretary.

Pattern Insurance.

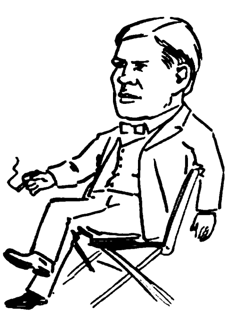
It will be remembered that the committee on pattern insurance reported a blank form for taking care of patterns last year and outlined a general scheme for pattern insurance. The report of the committee this year was read by Dr. Moldenke, in the absence of the chairman, Frederick Conlin, of Bethelehem, Pa. In the course of his remarks he said the insurance interests of the country have an agreement by which is case of fire they never pay more than ten per cent of the value for the loss of patterns, which is often an injustice to the foundryman, because frequently the patterns are worth more than the foundry itself. He recommended that all members of the association press the insurance interests harder to get this injustice corrected, and suggested that a system be substituted whereby losses would be paid on a depreciation of 5 per cent per annum for metal patterns, and 10 per cent for wooden patterns, the date of the last use of the pattern to be that from which the depreciation is dated. An illustration in point was made of the system in vogue on railroads for insuring rolling stock,



PULLEY JONES

in which the value of the car is depreciated each year it is in service.

The report of the committee on coke tests was also made by the secretary. H. E. Field, of Mackintosh, Hemphill & Co., Pittsburg, drew up the plan of operation and Dr. Moldenke carried on the tests. A series of cokes which were made at the exposition were used to melt iron under standard and identical conditions in the cupola of the model foundry at the World's Fair. The results of the 19 tests made will be published by the Government later. The secretary added that the lesson to be learned was that if every foundryman watched closely the method of charging and adapting the cupola to the particular quality of coke used they might get much better results than they do, and it would be no longer necessary to swear by Connellsville coke as the only thing to use. For instance, a very light coke which was tried burnt out so quickly in the bed that the iron being brought in contact with the blast burned away over 60 percent. On the other hand, a very heavy coke took so long to burn that very unsatisfactory results were obtained.


L. G. BLUNT.

The committee on sand beds for molds reported progress and was continued.

Report of Committee on Foundry Trade Schools.

The chairman of the committee on trade schools was absent, but the report was presented by W. H. MacFadden, of Pittsburg. The report dealt wholly with the Carnegie Technical School, and was as follows:

The Carnegie Technical Schools expect to have ready for operation this fall a portion of its buildings. Among the first buildings to be erected will be that one which contains the foundry. This foundry will be equipped with the best modern appliances, and supervised by an instructor of experience in both the practical and theoretical side of foundry practice, aided by such assistants as he may need.

Two courses will be established; a day course for the students in Applied Science, who wish to ultimately specialize in one of the engineering branches, or in foundry practice. Their instruction will be thorough, on the theory and practice of molding, construction of the cupola and furnaces, the technology of the fuels, the metallurgical chemistry underlying the mixes, construction of the flasks, the making of cores, and such familiarity with foundry equipment in general as will enable them to see the underlying principles on which they operate.

In addition to the above technical instruction, general instruction will be given in physics, chemistry, mechanical drawing, English, mathematics, costs and business organization. A limited number only can be admitted this year for this course of instruction.

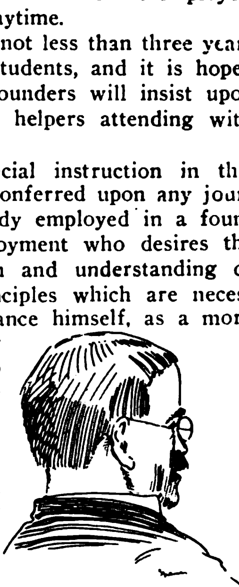
The applicants for admission will be tested by entrance examinations.

The evening course in this foundry covers, in the same number of lesson hours and therefore a greater number of years, practically the same ground that is covered in the technical branches, but merely deals with the general branches in an elementary form. This night course for instruction in molding and foundry practice is projected primarily for the benefit of those already engaged in that occupation. Preference will be given to those who are employed in foundries in the daytime.


"YOU SEE IT'S JUST THIS WAY."

The course will be not less than three years in length for night students, and it is hoped that the employing founders will insist upon their apprentices and helpers attending with regularity.

Admission for special instruction in this night course is also conferred upon any journeyman molder already employed in a foundry, or out of employment who desires the theoretical instruction and understanding of the fundamental principles which are necessary for him to advance himself, as a more skillful molder or to raise himself to the position of foreman of molders. This night course of instruction will be thorough and consist largely of laboratory constructions, directly attached to the foundry, or in the foundry itself.


DAVID SPENCE.

In no instance will emphasis be laid upon the student applicant to pass a difficult entrance examination as it is the opinion of the school authorities that the employers have already examined and qualified to the fitness of the applicant, since said student is already in the employ of said manufacturer.

A series of general lectures on sand, on iron, graphite, silica and on basic open-hearth steel, brass, copper, and other castings will form a part of the instruction, and these lectures all who are interested can attend.

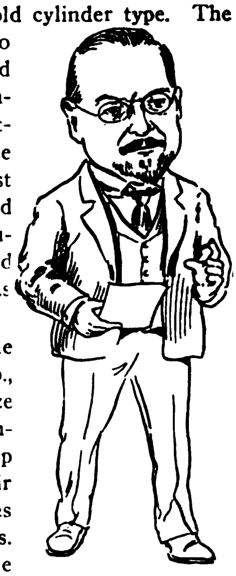
Blowers, Piping and Cupolas at the Plant of the Michigan Stove Co.

After all the business had been transacted on Tuesday morning, Mr. W. J. Keep, of Detroit, Mich., read his paper on "Blowers, Piping and Cupolas at the Plant of the Michigan Stove Co." This paper provoked considerable discussion.

W. J. KEEP ANSWERS A FEW INQUIRIES.

L. G. Blunt, of the Westinghouse Electric & Mfg. Co., Pittsburg, asked if Mr. Keep had noticed the oxidation of silicon and carbon in the cupola at the melting ratio he mentioned, and whether he had kept any record of the losses. Also if he found by varying the amount of fuel and blast whether a cheaper grade of pig iron could be used. Mr. Keep replied that they had made some very accurate tests on a week's work on the melting losses only. He called attention to the fact that in a stove foundry he found it very difficult to keep any record of the losses, mentioning that they swept the foundry every night, picked up all the scrap, riddled the sand, and extracted the chippings, etc. Every day's record was kept by itself, so that they knew absolutely all the time what they were doing. In this way, he found that there was about 4½ percent loss from all sources. The loss of silicon was only about ¼ of 1 percent, and the carbon loss very slight.

W. A. Jones, of Chicago, wanted to know what cupolas Mr. Keep used, and was told that they were of the old cylinder type. The same gentleman also asked if any data had been kept as to a comparison between the outlet of the tuyeres and the capacity of the blast pipe. He was informed that the area of the tuyeres is about two and three times as large as that of the blast pipe.



J. B. NAU.

David Spence, of the Greenlee Foundry Co., Chicago, asked the size of the tuyeres as they enter the cupola. Mr. Keep answered that in their No. 3 cupola the tuyeres are almost continuous. Nos. 1 and 2 cupolas, he added, have tuyeres 4½ in. by 7 in., each cupola being equipped with sixteen.

Notes on Pipe Foundries and Suggestions on Metal Mixers for Foundry Purposes.

Mr. J. B. Nau, of New York City, next read his paper entitled "Notes on Pipe Foundries and Suggestions on Metal Mixers for Foundry

MRS. CLARK FISHER AND DAUGHTER.

Purposes." While this paper contained a large amount of matter which was very interesting and which caused some discussion in the lobbies afterward, there was no official discussion upon it.

Retort Coke Melting Ratios.

C. M. Schwerin, of the Milwaukee Coke & Gas Co., Milwaukee, Wis., followed with his paper on "Retort Coke Melting Ratios." This paper proved very interesting to the members and was followed by considerable discussion. L. G. Blunt, of Pittsburg, asked if by increasing the quantity of coke on the charge from one to ten to one to seven, in both cases putting in a good bed, whether a cheaper grade of pig iron could be used. Mr. Schwerin's answer was that after a certain amount of coke had been put in there was no gain, but for very light work by pouring the iron hot, it had less tendency to take a sand chill. "It is true," he continued, "that a softer grade of iron can be used when running a high bed and keeping the melting points up than if the melting points were allowed to go too near the tuyeres by running a low bed or not putting sufficient coke on the charges, as the blast will oxidize the iron, making it harder."

C. M. SCHWERIN

Production Costs.

Mr. Ellsworth M. Taylor of Boston next read his paper on "Production Costs." Mr. Taylor's remarks were heartily applauded and Mr. David Spence, of Chicago, told of the method of keeping track of costs in vogue in the plant of which he is superintendent. It was thought expedient, however, to reserve further discussion of this subject for Thursday, when more members would be present.

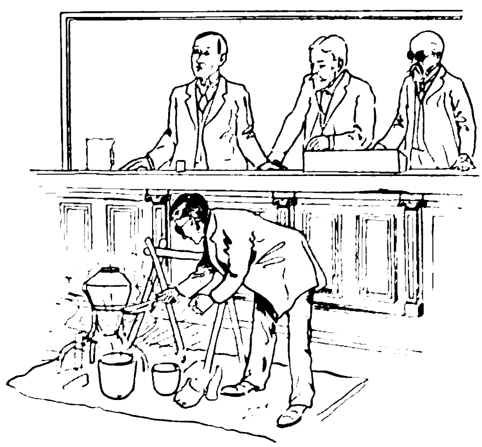
ELLSWORTH TAYLOR.

Making a Molder.

Henry M. Lane, of Cleveland, next read the paper entitled "Making a Molder," which was on the program for Wednesday afternoon but which was read and discussed Tuesday morning, so as to be sure and finish the discussion on other papers later in the week.

In the discussion that followed, August T. William, Philadelphia, told the convention that the firm with which he is employed undertook some time back to put into operation a plan to educate the boys and men in its employ

SOME OF THE REPRESENTATIVES OF THE PRESS.



A DEMONSTRATION OF THERMIT.

along the lines suggested by Mr. Lane, and that the attempt was a signal failure. Mr. William was of the opinion that the influence of labor unions upon apprentices destroyed in a large measure the efforts of the employer in his educational work. The fact also that so many concerns confined their shops to the manufacture of specialties prevented the teaching of the molder's trade in all its details. To make a competent workman this speaker thought that manufacturers should adopt a plan by means of which a boy could, after learning all the details of the work in the shop of his first employer, be transferred to another shop, where a different product was made.

H. M. LANE ANSWERING QUESTIONS.

L. G. Blunt told of the technical school maintained by the Westinghouse Electric & Mfg. Co., at Pittsburg, for the benefit of its employes, the instructors in which were the best engineers in the employ of the company. In this institution, three classes are maintained. One of two years, one of three years and one of four years. The first mentioned is intended for college graduates, and is a sort of post graduate course; the second is for boys and men who have had a common school education, and the four-year course for those whose education has been very limited. The latter students pass through every department of the electrical company's works, learning the details of each thoroughly. Finally, they reach the dynamo test department, which is the senior class. By this time, they have received an excellent training in the manufacture and operation of electrical machinery and can be classed as first-class workmen.

In answering the above, Mr. Lane states that Mr. William evidently misunderstood the paper, as it would be impossible for any ordinary manufacturing concern to put into effect just the course outlined in the paper without going to a very great expense, and without the necessary books and preliminary training the experiment would be almost sure to fail.

American Pig Iron Warrant System.

The session Tuesday afternoon was opened with a talk on the latest developments of the American Pig Iron Warrant System for foundry use, by George H. Hull, of New York. At the close of his talk Mr. Hull answered a number of questions concerning the working of the system.

Foundry Foremen's Session.

After the paper on Pig Iron Warrants President Wolff turned the meeting over to the Associated Foundry Foremen, vacating the chair to C. H. Thomas, president of the section. After a brief speech by Mr. Thomas Secretary Everitt read his report for the year

GEO. H. HULL TALKS ON PIG IRON WARRANTS.

Report of the Secretary of A. F. F.

The close of another year brings us to a statement of the conditions and affairs of our association, and the general conditions of shop affairs. The year ending June 6, 1904, found us with 177 members and five local associations. During the past year the membership has increased to 278 and we have added three local associations to our number.

The organization of the Foreman's Club of Cleveland, July 8, 1904, has attracted no little attention on the part of the association and its friends. They have been, and are, doing excellent work in their locality and deserve recognition as being among the most progressive of the local associations.

No less can be said of the Associated Foundry Foremen of Philadelphia and vicinity, which association was organized Oct. 17, 1904. The various subjects that have been taken up at the regular monthly meetings have been wisely selected and have resulted in very profitable discussions.

The fact that the formation of these associations was prompted by the foundry operators is in itself very significant and affords encouragement to the extent that we, as a body, should show our appreciation by putting forth every effort to improve the general conditions of the foundry.

The organization of the Foundry Foremen of Hamilton, Canada, March 11, 1905, was an event of unusual interest. This is practically a new field for the work of our association and consequently resulted in the more strenuous efforts of our worthy vice president, Mr. Reid, to effect an organization. There are, at present, comparatively few members, but the progress thus far made is of marked value and significant of permanency and continued growth.

Charters were granted, as a result of the committee appointed at the Indianapolis convention to the eight local associations and all, but one, replied and accepted. The Indianapolis association decided not to consider the National Association for the present.

A most natural procedure has been taken up by the foremen's club of Cleveland, namely, the enrollment of the "foremen patternmakers" as active members of their association.

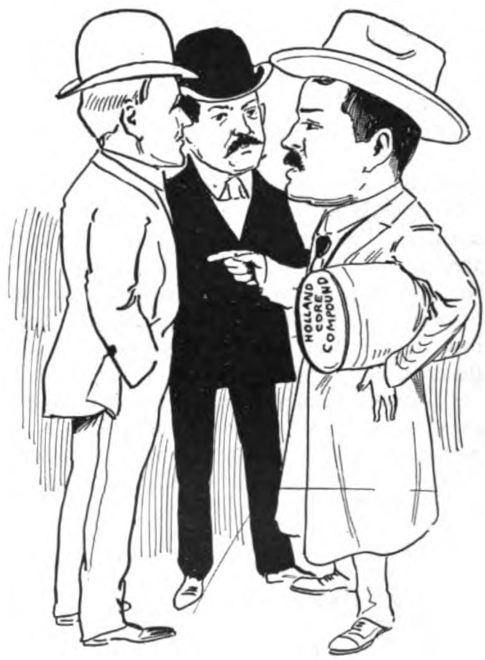
This question was placed in the hands of a committee for investigation and in reply to a communication from Mr. Henry M. Lane, editor of *The Foundry,* and a member of the committee, the president and secretary stated that due to the present constitution the best that could be done would be to enroll the foremen patternmakers as honorary or associate members and present the matter at the June convention. The proposition was referred to Mr. Wm. Parry, chairman of the patternmakers' section of the American Foundrymen's Association, who replied very favorably and offered any assistance that would be instrumental in effecting a union.

SIMON KEMP, THE SAND MAN.

The idea has been very favorably received wherever presented and when we consider that the foundry and pattern shop are more closely related than any other two departments it seems that it would be to the advantage of all concerned to enroll the foremen pattern makers as active members of the Associated Foundry Foremen.

The work of the Foremen's association is unquestionably the discussion and development of the productive side of the foundry. It is necessary, then, that we, as members of this association, introduce some method whereby we may arrive at some definite result for the advancement of general foundry practice.

Up to the present time the various local associations have selected different subjects of importance and discussed them in a general way, but we have arrived at no definite conclusions through which all our members may be equally benefited. When we consider that 50 percent of our members are so located as to be unable to attend the local meetings, and find comparatively few of these valuable discussions published, we recognize at a glance the importance of providing some means to furnish definite data from which our members may obtain satisfactory results.



CLINCHING THE ARGUMENT IN THE DISCUSSION ABOUT VENTLESS CORES.

In consideration of this fact, arrangements were made in February with the Penton Pub-

SOME OF THE WHISKERS AT THE CONVENTION.

lishing Co. which has enabled us to include in the annual dues a year's subscription for *The Foundry*. 6,700 notices were sent out to this effect in April to all foundries in the United States and Canada. The appreciation of this offer seems rather discouraging inasmuch as only 66 have made replies, 25 of these being new members.

The many subjects that are daily brought to our notice and need much valuable consideration to produce satisfactory results can be placed in the hands of special committees for proper investigation.

The following subjects may be selected for the work of such committees:

Cupola Management, Foundry Chemistry, The Core Department, The Cleaning Department, Molding Machine Practice, subdivided according to the class of work; Stove Plate and Heaters, Sanitary Work, General Jobbing, Foundry Equipment, Provisions for the Comfort of the Men, Pattern System, Foundry Records, etc.

To obtain the most profitable results on the above subjects we might suggest that a committee of three or five be appointed, or we might distribute the different subjects amongst the local associations with instructions to make a thorough study of the subjects assigned, in all their details, make such experiments that may be of value, enter upon such correspondence as will aid in rendering an instructive report at the next annual meeting and incidentally consult with the managers and owners as to the advisability of adopting such methods as may be selected by the committees.

A. WILLIAM EXPRESSES HIS OPINION.

We might also plan, for our next convention, a period of longer duration, *i.e.:*

The Morning Session.—Report of committees selected to investigate the subjects presented. Said reports to be made on standard forms and on vote of the convention, be printed and distributed to all members of the association.

The Afternoon Session.—The reading of papers.

The Evening Session.—Business of the association and election of officers.

We have another valuable suggestion, namely, the circulation of papers. The plan being outlined as follows:

Have all papers from the various local associations sent to the secretary, copied and mailed to the remaining number of locals for their discussion. The paper with the discussion again returned to the secretary to be compiled and sent to all members of the association. The discussion is, without doubt, the most important part of a paper as it often brings to light valuable points that have been omitted by the writer. This point in itself brings to our notice, at once, the value of such a plan and would give every member an equal opportunity to profit through the work of the association.

Whatever the plan be that is adopted, we have first to consider the cost necessary to complete the work. This brings us to a statement of the finances of the association, and with the permission of the treasurer I have included his report.

Cash on hand June 9, 1904....	$51 99	
Total receipts to June 5, 1905..	426 73	
Total disbursements		$368 21
Cash on hand June 5, 1905....		110 51
	$478 72	$478 72

Number of members, dues unpaid....	102
Amount outstanding dues............	$294 03
Report of Membership—	
Honorary members, June 9, 1904....	10
Active members, June 9, 1904......	167
	177

Honorary members June 5, 1905......		16
Active members, June 5, 1905.........		262
Resigned	4	
Dropped	7	
Total		278

Respectfully submitted,
F. C. EVERETT, Secy.
New York, June 5, 1905.

Papers Read.

After the Secretary's report, Mr. Benjamin D Fuller, of Allegheny, read a paper entitled "Needed in the Business." As no discussion followed, David Spence, of Chicago was called upon to read his paper entitled "Things We Need in the Foundry." The gist of this paper was that instead of cutting one another's prices we should aim to make the very best quality of castings possible, and get a good price for them. Mr. Spence characterised cutting prices as one of the greatest evils the foundry business has to contend with; as it involves poor work, and slovenly methods in general.

E. B. GILMOUR.

A paper on "The Use of Plaster of Paris in the Foundry," by Edward B. Gilmour, of Peoria, Ill., was next taken up, and as there was no discussion this was followed by two papers by Archibald M. Loudon, of Elmira, New York, entitled "A Simple and Economical Method of Molding Propeller Wheels," and "A Successful Foundry Combination." In the discussion of the first paper, one man asked Mr. Loudon if he knew of any cause in which a plaster of Paris match had been used for a pattern for a big propeller wheel. Mr. Loudon replied that plaster of Paris would be too expensive for this purpose.

763 MILES TO CUYAHOGA FALLS.

The paper on "Fan and Blower Tests," by H. E. Field, of the MacIntosh-Hemphill Company, of Pittsburg, was next read, but discussion on this paper was postponed for the session next morning. The Secretary then told W. W. Sly, of the Sly Manufacturing Company, of Cleveland, that he could have just ten minutes to present his paper on "Shot Iron," as the members were getting hungry and it would not do to keep them too long. Mr. Sly had not prepared his paper in writing before the meeting, but had had some analyses made and had tried some experiments to test the value of shot iron. He stated in brief that the shot iron was just as good as any of the scrap which came from the sprues, provided it was properly treated.

A. M. LOUDON.

If the shot iron is allowed to lie in the dump while the coke remaining in the dump burns out the shot will absorb an excess of sulphur and become so oxidized that it is worthless, but if the dump is thoroughly quenched the shot will not absorb sulphur, and will be as good as any other scrap from the cast.

Some of the analyses which Mr. Sly read were as follows: He took a grate bar and had both ends analyzed. The burnt end analyzed as follows: Silicon, 2.23; sulphur, 0.23; phosphorus, 0.838; manganese, 0.41; combined carbon, 0.36; graphitic carbon, 1.88. This gives a total carbon of 2.24. The unburned or stub end of the bar analyzed as follows: Silicon, 2.16; sulphur, 0.111; phosphorus, 0.819; manganese, 0.44; combined carbon, 0.07; graphitic carbon, 3.19.

This shows that the burned end of the bar had had almost no change in silicon, contained more than double the amount of sulphur, that the phosphorus and manganese were only changed slightly, and that the total carbon had been reduced over one percent. This loading of the iron with sulphur, and reduction of the carbon

D. J. THOMAS.

would be enough to damage the iron greatly. Mr. Sly also presented the following analyses of shot iron, and sprues from the same cast. The shot iron contained silicon, 1.90; sulphur, 0.077; phosphorus, 0.684; total carbon, 3.58; while the sprue contained silicon, 1.88; sulphur, 0.074; phosphorus, 0.57; and total carbon, 3.200 percent.

From this it will be noticed that the composition is almost identical and that the shot

AUGUST WILLIAM, PHILADELPHIA, PA.
VICE PRES. A. F. F.

is just as good scrap as the sprue. Mr. Blunt, in discussing the paper, stated that it was the magnetic oxide contained in burnt grate bars which rendered it useless, and that it was also the magnetic oxide in burnt shot iron that rendered it useless. He stated that they used all of their shot iron without difficulty. Mr. Sly promised to work this paper into more complete shape and present it later.

Wednesday Morning.

The main lecture room of the chemical laboratory of Columbia University was well filled when President Wolff called the meeting to order. Owing to the absence of the various members of the faculty at the summer schools, Dr. Moldenke welcomed the assembly in behalf of the institution, of which he is an alumnus. His remarks were as follows:

Mr. President, Ladies and Gentlemen.

I have been honored with the pleasant task of welcoming you to Columbia University. I have been asked to do so on behalf of this great institution because the dean and professors are all away with the summer classes in mine and mountain, shop and smelter, since the young men who are later on to manage our establishments are required to get into touch with actual conditions in business life as early and often as possible. They thus become of greater immediate value to you when they have left their Alma Mater.

I take peculiar personal pride in having been designated to receive you, as I myself am one of Columbia's sons, and as the Secretary of your great and important association, enjoy the distinction of being a resident lecturer to the classes here on Foundry Practice.

The twenty years that have passed since I was graduated from this institution of learning, have seen wonderful changes in America's university life. You behold the stately pile of magnificent structures, some of them still

N. H. McPHEE, BRIDGEPORT, CONN.
VICE PRES. AT LARGE A. F. F.

rising, all about you here. They are but the outward evidences of the work that is being done. Within these walls, in daily touch with famous men of warm-hearted interest for each and every student, there is developed a culture which the university life gives the faithful searcher after truth. The personal element in the daily contact with men of splendid character, such as is always met with within our great universities and technical schools, becomes the chief element in forming the minds of our young men, and places them on the road of life, leading to solid and righteous citizenship.

Here in the laboratories, workshops and museums will be found everything that science and art can provide, to teach the principles underlying the utilization of Nature's forces for

W. F. GRUNAU, ERIE, PA.
VICE PRES. A. F. F.

the good of man. All that a university can teach us, is, after all, only how to learn. How to observe correctly, make the proper deductions therefrom, and apply our knowledge to the best advantage. It is this training of the mind along the paths of logic, and correct thinking, that give the university bred man, if he is otherwise capable in business, the great advantage he enjoys, in being capable of filling important places earlier in life than has been the case heretofore. What does not ten years of life mean to us in these strenuous days.

It is the aim of all our universities and technical schools to train the youth of the nation to utilize our wonderful resources in the most economical way. Hence only the best methods for turning out high class material are taught. The student is made self-reliant, and learns to make the best use of what he finds, whatever the conditions may be that surround him. Thus do we aid in stemming the shameful waste of the nation's economic resources, and not only are we making good metallurgists and engineers, but high spirited citizens.

We will be taken through the mechanical and metallurgical laboratories later in the day, and see the many and varied appliances which facilitate the study of methods and results in our chosen field.

Columbia welcomes you as an educational association, and with us, wishes that we were not almost the only body of men seeking to elevate an industry which forms but one small part of the vast system on which rests the prosperity, and comfort of the world. Columbia invites you to send your sons to round off their characters and acquirements before entering the competition of man to man in the race for wealth and station. She wishes to see your good influence extended still further, and continue to benefit the great foundry industry even more than it has already done.

Columbia welcomes you one and all, hopes that when the day is over that it may be passed to the credit side of your experiences, and wishes you to keep her in warm remembrance, and use her resources wherever she may help you in the problems of your daily work.

W. H. NICHOLLS, CLEVELAND, O.
VICE PRES. AT LARGE A. F. F.

Discussion on Fan and Blower Tests.

F. W. Stickle, of Waterbury, Conn., opening the discussion of the paper on "Fan and Blower Tests," read on the previous day by H. E. Field, Pittsburg, inquired whether the time of tapping the slag had been the same in both tests, and whether the volume of air had been sufficiently uniform to insure the same conclusions.

Mr. Field replied that the work had been performed by trained men and that everything possible had been done to render the test absolutely correct. The volume of air had not been measured.

Mr. Stickle remarked that the catalogue figures of manufactures did not always agree with the actual volume of air furnished by their machines, and that in some cases the claims were purposely made lower than measurements seemed to warrant. The power necessary to melt a given quantity of iron depended very largely upon the time required. He had found that while a certain volume of air is necessary, it is possible to double the output by increasing the volume furnished. The increased resistance due to rising temperature might also increase the power required very materially. In his opinion unsatisfactory results were very often due to failure to supply a sufficient volume of air. The best policy was always to melt the iron as rapidly as possible.

David Spence, of Chicago, asked about the number of ounces of pressure employed in the tests, and spoke of the influence of the physical properties of the coke upon the melting process. He had found that with a relatively light coke the melt proceeds more rapidly, apparently because the carbon is consumed more readily than is the case with a denser fuel. Referring to a custom of beginning the operation with 10 ounces blast pressure and increasing to 16 ounces, he personally believed that quite as rapid work could be done by keeping the pressure uniformly at 12 ounces.

Foundry and Pattern Shop Standards.

William H. Parry, Brooklyn, N. Y., read his paper at this meeting on "Foundry and Pattern Shop Standards," in which he urged the adoption of measures to secure greater uniformity in the matter of dimensions, draft, spindles, etc.


W. H. PARRY.

H. M. Lane, of Cleveland, said that he had for some time been trying to find out whether anything had been done toward the standardization of flasks. He had written a number of letters and had received many interesting replies. It had been suggested that the Association take the matter up. Some rational standards for snap flasks, pins and pin holes are especially desirable. He thought that what had been done in the case of standardizing the size of machine catalogues might also be done in foundry practice.

E. B. Gilmour, Peoria, Ill., suggested that the matter presented fewer difficulties than appeared at first sight.

Dr. Moldenke proposed that a committee be appointed devoted entirely to the interests of the patternmakers, a committee to report from time to time on standardization of patternshop-foundry practice. The motion was adopted. A second motion for similar action for the standardization of flasks aroused considerable discussion.

Benj. Fuller, Allegheny, Pa., said it would be difficult to tie down the foundryman to standard flasks. Flasks must be of such form as to accommodate the pattern. W. H. Parry disclaimed any intention to dictate as to size and shapes, but he saw no reason why something could not be done to eliminate odd sizes, sometimes involving differences of small fractions of an inch. August T. William endorsed Mr. Parry's remarks. He said it was often necessary to change the flasks for the molding machine every time a new pattern was used. Chas. J. Caley, Bridgeport, Conn., suggested that the motion be limited to flasks of certain sizes only. F. W. Stickle, Waterbury, Conn., believed in standardization in every way possible. He said that foundrymen had trouble enough without a lot of odd flasks. Eugene W. Smith, Chicago, thought that a standard in even inches could be set to which machine men could agree in time. One of the worst features of modern practice was, in his opinion, too much crowding of flasks.

The motion to provide a committee to look into the standardization of flasks prevailed.

H. M. Lane, Cleveland, gave a brief synopsis of his paper on the "Care and Storage of Patterns."

Paper on Thermit.

W. M. Carr of the Goldschmidt Thermit Co., New York, entertained the assembly with a practical demonstration of the use of thermit. He described the different kinds of this product, the variety used for ordinary welding being a mixture of metallic aluminum and iron oxide. When ignited, the oxidation of the aluminum produces an intense heat, in ordinary quantities approximating 5000 degrees F. or 3000 degrees C., the iron oxide being reduced to the metallic form. In order to show the


W. M. CARR.

intensity of the heat produced, a quantity of the material was ignited and the products of the reaction allowed to flow upon an iron plate, one inch thick, burning a hole through it instantly. A second experiment was a butt-weld of two sections of two-inch pipe. In the discussion which followed, Mr. Carr explained a number of interesting details connected with the manipulation of thermit. The reaction as ordinarily carried out produces about 50 percent of a mild form of steel containing about .1 percent of carbon derived from the graphite of the crucible. Nickel thermit is employed for the introduction of a definite quantity of nickel into cast iron or steel. About ½ percent of nickel in cast iron kettles increased the resistance to acids and alkalis to a marked degree. The demonstrator explained that while it was possible to use thermit in welding cast iron, it was in this case necessary to employ a larger proportion of the material than with steel.

A paper by G. N. Prentiss, Milwaukee, Wis., on thermit practice closed the morning session.

Noon Intermission.

At 12:30 the meeting adjourned until after dinner, and the members and guests repaired to the University Commons, where they were served with a substantial luncheon. One of the enterprising supply men had distributed little feathers upon which was printed "The J. D. Smith Foundry Supply Co. We don't stick our customers," and upon the end of which a burdock burr was attached. He had succeeded in making pretty much every one look like Indians, by the number of colored feathers that were attached to them. This feature and various other little tricks played by the supply men served to keep everybody in a good humor. The Obermayer Company distributed a little button with a piece of steel in the back so as to form a clicker or cricket, and these were in evidence everywhere by their clicking.

J. S. SMITH, THE FEATHER MAN.

After luncheon the party assembled on the library steps where a photograph was taken. They then inspected the laboratories, admired the campus and buildings, and visited all parts of the university.

Afternoon Session.

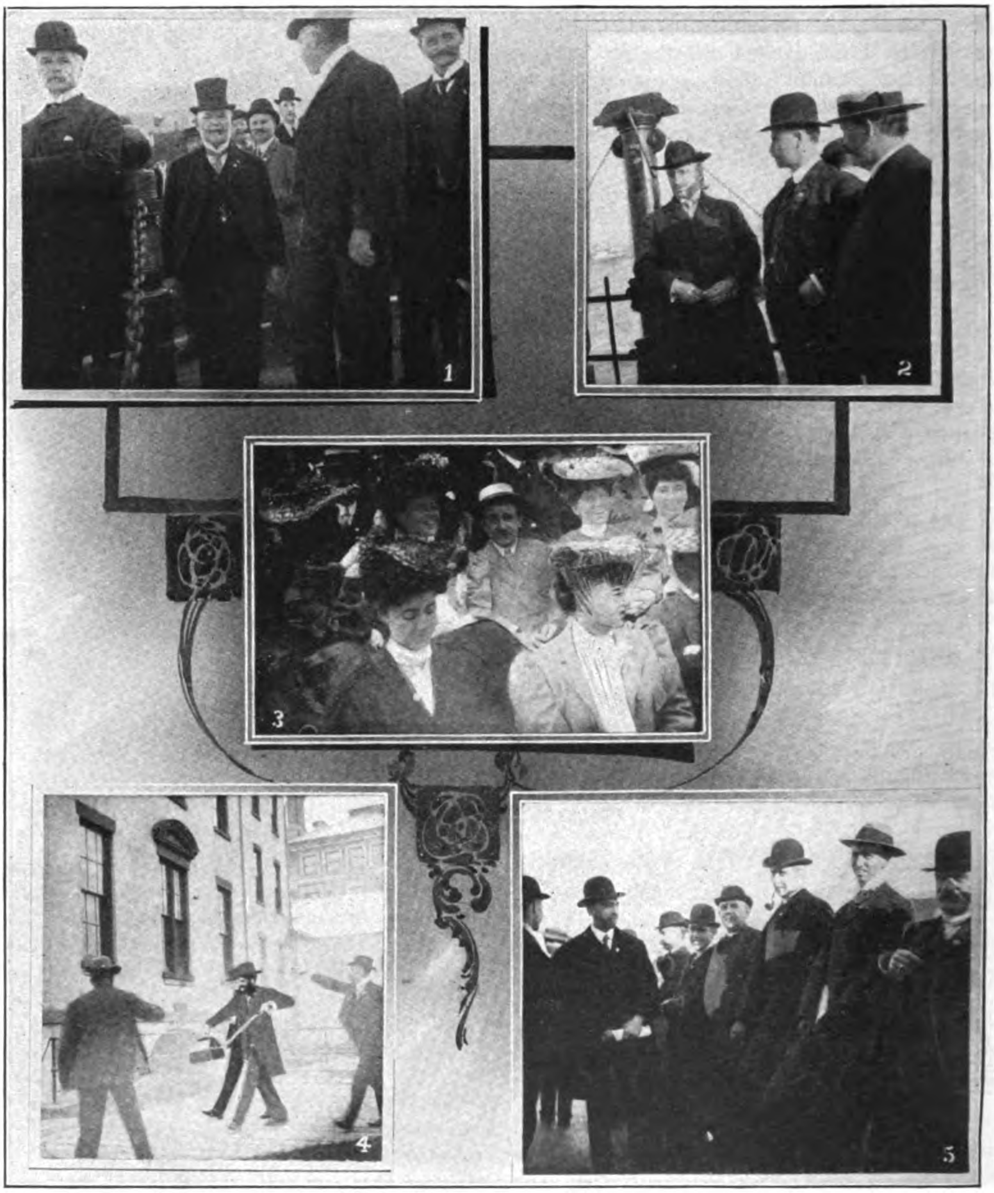
The afternoon session was called to order by the President at half past two. Several of the papers presented in the afternoon were illustrated by stereopticon. The first one was on "The Variation of the Properties of Alloys," by Percy Longmuir, of Sheffield, England. This was contributed by The Metal Industry, and read by Dr. Scholl. The lantern slides showed the apparatus used, photographs of the specimens, the microstructure of the different alloys, and a chart showing the results. There was no discussion of the paper though it had been extremely interesting to all present.

The next paper was a description of "The Use of Thermit in a Railroad Shop," by James F. Webb, of Elkhart, Ind. This was also illustrated by a number of lantern views. There was quite a little discussion of the paper, mainly in the shape of questions which Mr. Webb answered. In the discussion the fact was brought out that in his more recent work, Mr. Webb has used molds made of fire-brick, the bricks being chipped or cut to such a shape that they were fitted about the piece to be repaired and then clamped in position; the joints being closed with fire clay. By using a porous brick, such a mold is practically self-venting.

ONE OF SMITH'S VICTIMS.

Microscopic views of a large number of well known varieties of core sands were a feature of a paper on "Core Sands," by J. S. Robeson, Camden, N. J. The author made clear that the occasional failure of cores prepared with any given binder was frequently due to the character of the core sand employed. He gave a number of successful formulæ and related several

LITTLE GRAINS OF SAND.



I AND 2 SNAP SHOTS ON THE FERRY. 3, BROWN WAS CHAIRMAN OF THE ENTERTAINMENT COMMITTEE AND LOOKED AFTER THE LADIES. 4, GOING TO THE SESSION. 5, A GROUP RETURNING FROM HARRISON.

experiences in which a slight modification of the mixture converted vexatious failures into conspicuous successes.

A discussion which caused more or less amusement concerned the possibility of casting cylinder jackets with cores without vents. One member remarked that it was all he could do to make cylinders of that kind with vents, to say nothing of ventless cores. The gentleman to whom the original claim that the thing could be done (P. M. Baumgardner, president The Holland Linseed Oil Co., Chicago), has been ascribed, failed to appear, and the discussion died for lack of opposition.

The next afternoon, however, when visiting the plant of the International Steam Pump Co., it was discovered that they were making jacket cores without vents, exactly as Mr. Baumgardner had described to some of the members previous to Wednesday afternoon's session.

Thursday Morning.

With the exception of a discussion of about half an hour's duration on the paper read by Ellsworth M. Taylor of Boston, on "Production Costs," the meeting Thursday morning was devoted entirely to the election of officers for the coming year, and to the transaction of new and unfinished business. Mr. Taylor was given the opportunity by the president to answer any questions on the subject of his paper which any of the members might be interested in asking. Following the lead of August T. William of Philadelphia, the discussion took the line of whether it was advisable to keep a detailed system of the costs connected with the manufacture of small castings. The opinion prevailed among the foundrymen who participated in the discussion, and was coincided in by Mr. Taylor, that in a great majority of cases it is neither practicable nor advisable to attempt to do this; that where very small castings are concerned it is better to get a fair average cost and charge accordingly. A periodical check on the cost of manufacturing such castings every one or two years would be sufficient to keep the price in line. Mr. Taylor thought it would be a saving to the proprietor if such labor was put on the piece basis.

After the discussion ended, the convention voted its thanks to Mr. Taylor, on motion of Mr. William, for the very able manner in which he had answered the questions asked.

Metallurgical Report.

The report of the metallurgical section was next read by H. E. Diller, secretary, which is as follows:

During the past year your committee has formulated a method for determinating the silicon in cast iron, and is now at work on the question of the total carbon. The following is the method which your committee recommends to be the standard of the association, for the determination of silicon in pig iron and cast iron:

"Weigh one gramme of sample, add 30 c. c. nitric acid, (1.13 sp. gr.); then 5 c. c. sulphuric acid (conc.). Evaporate on hot plate until all fumes are driven off. Take up in water and boil until all ferrous sulphate is dissolved. Filter on an ashless filter, with or without suction pump, using a cone. Wash once with hot water, once with hydrochloric acid, and three or four times with hot water. Ignite, weigh, and evaporate with a few drops of sulphuric acid and 4 or 5 c. c. of hydrofluric acid. Ignite slowly and weigh. Multiply the difference in weight by .4702."


H. E. DILLER.

In recommending the above method, it was recognized that it is almost an impossibility to get chemists to use a standard method in their daily work. Hence the above method, as recommended, is intended primarily as a check method in case of dispute between different laboratories, or as between buyer and seller.

Hence a method, accurate in every point was sought, shortness being sacrificed to some extent to insure accuracy or the chance of error by a careless operator. Little in the above is left to the judgment of the chemist.

It will be further recognized that in the purchase and sale of pig iron or castings under specification, that standard methods are essential in order to allow the parties of both parts to make their determinations with the assurance that, on the score of method, they are on the same footing.

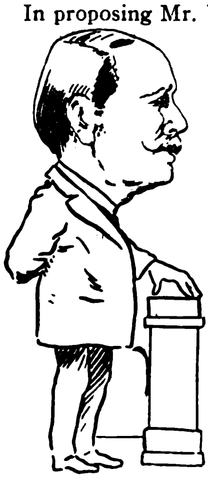
Miscellaneous Business.

Under the subject of new and unfinished business, Dr. Moldenke brought up the question of reducing the dues of the Association. He suggested this step not only as an inducement to increase the membership, but because he felt that since the discontinuance of the Journal the members were not getting full value for the $10 they were paying. To bring the matter to some sort of conclusion, he made a motion that the dues be reduced to $3 per year. This proposal was not favorably received and after some discussion the original motion was amended to make the annual dues $5, with the proviso that this amount be charged to members of the different sections as well as to members of the Association. This was carried.

Following this action, the Association voted its thanks to Columbia University, to the contributors of the papers read, to the foundry supply men and to the entertainment committee.

The nominating committee, composed of W. A. Jones, of the W. A. Jones Foundry & Machine Co., Chicago, Ill.; J. P. Golden, Golden Foundry and Machine Co., Columbus, Ga.; George H. Lincoln, Lincoln Foundry Co., Boston, Mass.; C. H. Thomas, president of the Foundry Foremen's Section, and A. V. Slocum, National Car Wheel Co., Pittsburg, which was appointed at the Tuesday morning session, was called upon for its report.

In proposing Mr. West's name for president, the chairman of the committee, W. A. Jones, spoke in high praise of Mr. West's services to the association and of his work as an investigator and contributor of original articles on foundry practice. He said: "As chairman of the nominating committee, I am pleased to state that the Association has thought it wise to select at each of its conventions a gentleman whose home is the city in which the convention will next convene. In this way, the president will preside in his own city. This presents many advantages and as far as can be seen few disadvantages. And working with this end in view, it affords me great pleasure to place in nomination for president of this Association a gentleman whom you all know, a gentleman who is well known throughout this country where foundry interests are known or even discussed; whose books and papers have a national reputation, and a gentleman who perhaps more than any other person excepting alone, Dr. Moldenke, has done more and worked harder for the interests of this Association."


THOS. D. WEST.

The secretary was instructed to cast the vote of the convention for the election of Mr. West as president and for the election of the other candidates presented for the offices named. This was done and W. A. Jones and C. H. Thomas were appointed to escort Mr. West to the chair.

The customary expressions of appreciation and thanks for the honor were made by the incoming and outgoing officers, and following the precedent established at the first meeting, C. H. Wolff, the retiring president, was made an honorary member of the Association.


THREE FROM THE HUB.

The vice presidents elected for the ensuing year are as follows: New England States, Harry A. Carpenter, A. Carpenter & Sons, Providence, R. I. New York & New Jersey, H. Van Atta, Supt. J. L. Mott Iron Works, New York. Penn., Delaware, Maryland and District Columbia, A. V. Slocum, National Car Wheel Co., Pittsburg. Michigan, Ohio, Kentucky, Tennessee, A. K. Beckwith, estate of P. B. Beckwith, Dowagiac, Mich. Indiana, Illinois, Missouri, Kansas, Colorado, Arizona, New Mexico, Utah, Nevada and California, David Spence, Greenlee Foundry Co., Chicago. Wisconsin, Minnesota, Iowa, North Dakota, South Dakota, Idaho, Nebraska, Wyoming, Washington and Oregon, Adam Bair, superintendent of foundry, C. M. & St. P. Ry., Milwaukee, Wis. Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma and Texas, J. P. Golden, Golden Foundry & Machine Co., Columbus, Ga. Canada, T. J. Best, Warden, King & Co., Montreal.

Foundry Foremen's Section.

Chairman, David Reed, Canadian Westinghouse Co., Hamilton, Can.

Secretary, F. C. Everitt, J. L. Mott Iron Works, New York.

Metallurgical Section.

Chairman, R. S. MacPherran, J. I. Case, Threshing Machine Co., Racine, Wis.


H. J. MCCASLIN.

Secretary, H. E. Diller, Western Electric Co., Chicago, Ill.

Patternmakers' Section.

Chairman, H. J. McCaslin, Wellman-Seaver-Morgan Co., Cleveland.

Secretary, Wm. H. Parry, National Meter Co., Brooklyn, N. Y.

Auditing Committee.

J. S. Seaman, S. H. Stupakoff and Wm. Yearl, all of Pittsburg.

Invitations to hold the 1906 convention in Cleveland were received from the mayor, chamber of commerce, foundry foremen's society and several large manufacturing interests of that city, and were read by H. M. Lane, of Cleveland.

An invitation was also received from the Philadelphia Foundrymen's Association asking that the convention for 1907 should convene in that city.

WE ARE EXTENDED AN INVITATION TO MEET AT TORONTO.

Mr. L. L. Anthes, of the Toronto Foundry Co., of Toronto, Canada, also stated that the Canadians would be glad to have the Association meet with them in 1908, and that he hoped to present a formal invitation later for the 1908 convention to be held in Toronto.

The meeting adjourned, and in the afternoon the members visited the works of the International Steam Pump Co., Harrison, N. J.

Excursion to Harrison, N. J.

About a hundred of the members and guests of the association set out from hotel headquarters Thursday afternoon to visit the great plant of the International Steam Pump Co., at Harrison, N. J., under the guidance of Dr. Moldenke. Clear skies and brilliant sunshine made up for the disagreeable weather of the earlier days of the convention.

J. S. McCORMICK.

At the works the delegation was received and conducted about the establishment by representatives of the firm, and the busy scenes in and about the foundries, some familiar and others suggestive of improvements in home plants, were, to many, a welcome change from the hustle and bustle of New York streets.

An interesting feature in connection with the visit was a demonstration by the Goldschmidt Thermit Co. of the manner in which nickel thermit could be used for introducing nickel into iron or steel castings. They also demonstrated the use of ordinary thermit for heating the risers to keep them open.

As mentioned, those who had been carrying on the ventless core discussion found such cores in use at the plant. By the use of the proper sand, and a suitable binder they had succeeded in solving the difficulty.

The Convention Core Room.

In order to make things seem homelike at the convention, some of the supply men provided a very good working core room in the basement adjoining the grill room. The Thos. W. Pangborn Co. had the largest exhibit and centainly went to a great deal of trouble to make a remarkable display. They had a steam pipe brought from the boiler room and had one of the Hanna post screen shakers in operation riddling sand. In addition there was displayed a complete line of the several types of shakers made by the Hanna Engineering Works, of Chicago. Adjoining the post shaking screen exhibit they had an exhibit of the Hammer core machine. The machine was so connected that it could be driven either by motor or hand, and was in operation making the various sizes of cores. At the back of the space there was an exhibit of corundum wheels of various sizes and shapes, together with samples of corundum ore, showing the product as mined and manufactured by the National Corundum Wheel Co., of Buffalo, for whom the Pangborn Co. is exclusive Eastern sales agent. In fact, they hold an exclusive Eastern sales agency for each of the lines which they had on exhibition. Among points of especial interest in connection with the general supplies on exhibition by this company, there was a Williamson universal double swivel machinist's vise, which attracted considerable attention.

ARTHUR W. WALKER.

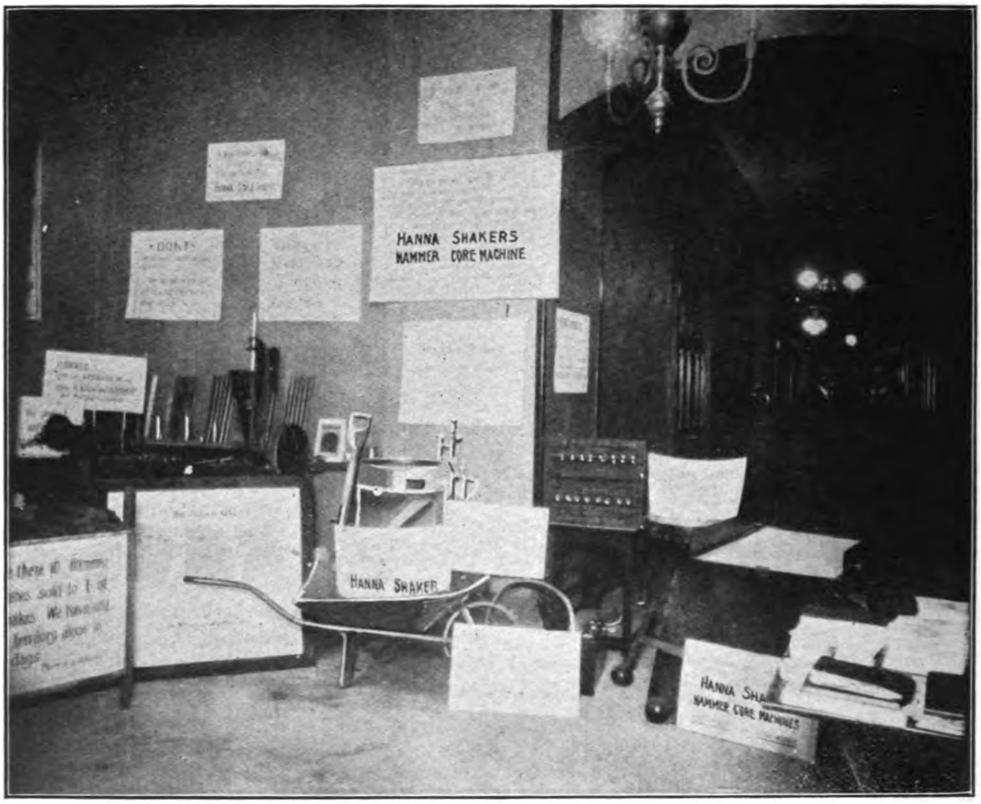
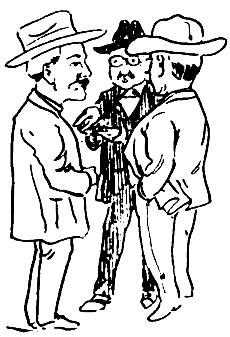


EXHIBIT OF THE THOMAS W. PANGBORN CO.

The Diamond Clamp and Flask Co.'s Exhibit.

This exhibit occupied a table in the center of the room, and consisted of one of their single pull universal belt shifters, and a core machine which has recently been designed and is now being perfected by this company. For agricultural machinery there are a large number of small cores required having a conical print on one end. To make these a machine has been devised in which the sand is fed to the machine by a spiral screw turned at right angles by a deflecting plate and forced out through an opening which can be turned down horizontally or placed in a vertical position. When the core is forced up vertical, its own weight tends to keep it in place. After the desired length has been forced out, a set of dies are brought together by a suitable lever so as to compress the lower end of the core, thus forming the print.



McCORMICK PUMPING VULCAN INTO REID.

This company also had a very neat souvenir in the form of a little folder, closed by one of their patent pattern dowels.

Exhibit of the Falls Rivet & Machine Co.

This company had on exhibit one of their 6-inch machines, which had been fitted up with a large fly wheel, so that it is possible to make 6-inch cores 24 inches long in 12 seconds by

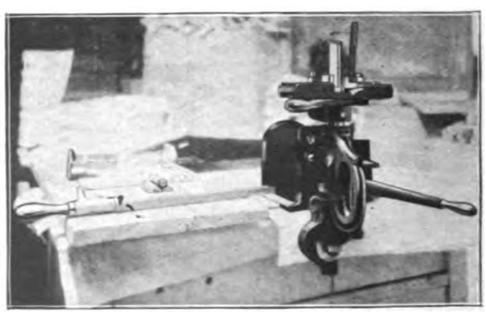


EXHIBIT OF THE DIAMOND CLAMP & FLASK CO.

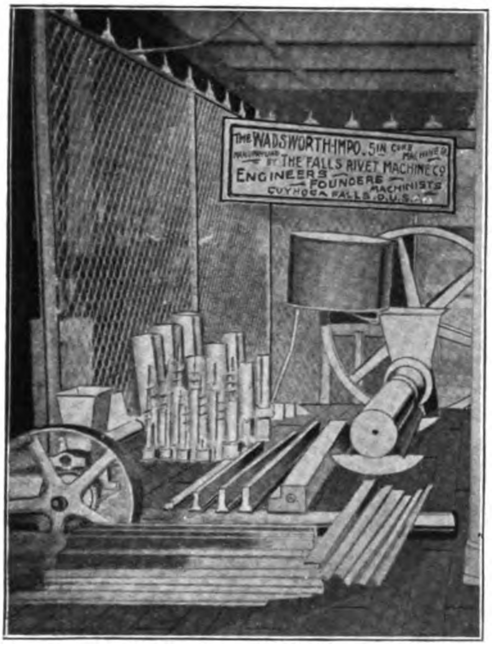


EXHIBIT OF THE FALLS RIVET & MACHINE CO.

hand. They also had on exhibit a large number of odd sized and shaped cores which had been made with special dies, for different customers requiring special forms of cores. Some of these were very interesting indeed, and showed that a large amount of careful thought had been expended in designing the equipment for producing them.

Convention Notes.

While at this convention there was not the amount of sight-seeing, entertainment, etc., that has marked some of the previous gatherings, a number of the members stated that they had never seen so much interest taken in the papers read, and so much general discussion. Evening sessions had purposely been avoided in order that the members might have time to take in the various New York attractions. The supply men were conspicuous in heading parties to the various places of amusement. The sand men, the Smith crowd, and some others could undoubtedly give a pretty good account of everything that was doing at Coney Island.

S. D. THOMPKINS.

J. S. McCormick and some of his Pittsburg friends guided a large party to the Hippodrome one night, and in fact, every night saw a good number there.

Just to keep the Sly Mills in memory and to please his old friends, Mr. W. W. Sly appeared in the hotel lobby one day with a box under his arm and distributed aluminum cigar holders, each filled with three good smokes.

At the first day's session Mrs. Clark Fisher and her daughter were present. Mrs. Fisher owns and operates the Eagle Anvil Works, Trenton, N. J. She took a lively interest in the discussions, and in conversation with some of the members afterwards told a number of reminiscences which occurred at her own plant.

The members who were present at the Milwaukee Convention will remember Miss Ella M. Jones, whom many of them thought was probably the only woman in the United States running a foundry. It would be interesting to know how many foundries in the United States are owned or operated by women.

JOHN HILL.

Mr. John Hill, of the Hill & Griffith Co., Cincinnati, presented all of the members at the Columbia University meeting with a very ornamental watch fob from which was suspended a metal imitation of the barrel of the facings for which his company is famous.

Henry E. Pridmore and his faithful right hand man, D. E. Egan, made a half-mile sprint from the railroad station at Harrison to the plant of the International Steam Pump Co., so as to hold all the members up at the door that they might present each with a handsome gold pencil with their compliments. Unfortunately, Mr. Pridmore was so secretive in his movements that the cartoonist did not succeed in catching him. Probably Mr. Pridmore was too busy entertaining his friends.

Mr. S. D. Tompkins, of the Smooth-on Mfg. Co., was present at all of the sessions, and met many old friends, and made some new acquaintances.

Mr. Charles J. Caley, of the Russell & Irwin Co., of New Brighton, Conn., distributed a very useful souvenir in the shape of a case-hardened screw driver which was gold plated. The head of the screw driver had stamped on it in a very neat design, the trade mark of the Russell & Irwin Co.

Those in Attendance.

Adamson, Robert, Farrell Fdy. & Machine Co., Ansonia, Conn.

Anderson, N., Matthew Addy & Co., New York.

Anthes, L. L., Toronto Fdy. Co., Ltd., Toronto, Can.

Ayers, E. M., Zanesville, O.

SOME OF THE SOUVENIRS.

Bair, A. W., C. M. & St. Paul Fdy., Milwaukee, Wis.

Bartlett, S. L., Elizabeth, N. J.

Baumgardner, P. M., president Holland Linseed Oil Co., Chicago.

W. W. SLY ASKS THE BOYS TO SMOKE UP.

Bean, A. P., The T. H. Symington Co., Corning, N. Y.

Bean, W. R., The T. H. Symington Co., Corning, N. Y.

Beckett, Jas. A., Hoosick Falls, N. Y.

Beckwith, A. K., Beckwith Estate, Dowagiac, Mich.

Beckwith, Mrs. A. K., Dowagiac, Mich.

Bell, Daniel, Dominion Coal Co., Glace Bay, N. S.

Bernhard, B., Garwood Foundry, Garwood, N. J.

Beverly, T. L., Cohoes Iron Fdy. Mach. Co., Cohoes, N. Y.

Blau, L. G., Golden Foundry & Machine Co., Columbus, Ga.

Blunt, L. G., Westinghouse Foundries, Pittsburg.

Blythe, Robert, Walker & Pratt Mfg. Co., Boston.

Bougher, J. K., J. W. Paxson Co., Philadelphia.

Bowe, Jas. J., Eddy Valve Co., Waterford, N. Y.

Bradford, Jas., Lord & Burnham Co., Irvington-on-Hudson.

Brant, W. J., Chicago Flour Co., Pittsburg.

Brewer, W. M., Colonial Fdy. & Machinery Co., So. Norwalk, Conn.

Brown, Aug. W., Abendroth Bros., Port Chester, N. Y.

Brown, L. K., L. K. Brown Molding Sand Co., Zanesville, O.

Brown, L. S., Springfield Facing Co., Springfield, Mass.

Bullard, H. W., Poughkeepsie Fdy. & Mach. Co., Poughkeepsie, N. Y.

Burgen, J. J., Lane Mfg. Co., Montpelier, Vt.

Burns, John C., Pond Pool Co., Plainfield, N. J

Burr, John W., The Burr & Houston Co., Brooklyn.

Burr, Mrs. John W., Brooklyn.

Caley, Chas. J., Russell & Erwin Mfg. Co., New Britain, Conn.

Caley, H. L., Hart & Crouse Co., Utica, N. Y.

Carr, W. M., Goldschmidt Thermit Co., New York.

Carr, Mrs. W. M., New York.

Chapman, Eugene M., Wm. M. Crane Fdy. Co., Peekskill, N. Y.

Cherrie, Jas., Friction Pulley & Mach. Wks., Sandy Hill, N. J.

Clark, A. L., American Brake Shoe & Foundry Co., Mahwah, N. J.

Colvin, C. H., Colvin Foundry Co., Providence.

Cooledge, Edw. R., Thos. W. Pangborn Co., New York.

Crawford, Robt., S. L. Moore & Sons Co., Elizabeth, N. J.

Crivel, Geo. F., F. B. Stevens, Detroit.

Cunningham, W. P., American Bridge Co., Philadelphia.

Cushing, Geo. H., H. B. Smith Co., Westfield, Mass.

D. F. EAGEN.

Dancer, J. C., General Electric Co., Schenectady, N. Y.

Danziger, J. L., chemist, New York.

Davie, Jas., Acme Fdy. Co., Brooklyn.

Dette, W. S., The Arlington Co., New York.

DeWolfe, W. H., P. & F. Corbin, New Britain, Conn.

Diller, H. E., Western Electric Co., Chicago.

Dorman, Robert, Garwood Machine Co., Garwood, N. J.

Eagan, D. F., Pridmore Molding Machine Co., Boston.

English, W. C., *The Iron Age*, Boston.

Everitt, F. C., J. L. Mott Iron Works, New York.

Fasy, Jos. I., W. W. Lindsay & Co., Philadelphia.

Fenwinkle, W. A., Electric Controller & Supply Co., Cleveland.

Field, H. E., Mackintosh, Hemphill & Co., Pittsburg.

Findley, A. I., *The Iron Age*, New York.

Fisher, Harriet, Eagle Anvil Works, Trenton, N. J.

Fisher, S. H., Harrisburg Foundry & Mach. Wks., Harrisburg, Pa.

Fitzpatrick, Wm. M., The S. Obermayer Co., Pittsburg.

Folant, W. S., Colonial Fdy. & Mach. Co., So. Norwalk, Conn.

Foster, W. C., M. J. Drummond & Co., New York.

Fraser, John, Mackintosh, Hemphill & Co., Pittsburg.

Frohman, E. D., The S. Obermayer Co., Pittsburg.

Frohman, H. F., The S. Obermayer Co., Cincinnati.

Fuller, Benj. D., Westinghouse Elec. Co., Pittsburg.

Gartside, W. N., Diamond Clamp & Flask Co., Richmond, Ind.

Gilbert, H. P., Piqua Flour Co., Piqua, O.

Gilbert, H. W., N. Y. C. & H. Ry. Foundry, Frankfort, N. Y.

Gilbert, L. D., Frick Co., Waynesboro, Pa.

Gilmour, E. B., Globe Foundry Co., Peoria, Ill.

Gilmour, J., Foundry Equipment, New York.

Golden, J. P., Golden Foundry & Machine Co., Columbus, Ga.

Golden, Mrs. J. P., Columbus, Ga.

Golden, Miss Mamie, Columbus, Ga.

Golden, Miss Sara, Columbus, Ga.

Googins, C. E., Smooth-On Mfg. Co., Jersey City.

Gorman, J. W., Ridgeway Machine & Tool Co., Ridgeway, Pa.

Gow, John, General Electric Co., Schenectady, N. Y.

Graham, W. M., N. Y. Green Fuel Economizer Co., Matteawan, N. Y.

Griffiths, Geo. H., *The Iron Trade Review*, Chicago.

Grunau, W. F., Erie City Iron Works, Erie, Pa.

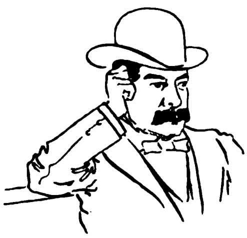
A CONFAB BETWEEN CALEY AND SMITH.

Gunn, John K., Utica Pipe Fdy. Co., Utica, N. Y.
Hamilton, Wm., Newport News S. B. & D. D. Co., Newport News, Va.
Hazeltine, Reginald, Magee Furnace Co., Boston.
Hessler, Geo. J., Syracuse Fdy. Co., Syracuse, N. Y.
Hill, J., The Hill & Griffith Co., Cincinnati.
Hirschheimer, L. C., La Crosse Plow Co., La Crosse, Wis.
Hockley, Rupert R., Abendroth Bros., Port Chester, N. Y.
Hockley, Mrs., Port Chester, N. Y.
Hodges, C. E., Utica Heater Co., Utica, N. Y.
Hooper, G. K., Con. Engineer, New York.
Hubbard, Geo. A., Chicago Flour Co., Chicago.
Hudson, J. M., president Piqua Flour Co., Piqua, O.
Hutton, C. E., Watt Mining Car Wheel Co., Barnesville, O.
Hutton, W. W., Advance Thresher Co., Battle Creek, Mich.
Jacobs, F. D., The Osborn Mfg. Co., Cleveland.
Johnston, S. T., The S. Obermayer Co., Chicago.
Jones, D., Barnett Foundry Co., Newark, N. J.
Jones, J. E., M. H. Treadwell Co., New York.
Jones, W. A., W. A. Jones Fdy. & Mach. Co., Chicago.
Juliem, J. Henry, J. W. Paxson Co., Philadelphia.
Kanavel, N. E., Interstate Sand Co., Cleveland.
Kaye, Ellsworth, J. S. McCormick Co., Pittsburg.
Keegan, J., United Eng. Foundry Co., Pittsburg.
Keegan, Mrs. J., Pittsburg.
Keep, W. J., Supt. Michigan Stove Co., Detroit.
Kelly, T. P., T. P. Kelly & Co., New York.
Kemp, Simon, Molding Sand Dealer, Catasauqua, Pa.
King, F. W., Corrugated Grinding Wheel Co., Philadelphia.
Knapp, L., Stiles Foundry & Supply Co., Parkersburg, W. Va.
Knapp, Mrs. L., Parkersburg, W. Va.
Knoeppel, John C., Oswego, N. Y.
Knoeppel, Mrs. John C., Oswego, N. Y.
Knoeppel, Frank W., Oswego, N. Y.
Lafever, M., Advance Thresher Co., Battle Creek, Mich.
Lambert, Edw. J., Syracuse Chilled Plow Co., Syracuse, N. Y.
Lambert, Mrs. Edw. J., Syracuse, N. Y.
Lane, H. M., editor *The Foundry*, Cleveland.
Langdon, Palmer H., *The Metal Industry*, New York.
Lent, Thos. K., Wm. M. Crane Co., Peekskill, N. Y.
Lincoln, Geo. H., Geo. H. Lincoln & Co., Boston.
Lincoln, T. M., Hartford Foundry Corp, Hartford, Conn.
Lindsay, E. C., W. W. Lindsay & Co., Philadelphia.
Logan, J. A., Jones & Laughlin Steel Co., Pittsburg.
Lord, Henry F., Lord & Burnham Co., Irvington-on-Hudson.
Loudon, Arch. M., Elmira Heater Co., Elmira, N. Y.
Loudon, Mrs. Arch. M., Elmira, N. Y.
Lyon, E. J., Brown & Sharpe Mfg. Co., Providence.
McCardell, Andrew, Pond Machine & Tool Co., Plainfield, N. J.
McCartney, J. T., Watt Mining Car Wheel Co., Barnesville, O.
McCaslin, H. J., Wellman-Seaver-Morgan Co., Cleveland.
McClintock, H. E., National Founders' Association, Detroit.
McCormick, J. S., J. S. McCormick Co., Pittsburg.
McFadden, W. H., Mackintosh, Hemphill & Co., Pittsburg.
McKenna, Chas. J., New York.
McLaren, John, Phillips & McLaren, Pittsburg.
McLean, E., Penn. R. R., Altoona, Pa.
McLean, Martha, Altoona, Pa.
McLeod, Robt., Newark, N. J.
McNeal, G., Garden City Sand Co., Chicago.
McPhee, H., Eaton, Cole & Burnham Co., Bridgeport, Conn.


E. A. MUMFORD.

McPhee, L., Eaton, Cole & Burnham Co., Bridgeport, Conn.
McPhee, N. H., Eaton, Cole & Burnham Co., Bridgeport, Conn.
McPhee, Mrs. Bess, Bridgeport, Conn.
McQuillin, W. S., Colonial Fdy. & Machinery Co., So. Norwalk, Conn.
MacDougalt, D., National Meter Co., New York.
Maher, Edw., Maher & Flockhart, Newark, N. J.
Malone, T. E., J. S. McCormick Co., Pittsburg.
Marceau, L. E., Abendroth Bros., Port Chester, N. Y.
Marceau, Mrs. E., Port Chester, N. Y.
Martin, Geo. H., Rand Drill Co., Ossining, N. Y.
Matthews, C. D., Camden Iron Works, Camden, N. J.
Meeker, David M., Meeker Foundry Co., Newark, N. J.
Meighan, John A., John A. Meighan, Pittsburg.
Meighan, Mrs. John A., Pittsburg.
Miller, A. J., Whitehead Brass Co., Providence.
Millett, E., Millett Core Oven Co., Springfield, Mass.
Mills, C. E., C. E. Mills Oil Co., Syracuse, N. Y.
Mills, J. F., Abendroth Bros., Port Chester, N. Y.
Mills, Mrs. J. F., Port Chester, N. Y.
Moldenke, Dr. R., secretary American Foundrymen's Association, Watchung, N. J.
Moldenke, Mrs. K., Watchung, N. J.
Morehouse, W. S., A. S. Cameron Steam Pump Works, New York.
Morse, H. R., The W. W. Sly Mfg. Co., Cleveland.
Mumford, E. A., E. A Mumford Co, Philadelphia.
Murphy, Hallet M., Eaton, Cole & Burnham Co., Bridgeport, Conn.
Nanert, Herman, Ridgeway Dynamo & E. Co., Ridgeway, Pa.
Newcomb, F. F., Crocker Bros., New York.
Nicol, Jas., Iron & Brass Works, Sandy Hill, N. J.
Norton, Jas. H., The Burr & Houston Co., Brooklyn.
Overton, C. J., The Winkle Co., Hartford, Conn.
Pangborn, John C., Thos. W. Pangborn Co., New York.
Pangborn, Thos. W., Thos W. Pangborn Co., New York.
Parry, W. H., National Meter Co., Brooklyn.
Pennewill, E. E., Abram Cox Stove Co., Philadelphia.
Perrine, W. A., Abram Cox Stove Co., Philadelphia.
Perry, Walter, Farrell Foundry & Machine Co., Ansonia, Conn.
Pettinos, Chas. E., Pettinos Bros., Bethlehem, Pa.
Pettinos, Geo. A., Pettinos Bros., Bethlehem, Pa.

Pridmore, Henry E., Henry E. Pridmore, Chicago.
Quinn, Hugh T., Eaton, Cole & Burnham Co., Bridgeport, Conn.
Raucherberg, E. C., Wheeling Mold & Foundry Co., Wheeling, W. Va.
Reardon, W. J., Westinghouse Foundry, Pittsburg.
Reese, John, Falls Rivet & Machine Co., Cuyahoga Falls, O.
Reid, David, Canadian Westinghouse Co., Hamilton, Can.
Rider, I. G., Frick Co., Waynesboro, Pa.
Rider, Mrs. I. G., Waynesboro, Pa.
Robeson, J. S., American Glutrose Co., Camden, N. J.
Roedell, W. A., Kennedy Valve Mfg. Co, Coxsackie, N. Y.
Savage, Wm. F., Smith & Anthony Co., Boston.



J. J. BURGER.

Sayles, N. W., American Brake Shoe & Fdy. Co., Mahwah, N. J.
Scnade, G. C., Braddock Machine Mfg. Co., Pittsburg.
Schaffer, J. H., National Corundum Wheel Co., Buffalo.
Schilling, Jos., Russell & Erwin Mfg. Co., New Britain, Conn.
Scholl, Geo. P., *The Metal Industry*, New York.
Schroeter, J. A., Western Foundry Co., Chicago.
Schwerin, C. M., Milwaukee Coke & Gas Co., Milwaukee.

AFTER A HOT DISCUSSION AT ONE OF THE SESSIONS.

Sherman, Wm. J., Bethlehem Steel Co., Bethlehem, Pa.
Sickels, W. H., A. A. Griffing Co., Jersey City, N. J.
Sleeth, S. D., Westinghouse Air Brake Co., Pittsburg.
Slocum, A. W., National Corundum Wheel Co., Pittsburg.
Sly, W. W., The W. W. Sly Mfg. Co., Cleveland.
Smith, Eugene W., Crane Co., Chicago.
Smith, F., Nelson Valve Co., Philadelphia.
Smith, J. S., J. D. Smith Foundry Supply Co., Cleveland.
Smith, M. Sheldon, Globe Foundry Co., Port Chester, N. Y.
Smith, P. C., Ingersoll-Sergeant Co., Easton, Pa.
Spence, David, Greenlee Foundry Co., Chicago.
Stafford, Wm. H., Gibby Foundry Co., E. Boston, Mass.
Stearns, Geo. H., Walker & Pratt Mfg. Co., Boston.
Steele, W. O., Bateman Mfg. Co., Grenloch, N. J.
Stehman, John V. R., Birdsboro Fdy. & Mach. Co., Birdsboro, Pa.
Stehman, Mrs. J. V. R., Birdsboro, Pa.
Stickle, F. W., Manufacturers' Foundry Co., Waterbury, Conn.
Stickle, Mrs. F. W., Waterbury, Conn.
Stone, H. H., Penn. R. R., Altoona, Pa.
Stutz, E., Goldschmidt Thermit Co., New York.
Tabor, Harris, Tabor Mfg. Co., Philadelphia.
Taggart, Edw. M., J. W. Paxson Co., Philadelphia.
Tatlock, W. L., Rand Drill Co., New York.
Taylor, Ellsworth M., Library Bureau, Boston.
Taylor, J. A., Port Chester, N. Y.
Thomann, Chas., Crosby Steam Gauge Co., Boston.
Thomas, Chas. H., Associated Fdy. Foremen, New York.
Thomas, D. J., Sterit-Thomas Foundry Co., Pittsburg.
Thompkins, S. D., Smooth-On Mfg. Co., Jersey City, N. J.
Thompkins, Vreeland, Smooth-On Mfg. Co., Jersey City, N. J.
Thompson, A. M., Link Belt Machinery Co., Chicago.
Thompson, Mrs. A. M., Chicago.
Thompson, Frank, T. P. Kelly & Co., New York.
Touceda, Enrique, Albany, N. Y.
Trimble, F. W., Whiting Foundry Equipment Co., New York.
Turnbull, R. E., Henry E. Pridmore, Chicago.
Turney, Jas., H. B. Smith Co., Westfield, Mass.
Tutein, E. A., Crocker Bros., Boston.

W. A. RODDELL

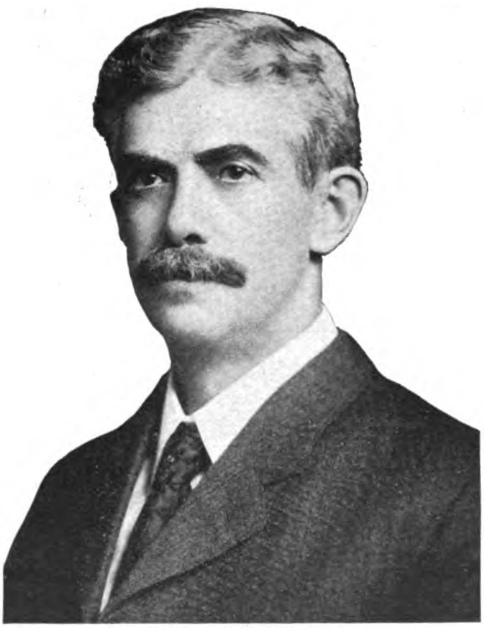
Vanatta, H., J. L. Mott Iron Works, New York.
Vanderford, Asa, Crescent Iron Works, Springfield, Mo.
Wadsworth, Geo. H., Falls Rivet & Machine Co., Cuyahoga Falls, O.
Waldorf, Henry J., Eaton, Cole & Burnham Co., Bridgeport, Conn.
Waldron, M. D., Utica Heater Co., Utica, N. Y.
Waldron, Mrs. M. D., Utica, N. Y.
Waldron, Miss L., Utica, N. Y.
Walker, Arthur W., Walker & Pratt Mfg. Co., Boston.
Walker, Geo. B., Whitehead Bros. Co., New York.
Walker, Mrs. J. W., New York.
Warren, D. C., *The Foundry*, New York.
Watt, Stewart, Watt Mining Car Wheel Co., Barnesville, O.
Webb, Jas. F., Lake Shore R. R. Co., Elkhart, Ind.
Webb, Mrs. J. F., Elkhart, Ind.
Weeks, A. B., Cambria Steel Co., Johnstown, Pa.
Weeks, S. C., Lorain Steel Co., Johnstown, Pa.

West, Thos. D., Thos. D. West Fdy. Co., Sharpsville, Pa.
Wilke, F. A., General Electric Co., Schenectady, N. Y.
William, A. T., Enterprise Mfg. Co., Philadelphia.
William, Mrs. A. T., Philadelphia.
Williams, Sidney M., A. & B. Brown Co., Elizabeth, N. Y.
Winlock, J. P., Barbour-Stockwell Co., Cambridge, Mass.
Wolff, Chris. J., L. Wolff Mfg. Co., Chicago.
Young, Jas., Penna. R. R. Co., Altoona, Pa.

Convention Notes.

The J. S. McCormick Co., of Pittsburg, published a very neat souvenir program of the convention, containing half tones made from the photographs taken at each one of the meetings, from the Philadelphia meeting in 1896 to the Indianapolis meeting of 1904. The half tones are remarkably good, so that the people can be recognized.

The Green Fuel Economizer Co., of Matteawan, N. Y., presented the members with a



A. L. HOTT, INTERSTATE FOUNDRY CO., CLEVELAND, VICE PRESIDENT A. F. F

very neat card case, containing a memorandum book in one of the pockets.

The Thos. W. Pangborn Co. presented each one of the members with a very neat match safe, with the compliments of the National Corundum Wheel Co., of Buffalo, N. Y., for whom the Thos. W. Pangborn Co. are Eastern sales agents.

The J. W. Paxson Co., of Philadelphia, are not as slow as their souvenir might indicate. The souvenir referred to is an exceedingly neat little cast iron turtle, having attached to his back a sheet of celluloid upon which it is stated: "It is now fifty years since we first learned to crawl. The J. W. Paxson Co."

The Springfield Facing Co., of Springfield, Mass., gave away an aluminum letter opener of very neat design.

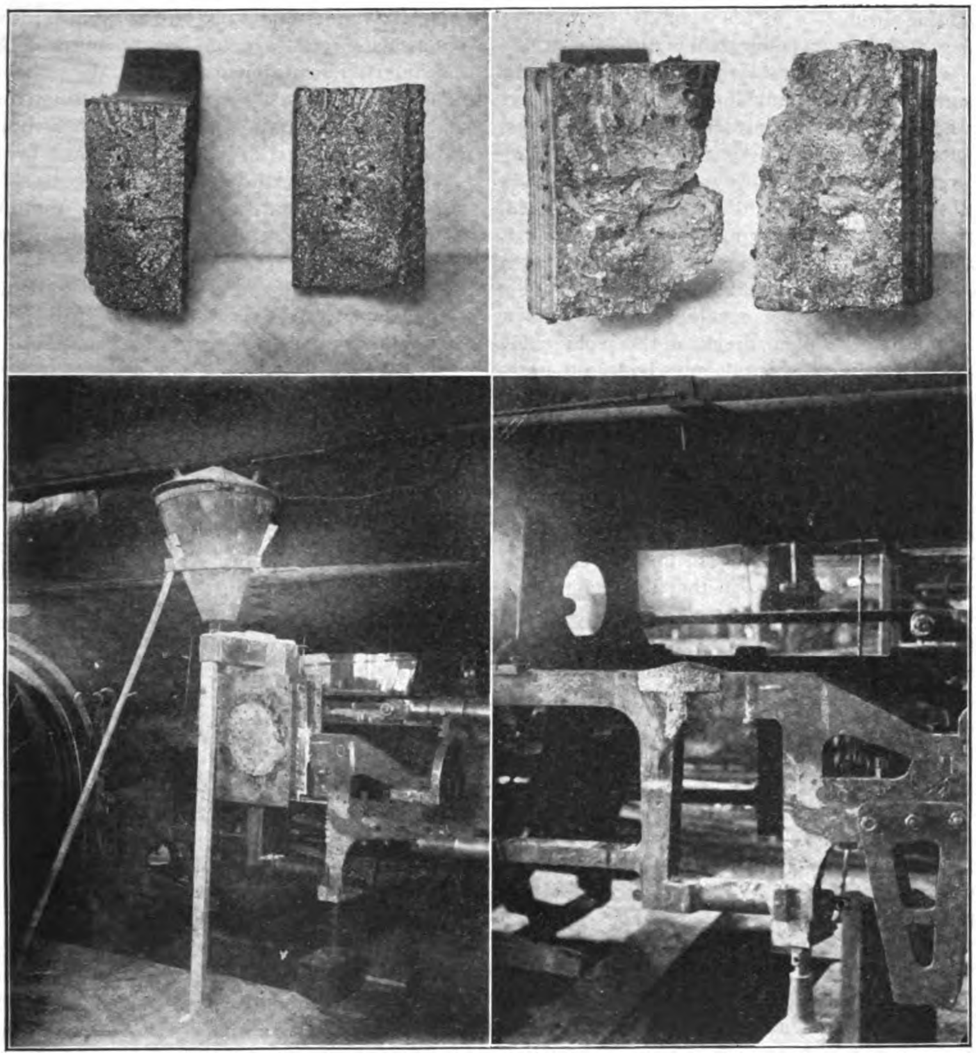
THE USE OF THERMIT IN A RAILROAD SHOP.*

BY JAS. F. WEBB, OF ELKHART, IND.

Thermit is quite new to the majority of us. The first the writer heard of it was about a year ago and since that time he has made a study of it and below is given the experience he has had with it in making several repairs in railroad work. Mr. Autz, general foreman of the Lake Shore railway shop at Elkhart, Ind., has been making some experiments with thermit and the writer assisted him.

The first test was a draw bar of wrought iron, the piece being 2½ x 4¾ in. It was cut in two and welded. We used an ordinary iron flask with openings cut in the sides to let the bar stick out. The size of the flask was 14 x 18 inches, both cope and drag being 8 in. deep. For the sand mixture we used 50 percent fire clay and 50 percent common builder's sand wet with water. The mold was well vented so as to allow it to dry easily. It was dried in a furnace used to melt brass. By placing the mold on top with the bottom side down at first and leaving it over night. The next day the furnace was fired up once more, the mold turned face down and brought to a red heat. The bar was cleaned for four or five inches each side of the break so as to remove the rust. It was then heated to a cherry red and placed in the mold, which was almost red hot. After closing the mold, all small cracks were well filled with soft fire clay so as to prevent run outs. A collar was cast around the break about ⅝ in. thick and 1¾ in. wide, the object of the collar being to give the metal an opportunity to run around the bar so as to melt the surface of it, thus forming a perfect weld. If it were not for the collar, the ends of the bar would not be sufficiently heated. The mold was gated from the bottom, so that the metal would strike the bottom corner of the bar first, run through under it and gradu-

*Read at A. F. A. Conventi n.



I AND 2 FRACTURE OF THERMIT WELDS, 3 CRUCIBLE IN PLACE FOR A WELD, 4 THERMIT WELD.

ally rise on all sides at the same time. The gate was at an angle of about 15 degrees. The riser was quite large, being 6 x 9 in. at the top and tapering to 2 x 4 in. at the casting or weld. We used a skim gate to catch the slag, as there is about three times as much slag as iron when measured by volume. The slag also is not as liquid as the iron. The skim gate connected from the pouring gate to the riser. We all know that if such practice as this were discovered in a gray iron foundry the molder guilty of it would be looking for a new job soon. The connection between the pouring gate and the riser which forms the skim gate was about 2½ in. from the top of the casting or weld, the opening being 1¾ x 1¾. The writer has found it good practice in this class of work to have a skim gate extend almost up to the top of the pouring gate and riser so as to avoid any tendency of the slag to pass down into the mold.

In this first weld we used 16 lb. of thermit, the collar and the space between the weld together requiring about 22 cu. in. of metal. After breaking the piece, it was found to be full of blow holes so that it broke easily under the screw press operated by hand. In this case the thermit was put in a crucible in the usual way, the ignition powder being placed on top and the metal being tapped as soon as the reaction ceased, which the writer thinks is not good practice. Better results are obtained by waiting from five to ten seconds, to give the slag a chance to come to the surface.

On the second test, which was made on the same sized bar and in the same way, we used 20 lb. of thermit and got a great deal better weld, with a very good grain and fracture. There were, however, a few blow holes at the top and near the center of the weld, as shown in the half tone reproduction Fig. 1, which is a cross section of the bar after it was broken at the weld. These bars had the collars machined off, together with the riser, so as to make them break at the weld. The second test piece was put on a hydraulic press and required 50 tons to break it, with supports 20 in. apart. The fracture was nearly straight across. In the second test the metal tapped itself about the time the reaction ceased, the reason being that the metal disc used in stopping the bottom of the mold is a little convex on one side and had been placed with the convex side down so that it did not have a perfect bearing. In the later tests we found it best to put the concave side down and thus avoid the trouble.

In test number three we used the same sand and the same treatment, only we used 35 lb. of thermit and 3½ pounds of ¼-in. iron rod, cut into pieces about 8 in. long so that they can be pushed into the thermit for their entire length, previous to igniting the charge. If the bar projects above the surface of the thermit a portion of the metal will not be melted. The amount of iron used in this case was about 10 percent of the thermit used. By using the iron more metal can be obtained from a given weight of thermit charged. Also, as the bars we were experimenting with were of wrought iron, we felt that the use of the wrought iron stock would produce a metal more nearly approaching the wrought iron. This third test was tapped just as the reaction was over. When machining off the collar we found that the metal was not hard, but was exceedingly tough. In machining off the top and one side we found some blow holes, but not to any serious extent. When tested upon supports 20 in. apart it took 50 tons' pressure to break the bar and the fracture was very good, as shown in Fig. 2. The fracture, however, was somewhat more uneven than the one shown in Fig. 1.

After our success with these tests, Mr. Autz decided to try a locomotive frame. The frame first operated upon was broken in the front pedestal over the driving wheels, as shown in Figs. 3 and 4. The break was a vertical one and the frame was of wrought iron, at this point being 3¾ x 5 in. cross section. The machinery taken down included the wheels, driving boxes, shoes, wedges, connecting rods and running board. Five-eighth inch holes were drilled vertically through the break about 1⅛ in. apart, the object being to give the metal a chance to flow up along the line of the crack and result in a solid weld across the entire surface.

The mold was made in a sheet iron flask designed by Mr. Autz, and was a perfect fit in

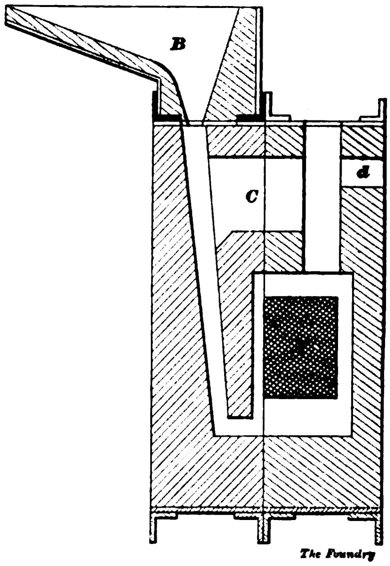


FIG. 5

every respect. The openings about the frame were cut about ¼ in. larger so as to allow some space for adjustment which could be filled later with fire clay. The accompanying sketch, Fig. 5, shows a cross section of the mold through the gate and riser, while Fig. 3 shows the crucible in place ready for ignition and Fig. 4 the weld after the crucible was removed and the gates cut off. In order to avoid the use of the matches and ignition powders in firing the charge, Mr. Autz conceived the idea of firing the charge by electricity, and the wires connected for doing this are shown in Fig. 3. This method of firing proved to be very successful, and it is certainly more convenient and safer than the lighting of the powder by hand. We used 60 lb. of thermit and 6 lb. of ¼-in. wrought iron rods. The charge was tapped from five to seven seconds after the reaction ceased. Owing to the position of the break it was necessary to build a runner 15 in. long to carry the metal from the crucible to the gate. A special crucible with one flat side might be made for such jobs as this and would probably be found advantageous.

The weld looked very good from the outside, though there were a few small holes on the top, some of which were 1¼ in. deep. The engine, No. 5024, went into service April 20, hauling heavy freight and fast passenger trains, and up to the present time has given A1 satisfaction.

NOTES ON SOME RETORT COKE MELTING RATIOS.*

BY C. M. SCHWERIN, MILWAUKEE, WIS.

During the writer's experience as demonstrator for one of the by-product coke companies, it has been his good fortune to have charge of cupolas of many various styles, melting iron for all classes of work, and as the question of melting ratio is of interest to foundrymen, the results of some tests are here given.

By-product coke is coming so rapidly to the fore and is replacing beehive coke to such a marked degree, that foundrymen all over the country, even when out of the district supplied by the present by-product companies, no doubt are interested.

Many statements have appeared in books and journals of the amount of iron that coke would melt, but the exact melting ratios under ordinary working conditions of the foundries have been very hard to obtain, as a melting ratio for proper foundry operation is not what the coke will do when driven to the limit, but is that ratio at which the coke will give hot, fluid iron adapted to the work being poured. Many foundrymen will tell of some excellent work which they have done at some past time, or will tell about a high ratio which upon close investigation proves to be erroneous, as in many cases the bed has been left out of the calculation, in others a certain number of pounds has been estimated to make up a bushel, and while again some simply take the cupola record as turned into the office without verifying the actual weights—an extra shovel or fork full for good luck, that many cupola tenders are prone to throw in, without recording, exerts quite an influence on the amount of coke consumed.

In this brief article the aim will be to give some exact figures of a number of heats which were run under the writer's supervision. All weights of both coke and iron were actual scale weights with no allowances of any kind.

It must be borne in mind that in every instance the cupolas used were in shops unfamiliar to the demonstrator, and were never, in any instance, in his charge more than three days. In some cases better ratios could have been obtained by carrying on the tests further, gradually reducing the quantity of coke until the limit of safety was reached.

It is my firm belief that coke is one of the most expensive things to economize on that there is about a foundry. It is very poor policy to make an apparently fine ratio without taking into consideration the percentage of bad castings due to poor iron. It is always good practice to use an excess of coke, as saving at "the spiggot and losing at the bung hole" does not increase profits. It pays to have hot iron for many reasons; firstly, it cuts off the molders favorite excuse for bad castings; secondly, it enables small gates to be used on light work, giving clean castings and an easily detached gate and a smaller proportion of remelt; thirdly, iron is more easily skimmed when pouring and slag kept back; fourthly, if a slight accident happens, such as the power shutting down, etc., there is a margin of safety to work with.

Another thing to be borne in mind when comparing ratios, in addition to the thinness of castings to be poured, is the chemical composition of the metal. High phosphorus, high carbon or high silicon iron will stay fluid much longer than low phosphorus, low carbon and low silicon iron. High sulphur in coke will make an iron set quickly even though it comes hot from the cupola. Doubtless many of the readers of this article will recall some experience of two years ago during the coke famine that will bring this fact home to them.

The so-called "semi-steel" mixtures which are simply low silicon, low carbon cast irons high in manganese, set very quickly, as every man who has ever had to keep ladles in repair in a foundry pouring this metal will testify to. The proportion of scrap to pig iron and the size of both affect both melting ratio and speed of melting, and both are constantly varying. This is another reason for keeping on the safe side in regard to the quantity of coke used.

Most of the heats here recorded are really too small to show the best total ratio as the bed enters in as too prominent a factor, but the figures are representative of the majority of the shops of this country as the big melter is the exception and not the rule.

Our experience has shown that a high coke bed gives better net result than starting with the so oft recommended 18 in. above the top

*Read at A. F. A. Convention.

of the tuyeres. This seems to be a disputed question, however, and the writer would appreciate information in regard to the actual experience of others. By running the bed high less coke by far may be used on the subsequent charges; once the bed burns out and melting commences too near the tuyeres, trouble begins. Many, no doubt, have noticed the rush of slag at the end of a heat, even when no flux has been used; when this happens it is invariably found that melting took place very near the tuyeres, causing the blast to excessively oxidize the iron. Not only is this a disadvantage in regard to the amount of coke used, and trouble with slag, but the iron resulting will be harder than if the melting was done at the proper place, due to the oxidization of silicon, carbon, etc. Those who had the good fortune to witness the tests on coke conducted at the Model Foundry in St. Louis, no doubt saw this point nicely illustrated. The bed in those tests was brought only eight inches above the top of the upper tuyeres; on heats of about 3,000 lb. the oxidization was very heavy and slag just poured in a liquid stream out of the slag hole, and the iron lost in melting was found to be very high indeed. For these tests this method of running was of course all right as comparative data of various cokes under the same conditions was what was sought, and the tests were very painstakingly and carefully conducted under supervision of Dr. Moldenke.

In running a cupola to get the most economical results it is found that the bed should be lighted up as late as possible, and that the blast should be put on as soon as feasible after the cupola is charged full of iron. In burning the bed it is a good plan to put only a portion of the coke on the wood before lighting, and as the flame shows through, the remainder of the coke should be charged. As soon as all the wood is burned out, and the blue flame appears through the top of the bed coke, all tuyeres should be closed and charging of iron begun. Just before putting on the blast, it is advisable to open one tuyere in order to prevent any possibility of a gas explosion, this tuyere to be closed, of course, after the blast has been on a minute or so.

Another point to be considered is the running of a cupola with only one row of tuyeres instead of with two. The cupola with only the lower row will run more economically, as far as coke consumption goes, and less difficulty would be experienced in the burning out of the brick. Of course a cupola with two rows of tuyeres melts somewhat faster with both rows open than if only the lower row be used, but if the lower row be enlarged, the same speed of melting can be obtained as though two rows were used. In an endless number of cases we have found that general economy results through using but one row of tuyeres, and very nearly all the foundries which the writer has visited are now running that way. The coke used in the following tests was from the Solvay by-product ovens at Milwaukee, Wis.

TEST NO. 1.

Inside cupola diameter at doors, 42 in., at tuyeres, 40 in., at melting zone, 41 in.

Tuyere arrangement—

6 tuyeres 10 x 4 in. flaring from 6 x 4 in.

Lower side of tuyeres 14 in. above the sand bottom.

	Pounds Coke	Pounds Iron
Bed charge	1,000	3,000
Charges 2 to 11, inclusive	120	1,500
" 12 " 15, "	100	1,500
Charge 16	80	1,000
Total	2,680	25,000

Ratio of coke to iron, exclusive of bed, 1 to 13.1.

Ratio of coke to iron, inclusive of bed, 1 to 9.3.

Total time blast on, 2 hours and 5 minutes.

Pounds or iron melted per hour, 12,000.

Blast pressure used varied from 9 to 10½ oz.

Mixture used consisted of 45 percent unbroken pig and 55 percent medium weight scrap.

Castings for agricultural machinery and threshing engines were poured.

The iron was considerably hotter than needed.

TEST NO. 2.

The same cupola was used as in test No. 1.

	Pounds Coke	Pounds Iron
Bed Charge	1,000	3,000
Charges 2 to 3, inclusive	150	2,000
" 4 " 11, "	125	2,000
Charge 12	100	1,500
Total	2,400	24,500

Ratio of coke to iron, exclusive of bed, 1 to 15.3.

Ratio of coke to iron, inclusive of bed, 1 to 10.2.

Total time blast on, 2 hours.

Pounds of iron melted per hour, 12,250.

Blast pressure used, varied from 9 to 10½ oz.

Mixture used consisted of 45 percent unbroken pig and 55 percent medium weight scrap.

Castings for agricultural machinery and threshing engines were poured.

The iron was hot enough throughout the entire heat, and for pouring some of the work it was cooled by the molders.

TEST NO. 3.

Inside cupola diameter at doors, 37 in.; at tuyeres, 33 in.; at melting zone, 36 in.

Tuyere arrangement—

4 lower tuyeres, 12 x 3 in., flaring from 6 x 3 in.

4 upper tuyeres, 6 x 1¾ in.

Lower side of lower tuyeres 11 in. above the sand bottom.

Top of the upper tuyeres, 23 in. above the sand bottom.

	Pounds Coke	Pounds Iron
Bed charge	600	1,100
Charges 2 to 8 inclusive	90	1,100
Charge 9	50	700
Total	1,280	9,500

Ratio of coke to iron, exclusive of bed, 1 to 12.3.

Ratio of coke to iron, inclusive of bed, 1 to 7.4.

Total time blast on, 1 hour and 10 minutes.

Pounds of iron melted per hour, 8,140.

Blast pressure was started with 10 oz. but was reduced, as the molders could not carry away the iron fast enough.

Mixture used consisted of 45 percent unbroken pig and 55 percent medium weight scrap.

Light sewing machine castings were poured. The iron was very hot.

The coke dropped in the bottom from this heat was picked out and found to weigh 240 lb. If this amount be subtracted from the coke used in the heat, the net ratio of coke to iron, inclusive of bed, would be 1 to 9.1.

TEST NO. 4.

Inside cupola diameter at doors, 44 in.; at tuyeres, 41 in.; at melting zone, 42 in.

Tuyere arrangement—

5 tuyeres, 8½ x 5 in.

	Pounds Coke	Pounds Iron
Bed charge	1,005	4,000
Charges 2 to 5, inclusive	240	2,800
Charge 6	240	2,300
" 7	85	1,000
Total	2,390	18,500

Ratio of coke to iron, exclusive of bed, 1 to 11.3.

Ratio of coke to iron, inclusive of bed, 1 to 8.1.

Total time blast on, 1 hour and 50 minutes.

Pounds of iron melted per hour, 10,090.

Blast pressure used, 7 to 8 oz.

Mixture consisted of 70 percent unbroken pig, with 30 percent of quite heavy scrap.

Machinery castings were poured.

The iron was hotter than needed and was cooled down throughout the heat by throwing scrap into the ladles.

TEST NO. 5.

Inside cupola diameter at doors, 34 in.; at tuyeres, 32 in.; at melting zone, 32 in.

Tuyere arrangement—

6 Tuyeres 7½ x 2½.

Lower side of tuyeres 10 in. above sand bottom.

	Pounds Coke	Pounds Iron
Bed charge	610	1,800
Charge 2	160	1,800
" 3 to 6	160	1,800
Charge 7	105	1,600
" 8	35	500
Total	1,550	12,900

160 lb. of old coke dropped in the bottom from the heat the night before was used during above heat, the amount being distributed throughout the charges. This gave 1,390 lb. of new coke used during the heat.

Ratio of new coke to iron, exclusive of bed, 1 to 14.2.

Ratio of new coke to iron, inclusive of bed, 1 to 9.3.

Ratio of total coke to iron, inclusive of bed, 1 to 8.3.

Total time blast on, 1 hour and 8 minutes.

Pounds of iron melted per hour, 8,795.

40 percent scrap and 60 percent of broken pig was used.

Very little agricultural castings were poured. The iron was very hot.

TEST NO. 6.

Inside cupola diameter at doors, 30 in.; at tuyeres, 33 in.; at melting zone, 31 in.

Tuyere arrangement—

4 Tuyeres 10 x 2½ in. flaring from 6 x 4½ in.

Lower side of tuyeres 15 in. above sand bottom.

	Pounds Coke	Pounds Iron
Bed charge	550	1,100
Charges 2 to 7, inclusive	90	1,100
" 8 " 9* "	80	1,100
Total	1,250	9,900

*Coke on last charge could have been reduced but it was first thought that more than 1,100 lb. of iron was to be put on the last charge; on the heat which was run the previous day only 105 lb. of coke were used on the last charge to melt 1,600 lb. of iron.

Ratio of coke to iron, exclusive of bed, 1 to 14.1.

Ratio of coke to iron, inclusive of bed, 1 to 7.9.

Total time blast on, 1 hour and 30 minutes.

Pounds of iron melted per hour, 6,600.

Blast pressure not determined.

Mixture consisted of 75 percent broken pig and 25 percent scrap.

Castings for furnaces, requiring hot iron, were poured.

Iron was hot.

TEST NO. 7.

Inside cupola diameter at doors, 36 in.; at tuyeres, 38 in.; at melting zone, 39 in.

Tuyere arrangement—

6 Tuyeres 16 x 3½ in. flaring from 8 x 4½ in. The lower side of tuyeres 14 in. above sand bottom.

	Pounds Coke	Pounds Iron
Bed charge	850	3,000
Charge 2	165	2,000
" 3	150	2,000
" 4 to 5, inclusive.......	125	2,000
" 6	75	1,500
Total	1,490	12,500

Ratio of coke to iron, exclusive of bed, 1 to 14.8.

Ratio of coke to iron, inclusive of bed, 1 to 8.4.

Total time blast on, 1 hour.

Pounds of iron melted per hour, 12,500.

Blast pressure, 10½ oz.

Mixture used, 50 percent pig, 50 percent light scrap.

Castings for railroad and jobbing work poured.

Iron was hot.

No records in any way are claimed for these heats, the figures simply being presented as of interest to foundrymen in general as showing what is actually being done under regular working conditions. These tests themselves show such a wide variation that that fact in itself is of interest in making comparisons, particularly as the quality of the coke used was very uniform. In many cases that have come under the writer's notice, similar cupolas in both size and type would give widely different results even when the same coke was used. These variations were due to a variety of more or less understood causes, which it is not the purpose of this present paper to discuss, but when comparing the records here given with his own practice, each foundryman must bear in mind that conditions vary.

BLOWERS, PIPING AND CUPOLAS AT THE PLANT OF THE MICHIGAN STOVE CO.*

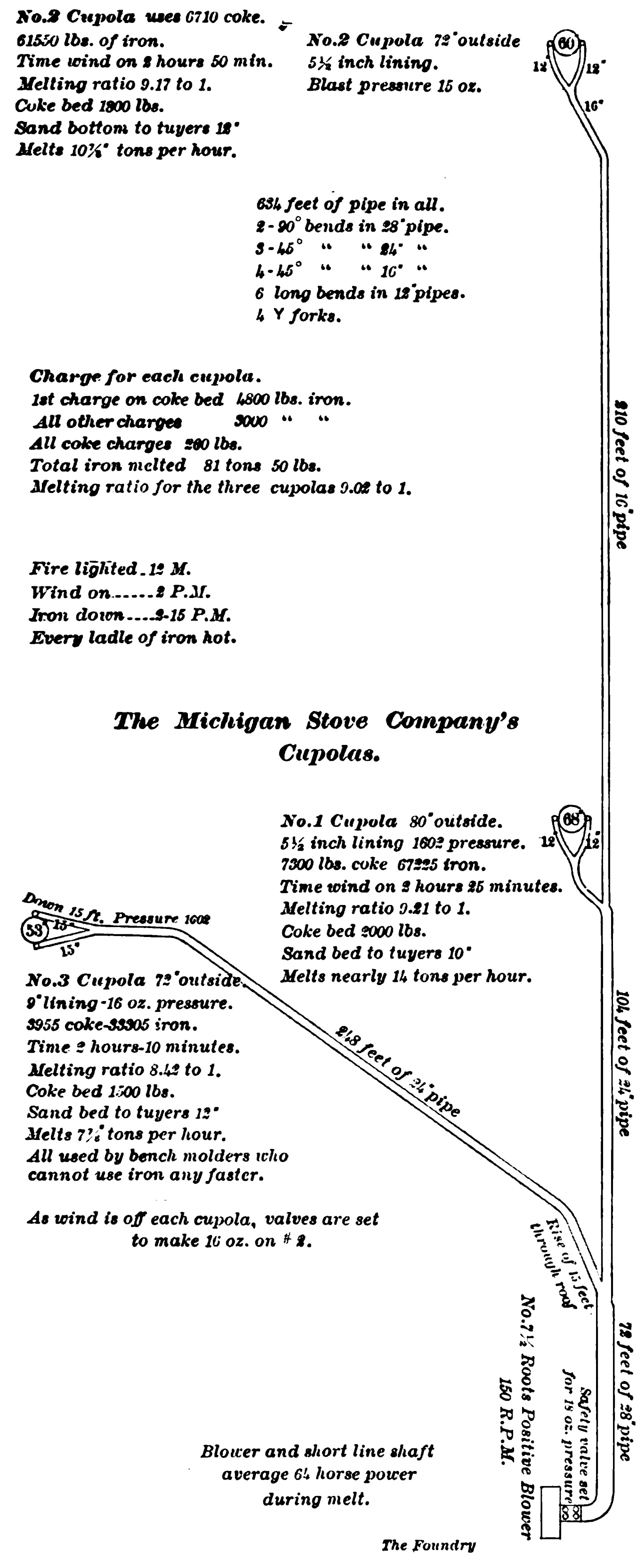
W. J. KEEP, DETROIT, MICH.

In describing this plant and the performance of the cupolas and blower, it is with the full realization that ideal conditions seldom exist, and that each man must fashion according to his needs.

An independent blowing unit for each cupola with short piping, is an arrangement we would like to have, but which only a favored few possess.

In our case, the piping from the blower has been extended to meet the growth and increased demands of our plant. Until now we have three cupolas operated by one blower, under the following conditions: Starting at the blower end is a No. 7½ Roots' blower, running at 150 r. p. m. From there the air piping is carried overhead by two 90-degree bends in a 28-in. line, 72 ft. to a point where it branches with a Y into two 24-in. lines, one running 248 ft. to cupola No. 3; the other 104 ft. to cupola No. 1. From No. 1 with a Y branch begins a 16-in. line running 210 ft. to No. 2 cupola. All bends are long radius and wind boxes are supplied by two pipes on opposite sides, starting from a Y on the main line. The

*Read at A. F. A. Convention.



sketch shows the general location of the pipe lines and cupolas.

There are butterfly valves in line at cupolas Nos. 1 and 3, so that cupola No. 2 may not be short of wind, and which are also opened to allow surplus air to escape when cupola No. 2 is operated alone. No. 3 is the point where the least air is needed and is where most of the throttling down occurs, because this cupola serves a snap flask shop, which cannot take care of the iron as fast as the normal operation of the cupola would furnish it.

As No. 3 cupola seldom operates over two hours, and with a very small heat, it is run at a disadvantage and cuts down the average efficiency of the entire plant.

In most of the data the results are for the plant as a whole, and while this shows unfavorably for Nos. 1 and 2, it represents the actual working conditions liable to occur in almost any large plant.

We find that our best results are obtained with a blast pressure at the cupola at from 16 to 18 ounces, for we get our fastest melting under those conditions, without sacrificing economy of operation. In order not to exceed 18 ounces a relief valve is placed at the blower to lift at that pressure. We have tried higher pressures and have found that with from 22 to 26 ounces there was no increase in the melting rate, as the chilling effect of excess air nullified the advantage of increased blast pressure. Up to 22 ounces there was a decided increase of output, but the best results were with a blast of 16 or 18 ounces.

The losses from friction in the piping are ½ ounce to No. 3, ¾ ounce to No. 1 and 1½ ounce to No. 2. At the beginning of the heat only Nos. 1 and 2 are on. Later No. 3 is started up and the pressure falls as low as 14 ounces at No. 2. This condition does not last for more than half an hour, when the pressure runs up to 15 ounces at No. 2 and 16 ounces at Nos. 1 and 3, at the end of the heat, with the dampers, this cupola getting 16½ ounces and melts very fast. The following is the record of an 81-ton heat in the fall of 1904 when the foundry was running to its full capacity:

AN 81-TON HEAT IN 1904.

Cupola	Outside Diameter	Inside Diameter	Coke Used	Iron Melted	Ratio Iron to Coke	Length of Heat	Tons Melted per hour
No. 1	80"	68"	7300	67225	9.21 to 1	2h—25m	14
" 2	72"	60"	6710	61550	9.17 to 1	2h—50m	10⅞
" 3	72"	53"	3955	33305	8.42 to 1	2h—10m	7⅞

Totals, 81 tons 50 lb. iron. 32.75 tons per hour. Ratio 9.2 to 1. Air displaced by blower per ton per hour 22,800 cu. ft.

For stope plate it requires close attention to avoid dull iron when the ratio is above 9 to 1, and the following are average records. When more coke is burned melting is slower:

A 75½-TON HEAT IN FEBRUARY, 1905.

Cupola	Coke Used	Iron Melted	Ratio	Length of Heat
No. 1	6900	63430	9.0 to 1	2h—55m
" 2	6450	59250	9.2 to 1	2h—55m
" 3	3640	28270	7.8 to 1	1h—50m

75 tons 950 lb. iron. Ratio 8.86 to 1. Air 25,380 cu. ft.

1905	March 1	March 2	March 4
Total Coke Used....	16950	16970	16660
Total Iron Melted..	75 tons 10 lbs	74 tons 1740 lbs	73 tons 190 lbs
Ratio Iron to Coke..	8.8 to 1	8.8 to 1	8.7 to 1
Tons Melted per hr	28.8 tons	28.07 tons	28.00 tons
Cu. ft. of Air per Ton per hour.....	25500	26400	26400

On March 8, 1905, on account of a funeral of one of the employes, No. 1 cupola was run alone with an air pressure of 17 ounces.

The molders could not pour fast enough to take the iron as fast as melted and it was therefore necessary to reduce the blast at times. Under these conditions 33 tons 960 lb. of iron were melted at the rate of 13.4 tons per hour with a ratio of 9.2 to 1.

As the average of the last four heats in No. 1 cupola was 11 tons per hour, the increasing of the blast 1½ oz. has increased the melting 20 percent.

HORSEPOWER REQUIRED TO DRIVE THE BLOWER AT VARIOUS PRESSURES.

Pressure at Blower	Indicated Horsepower to drive Blower	Theoretical Horsepower to drive Blower	Per cent Efficiency of Blower	Friction
13 ounces	50 I. H. P.	45.23	90.4	6.9
18 ounces	72 "	62.48	92.0	8.0
23 ounces	87 "	80.00	87.0	13.0

The engine was indicated by an expert. 18 ounces at the blower would produce the normal pressure at each cupola.

The friction of a short countershaft and belt are included in these figures. As the relief valves of our blower are set for 18 ounces and our pressure varies from 13 to 18 ounces, it is fair to assume 64 as the average horsepower consumed during one melt. As the tonnage with three cupolas is 28½, the horsepower per hour required under our conditions is $64 \div 28½ = 2.25$, and the air displacement per ton of iron per hour is 26,220 cu. ft. per hour, instead of 30,000 cu. ft., as usually allowed.

As a pound of carbon requires about 11 lb. of air for combustion to CO^2 and 13 cu. ft. of air equals 1 lb., therefore 1 lb. of coke should require 143 cu. ft. of air. The coke averages about 5,650, requiring theoretically 28,500 cu. ft. of air per hour.

Wishing to know what the makers would recommend for our work, as the most economical installation, we find, in spite of our long pipes, and air actually wasted, when Nos. 3 and 1 are shut down, that we are still well within what would be ordinarily expected in an ideal arrangement of independent blowers and motors for each cupola, with consequent decrease of pipe friction.

The makers recommended as follows:

Cupola Blown	Cu. Feet Air Displacement per Minute	Horsepower	Tons
No. 1	7000	30.5	14
" 2	5400	23.5	10⅞
" 3	4000	17.5	7⅞
Total......	16400	71.5	32¾

Allowing 20 percent for friction of blower and motor, we get 90 horsepower, or 2¾ horsepower per ton, against 2¼ actually required.

On the above basis of air the friction losses figure out 1 ounce to No. 1 cupola, 3.1 ounces to No. 3, and 6 ounces to No. 2. On an allowance of 24,000 cu. ft. per hour per ton of iron the friction to No. 1 cupola is .9 ounces, to

No. 3, .55 ounces, and to No. 2 cupola is 2.50 ounces.

The actual loss as stated before is from ½ to ¾ of an ounce to Nos. 1 and 3. It is from 1¼ to 1½ ounces to No. 2, showing that our piping is of correct size to Nos. 1 and 3 but too small to No. 2. It would be better to continue the 28-in. pipe to the fork at No. 1 and make it 20 in. or 24 in. to No. 2.

The data presented here represents as near as possible actual running conditions, and our plant could be improved upon by independent units for each cupola with shorter piping, thus avoiding the waste of air when Nos. 1 and 3 are down. This could be done by reducing the speed of the blower, but as we are fixed we have to use constant speed.

However, as we are now getting iron as hot and as fast as we wish it, there is no object in increasing the blast pressure.

We would be very much interested to have the records from a plant where the arrangement is similar to ours, and where a fan is used instead of a rotary blower.

A MODERN METHOD OF VENTING CORES.*

BY JAS. A. MURPHY, FRANKLIN, PA.

The proper venting of cores has always been a theme upon which foundrymen could base interesting argument. Bad venting has always furnished a ready made excuse for a bad casting by the molder; indeed, when he could think of nothing else to lay the blame on, the core was sure to come in for a bad character and the coremakers' ability was criss-crossed with suitable and expressive adjectives.

Not all molders recognize the degree of skill that is required to vent some crooked cores properly, nor do all coremakers realize how necessary it is to have vents through which the gas will flow easily and without any unnecessary obstruction.

The evolution of the air compressor, gas engine and automobile has set the brightest minds in the business experimenting, seeking a remedy for the poorly vented cores that cause such disturbances at casting time. The proper venting of this class of cores is a far more skillful operation than most people are ready to allow, and it is only seldom that the coremaker has the proper facilities to do the job properly. The core shop is the most neglected part of our foundries today and it is only within a few years that it has been given any notice at all. It is a hopeful sign of the times, however, to see foremen and employers in general waking up to its necessities and its possibilities.

*Read at A. F. A. Convention.

The pulling of wires and soaped strings around corners as a means of venting is a thing of the past. The wax wire method of venting has come into our foundries to stay. All methods of wax wire venting are not by any means satisfactory.

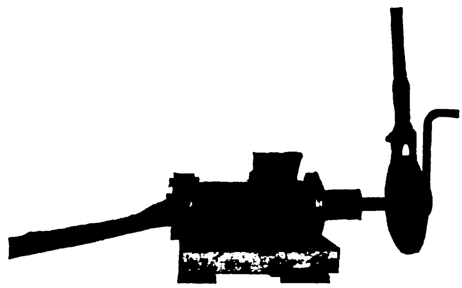


FIG. 1. PRESS WITH WAX WIRES BEING FORCED OUT.

The wax taper with a string or threads running through it gives very poor satisfaction, that with the wire through it is better but its cost is an item of no small consideration and many foundries prefer to do without it and continue to lose castings on this account. The object of using the wax, of course, is that the core while drying absorbs the wax, leaving only the string or wire which when pulled out leaves an open and free hole.

If the string gets burned on the end it is a difficult job to pull it and if it breaks inside the core it cannot be extracted. An imperfect vent is the result and a possible blown casting.

The wax wires, Fig. 1, are the result of much experiment to do away with strings of any kind in the wax, in fact, to have something that was as nearly fool-proof as possible.

The element of cost was also a consideration and the composition used is made at less than one-eighth of the cost of any wax on the market today. The illustration of the machine, Fig. 1, gives a fair idea of the process of manufacture. A helper will turn out enough of different sizes to last 30 coremakers one day in about one hour, so the cost of manufacture is infinitesimal, once the installation is made.

These wires are easy to handle, are not sticky except when hot, are as tough as twine when at the right temperature, and can be made in coils of any length or cut off in desirable lengths and laid away in trays ready for instant use. There is no waste as the pieces not used, short ends, etc., are again put back in the machine and pressed out as new wires.

The thickness is regulated by the die. In practice I make them from 3-32 to ⅛ in., but any desired size can be made. The material is very light and I have known men not to use a pound all day venting the most complicated of jacket cores for air cylinders.

The skill of the coremaker is considerably minimized in producing a perfectly vented core, as it is impossible for him to do otherwise if he rams up a string of this wax in the proper parts of the core. It is not claimed that this wax will take the place of rods, but its absorption by the sand in baking has a very decided tendency to strengthen the core.

Several cores that must be made in halves in order to be properly vented can be made in one

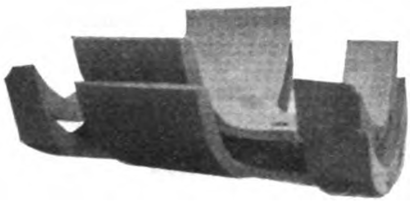


FIG. 2. JACKET CORES VENTED WITH WAX WIRES.

piece by this process at a considerable saving of time and expense.

Since I designed this machine and brought this method of venting cores to what I consider a state of absolute perfection, in the shops of the Chicago Pneumatic Tool Co., at Franklin, Pa., blown cores are a thing unknown in our foundry where every casting is filled with them and where work of the most intricate character is the rule rather than the exception.

I cannot lay too much stress on the time saving qualities of this machine. Venting is at best a tedious and time-killing operation no matter how it is done, but with this wax all that is necessary is to ram up the string in the proper place and the job is done permanently and well.

The ingenuity of the most expert designer in producing crooked orifices for which cores must be employed in the production of the casting, is defied, for as long as there is left any opening through which a small pipe can be passed a perfectly vented core can be made by this process.

Several foundrymen who have seen the process in operation have pronounced it one of the most important of inventions for the cheap and safe production of intricate work.

Its cost of installation being very small, the cost of the material not worth mentioning, no waste material, the accessibility of all sizes of strings in any quantity at a moment's notice and the perfection of the cores that it is used in, are all points very much in its favor of being later as universally adopted as the core making machine.

FIG. 3. CYLINDERS AND CORES.

NOTE—The protograph reduces the cores more than the cylinder. The vent is all taken off trough x x.

I consider it an absolute indispensability in shops which make a specialty of pump, engine, air compressor, gas engine, automobile or other intricate or delicate work. In several of these shops its savings in the course of a year would run well into the thousands of dollars.

TRADE PUBLIICATONS.

The Canadian Engineer, published at Toronto, beginning with the issue of June 1, 1905, will be issued under new auspices; both as regards ownership and the editing of its columns. The paper is now owned by the Monetary Times Printing Co., which also publishes several other trade papers. Biggar-Samuel, Ltd., were the former publishers. Under the new regime Thomas Robertson will be president, James Hedley, vice president, and Edgar A. Wills, secretary and treasurer. Samuel Groves will be editor. He is an expert in metallurgical science and was 1904 lecturer on "Mines, Furnace and Foundry," to the Carnegie Technical Schools, Pittsburg.

The National Electric Co., Milwaukee, Wis., have started a series of publications which they call "An Electrical Catechism." These are neatly printed little leaflets, 5 by 6½ inches, in which they give various electrical definitions and matter of interest to any one working along electrical lines. The leaflets are so gotten out that they can afterwards be placed in a suitable binder.

The F. W. Greene Co., of Mechanicsville, N. Y., has issued a catalogue showing an extensive line of stove trimmings manufactured by this company, including plans for stoves for both gas and solid fuel.

The McConway & Torley Co., of Pittsburg, Pa., have gotten out a very neat publication entitled "The Evolution of Car Couplings." It is a well illustrated booklet 9½ by 12 inches, which contains diagrams and illustrations of the various forms of car couplers which have been brought out from time to time, showing the gradual advance from the previous form to the more recent. The book is published in both English and French, there being two columns on each left hand page, one telling the story in English and the other in French. The right hand pages are taken up with the illustrations, diagrams, etc.

W. W. Lindsay & Co., of Philadelphia, are sending out a very neat little catalogue, 3¼ in. x 6¼ in., in which they describe the foundry chaplets and anchors which they manufacture. These devices are fully illustrated and tables of dimensions and prices given.

The Ansonia Brass & Cooper Co., with head offices at 99 John street, New York, is sending out a catalogue, 4 in. x 7¼ in., describing and illustrating the various uses of tobin bronze. The second page contains an illustration of the mills of the Ansonia Brass & Copper Co., at Ansonia, Conn. Following this there are several pages of what the company furnishes, what the material is suited for, what tobin bronze is, including its physical tests, instructions for ordering the same and much other information which should be of use and interest to all requiring such special metals.

The Ingersoll-Sergeant Drill Co., of New York, is sending out a book entitled "The Blue Book of Air Compressors." It contains a list of their offices, next a general introduction or statement concerning the company and the book, after this a view of its works at Easton, Pa., and Phillipsburg, N. J. This is followed by illustrations and short descriptions of its various classes of compressors. These statements describe the machine in a few words and then state the classes of work for which it is especially adapted. The last few pages of the book mention the other classes of machinery the company makes, including rock drills, quarrying machinery, pneumatic tools, etc.

The Crocker-Wheeler Co., Ampere, N. J., has issued a publication entitled Bulletin No. 52, describing its large electric generators which are used largely for railroad work.

The Williamsburg Heating & Foundry Co., of Williamsburg, W. Va., has issued a catalogue describing its X L O P warm air furnaces. Each part of the furnace is illustrated in detail and its working fully described.

The Chicago Pneumatic Tool Co. has issued a catalogue of new pattern type "G" Franklin Compressors. They are made steam belt or motor driven.

The Ingersoll-Sergeant Drill Co., of New York City, has issued a bulletin entitled "Track Laying on the Williamsburg Bridge" in which it illustrates the use of its pneumatic tools for various classes of work in connection with the laying of the track on the bridge mentioned.

The C. E. Mills Oil Co., Syracuse, N. Y., has issued a little catalogue entitled "The Selection of a Core Compound," in which is given a short statement of the expenses showing the comparative expenses of different compounds. This is followed by several pages of users of their compound and then a statement as to the kind of products which the company furnishes.

Manual for Engineers. Published by the University of Tennessee, Knoxville, Tenn. Price, $.50. This is a small vest pocket manual gotten up by Prof. Charles E. Ferris. The original object of the book was to interest men of the South in education. It contains first a preface stating its object, and next a list of the Faculty of the University of Tennessee. Following this there is a short description of the University, fees charged, classes taught, etc. This is followed by 147 pages of tables and useful information such as would be handy in engineering work. This includes areas and circumferences of circles, squares, cubes, logarithms, and many useful tables covering material used in engineering construction. The book is of interest to any one engaged in engineering work. The last of the book contains advertisements of various engineering firms, and there is also a very well-gotten up index covering the subject matter of the volume.

The directors of the Utica Pipe Foundry Co., at a meeting May 12, adopted resolutions on the death of Henry W. Miller, former president of the company. He was one of the founders and incorporators of the company. To his wise council, careful guidance and unflagging energy, much of its success is due.

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When sending in articles be sure to place your name and address on the article and on the drawings.

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CONTENTS.

TRADE OUTLOOK.

There have been no especial developments in the foundry field since our last issue. Southern iron shows some weakness and $11.75 Birmingham for No. 2 foundry is the ruling price. Some furnaces, however, still ask $12 per ton, while, on the other hand, a few sales have been made at $11.50 per ton. None of these quotations, however, have induced large buying. The Northern pig iron market continues somewhat stronger than the Southern and many furnaces will not sell No. 2 foundry at less than $15 per ton Valley, although some parties would probably shade the price slightly. There has been considerable inquiry lately for all grades of pig iron, showing an increased interest in the market and indicating that there will probably be considerable buying during July. Reports from foundries indicate that they are melting all their iron about as fast as it is delivered, and an occasional rush order reveals the fact that some only have small stocks on hand.

The steel foundries throughout the country all continue very busy and most of the malleable foundries are exceedingly busy. The gray iron foundries as a rule are not working to their full capacity. An explanation of this condition probably lies in part in the fact that the steel foundries have taken from the malleable men a large tonnage, especially in railroad work. To make good their loss the malleable men have succeeded in inducing many manufacturers to use small malleable castings, where formerly gray iron was employed. This is especially true in the stove trade. This means that the side floors of many jobbing foundries are short of work, while the heavy floors are crowded. The preponderance of heavy work in the gray iron foundries keeps up the melt to quite a high figure, so that the tonnage from these plants no longer bears the same relation to the number of employes that it did formerly.

After all is said, however, a careful canvass of the field shows that the foundry interests of the country are only moderately busy, with comparatively few large contracts ahead. It is to be hoped that the present conditions will continue without any tendency toward abnormally high prices for supplies on the one hand, or excessive demands for increases in pay on the other. With the foundry business in its present condition, some foundries can actually buy their castings as cheaply as they can produce them themselves, and keep their plants going simply to hold their working force together.

When there are plants in the country which are in this condition, it is no time for an increase in either the cost of material or labor unless accompanied by an increase in the price received for the output.

NEW OFFICERS OF THE A. F. A. AND A. F. F.

In this issue we publish photographs of some of the new officers of the A. F. A. and A. F. F., but the photographs of some could not be obtained in time for publication.

THOMAS D. WEST, PRESIDENT OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION.

NEW BOOKS.

American Tool Making and Interchangeable Manufacturing, by Joseph B. Woodworth, published by the Norman W. Henley Publishing Co., price $4.00. The author of this work has been well known to all connected with American manufactories, as he has written extensively for the technical press. He has now gone back over the many articles he has written, carefully rearranged the matter, and put it forth in a volume of 560 pages, which contains 600 illustrations. As the name implies, the work is intended as a guide for toolmakers and those interested in the making of machinery for manufacturing duplicate parts. A large number of devices are described and very fully illustrated. This work fills a long-felt want in our mechanical literature, and will be found of great value not only to the patternmaker, but to all interested in the class of manufacturing work. There are many things in the work which would be of great interest to metal patternmakers, though the work was not written primarily for their guidance.

DR. RICHARD MOLDENKE, SECRETARY AMERICAN FOUNDRYMEN'S ASSOCIATION.

Tools for Engineers and Woodworkers, by Joseph Horner, price nine shillings, net. Published by Crosby, Lockwood & Sons. This work might be called an encyclopædia of tools and devices used in manufacturing. It contains tools for both wood and metal working, together with illustrations of the same, and a comparison of the tools used for different classes of work. In many cases a careful reading of this book would enable a workman to select tools more nearly adapted to the work in hand. The book contains 340 pages, and over 450 illustrations. Considerable space is given to the subject of measuring instruments and devices. The work does not treat of machine tools at all, but simply of hand tools or cutters used in machine tools and their application.

Mechanical Drawing, by Charles W. MacCord. Published by John Wiley & Sons, price $4.00. This is a large book comprising two parts, the first containing 145 pages, and the other 97 pages. In the first part the author treats of mechanical drawing in general, starting with the simplest problem and giving a series of exercises illustrating each class of work. He starts out with a significant statement that mechanical drawing and geometrical drawing are by some writers used synonymously. He proceeds to show the distinction between the two and to develop the subject of mechanical drawing in what he considers the clearest and shortest method. The hints given are all practical and to the point. The exercises are well selected, and the work tends to a carefully considered climax, that is, the author has aimed to give a complete understanding of the principles of mechanical drawing in this first section, including the various methods of projection. The seventh chapter deals entirely with isometrical drawing, Cavalier projection, and pseudo-perspective, showing the distinction between these methods, and the advantages to be obtained from each. There is also a chapter on spur wheels, bevel wheels, and worm wheels. The second part of the book is entitled "Practical Hints for Draftsmen," and is intended to explain the various modes of representation which are in many cases better than precise methods of projection, on account of the fact that projection will often obscure some point in the drawing. A large number of carefully selected examples are given, and the proper method of drawing each shown. There is also a chapter on freehand sketching, which contains many very useful hints and suggestions. There is a chapter on drawing instruments and materials, in which the instruments and their uses are described.

Elements of General Drafting, For Mechanical Engineers, by C. E. Coolidge and H. L. Freeman. Published by John Wiley & Sons, price $2.50. This book is intended to give a representative course of progressive exercises necessary for a two-hundred-hour course in drawing in the first part, and in the second part a manual of drawing which will convey the essentials of modern conventional drafting, as practiced by the profession of mechanical engineers. The course is divided for convenience into five grades of drawing. The object of the first grade is to give the student some idea of the elementary principles of drafting, together with instruction in the use of materials, instruments, etc. The work progresses by easy stages in the successive grades, to the more difficult drawing necessary in laying out machines from sketches, etc. The second portion of the book, entitled "A Manual on Drawing," treats of the materials required, instruments and their use, and also gives very valuable hints as to the carrying out of the work and the conventional symbols used for representing different parts or materials. There are 21 plates included with the work, which are arranged in such a manner that they can fold out and lie flat and exposed no matter where the book is open, thus enabling the student to refer to anything in the volume without covering up the plate he is studying. The book is bound with a pocket in the back for containing notes, sketches, etc.

ASSOCIATIONS AND SOCIETIES.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care J. W. Paxson Co.

The last regular meeting before the summer recess of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club, Philadelphia, on Wednesday evening, June 7, President Thomas Devlin occupying the chair. There were about forty-five members and visitors in attendance, including several ladies. In his opening remarks the president stated that although this was the 148th meeting, it was the first at which the association had been honored by the presence of the ladies, and on this occasion he thought it very appropriate that the program of the evening be set aside for them. Miss Gertrude Beeks, secretary of the Welfare Department of the National Civic Federation, New York City, who had been announced as the speaker for the evening, was then introduced.

Prefatorial to the subject, which included ventilation, drinking fountains, lunch rooms, shower baths, individual wash rooms, locker rooms, and gymnasium for the foundry and machine shop, Miss Beeks explained that the object of the association which she represented was to bring about more rightful relations between employer and employe. In the course of her remarks, which were profusely illustrated with lantern slides, she stated that the parties mostly concerned in industrial disturbances were represented in the membership of the National Civic Federation by prominent employers, labor leaders, and the public.

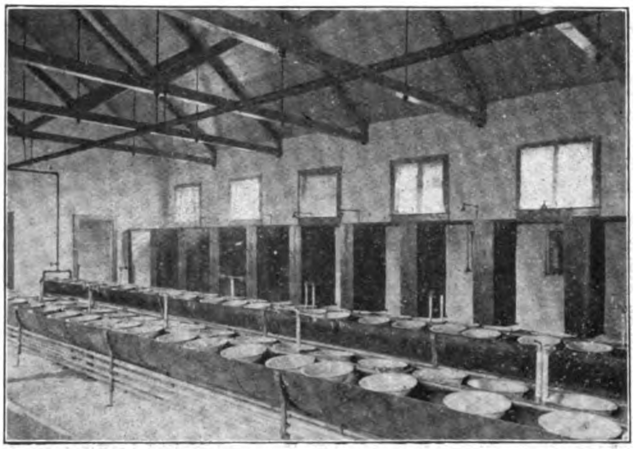
The Welfare Department of this organization, of which Miss Beeks is the secretary, was organized at the Waldorf, New York, a little over a year ago, the purpose of this department being to promote the welfare work for employes. The 150 members are naturally employers who employ large and few numbers of men and women. Among other photographs of those prominently connected with the federation, one of Mr. H. H. Vreeland, the chairman of this department, was thrown on the screen. Mr. Vreeland was expected to participate in the discussion of the subject, but on account of sudden illness was unable to attend the meeting.

Miss Beeks stated that the Welfare Department aims to educate employers and convince them of the necessity of showing especial consideration for the welfare of employes, and for that purpose conferences have been had with men who have tried these things and succeeded. In the National Civic Federation Review, a monthly publication, special topics are presented, and picture pamphlets for different trades are in preparation and will be issued shortly. It will be demonstrated, for instance, that portable houses may be supplied for workers in the building trades where clothes and other articles may be kept and luncheon and hot coffee served. Such places are very desirable when you take into consideration the kind of weather in which some men are compelled to work constantly.

Through the Bureau of Exchange of the Welfare Department a vast amount of data may be had and photographs supplied to employers.

The great value of light and depressing effect of dark work rooms was emphasized, poor light being the cause of many headaches. Ventilation by means of sliding doors in the roofs, and the exhaust air system were also alluded to, and the various methods in vogue at different establishments explained. Slides were shown of apparatus employed for removing dust from the foundry, sand room, and the advantage of automatic stokers in use at different places was demonstrated. By means of a series of pipes fresh air is supplied to the faces of the workers. Pure drinking water easily accessible is another essential feature. One method of supply was shown where water is delivered at 55 degrees F. and kept in constant circulation.

A slide was exhibited showing an establishment fitted with individual wash bowls of enameled iron, so constructed that they might be tipped over into troughs, where the water would run off. Shower baths were also installed, and departments well fitted with wire lockers, it being claimed that wooden lockers are not the best on account of the accumulation of vermin, and by the use of wire lockers this danger is not only eliminated but a good source of ventilation is admitted. Methods of drying clothes on steam pipes were also shown on the screen, and the necessity for general janitor service in large establishments mentioned. In many cases the question as to why these facilities were not made use of by the men was answered by the fact that they are inadequate, unclean, too cold and frequently the men do not know of the existence of such accommodations, which were sometimes in remote places. In several instances the floors are of concrete with wooden racks in the individual compartments upon which the men stand, and the entire floor can be easily cleaned by a hose stream. Slides were shown of dressing rooms for women, where the clothing in stormy weather is hung over steam pipes and dried in a method similar to that used for the men.

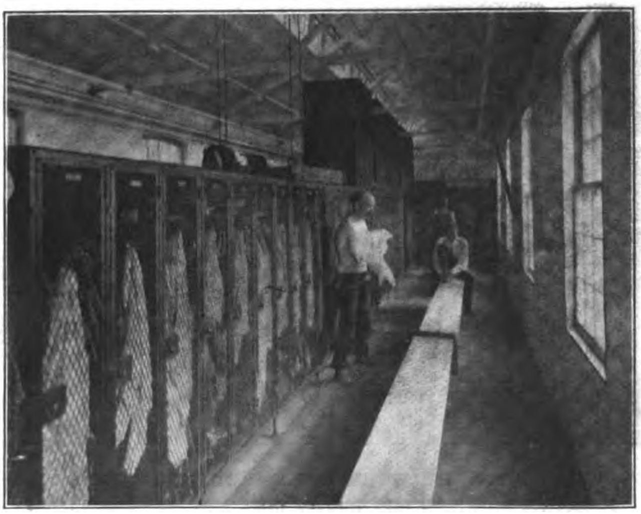


WASHROOM AND SHOWER BATHS OF THE CLEVELAND CLIFFS IRON CO.

While it is not essential that a girl should be seated all day at her work, yet is necessary that she should sit part of the time, and chairs fitted with back and foot rests according to the height should be provided for her welfare. These can be so constructed on rollers, fitted in grooves, that they may be readily moved from place to place enabling the girl to operate several machines. Photographs were shown of lunch rooms for the officials, the superintendents, and the working classes, and the different styles of lunch counters in use, where some bits of food have a nominal price of three, four and five cents. The attractive and clean lunch room is more apt to be a success than one which is not so pleasant. In some establishments the junior help have coffee, tea and milk given them.

Rest rooms and hospitals for both sexes were also shown, and the methods of fire protection and the advisability of organizing fire brigades among the younger men suggested, and a description given of some houses for firemen showing the delightful surroundings.

The question of transportation was referred to, showing conveyances for both men and women, and the better method of allowing the girls to leave the factory a few minutes before the men, instead of all at the same time, thus meeting the moral question and preventing the jostling of the girls by the men. Special stress was laid upon the importance of forming men's clubs, where the men may assemble and play pool, and of providing places where meetings may be held once a month; also emergency hospitals where relief may be had in cases of serious accident. Another very good feature adopted by different concerns is the policy of establishing vacation houses, where employes may spend their holidays.



LOCKER ROOM AND SHOWER BATHS OF THE ENTERPRISE MFG. CO.

In some establishments two weeks' vacation is given with pay to all engaged over one year, and in other cases overtime has been abolished with good results. Several views of employes' homes and tenement houses were exhibited, the rent for which is made nominal, and all for the welfare of the employes.

Each industrial establishment is a study. Certain things may be done in one place which may not be applicable to another in the same trade, but in any event constant attention is needed or failure is the result.

A vote of thanks was tendered to Miss Beeks for her most able address, which was backed up by the statement from Secretary Evans that he was going to start in with some of the arrangements mentioned at the plant of the J. W. Paxson Company, as he had been so very much delighted with the subject.

Dr. Brown said that this was the third address on welfare, work that he had had the pleasure of listening to, and that it was by far the best that he had heard, and he could not do less than follow Mr. Evans' lead.

ABRAM COX CO.'S PLANS.

The representative from the Abram Cox Stove Co. stated that that company had organized a club for the heads of the departments, where different subjects were discussed and complaints made every month. He believed that it would lead up to something valuable, but was not prepared to say what has been done at this time. Four meetings have been held and some good has been accomplished, but not in the direction of the welfare of the men. The work has been taken up and he believes it will lead in that direction.

In reply to a question, Miss Beeks said that about twelve wash bowls for sixty employes are sufficient in cases where they have only to wash their hands.

Mr. Thompson said that of all the meetings he had attended, this was one of the most interesting he had heard yet, and he hoped there would be many more like it.

A letter was read from the Pennsylvania Child Labor Committee in reference to the employment of children and calling attention to the fact that certificates issued by notaries are no longer legal but must emanate from the school authorities.

The treasurer's report showed a balance of $2,038.37 and all bills paid.

After an announcement that the next meeting would be held on the first Wednesday in September, the meeting adjourned.

Cleveland Foundry Foremen.

W. H. Nicholls, 608 Gordon Avenue, District Vice-President.

The regular monthly meeting was held June 3d. At this meeting a vote was taken in accordance with which no meetings will be held during July and August, and the next regular meeting will be September 2, 1905, at which time the annual election of officers will occur.

A committee of three was appointed to arrange for a joint outing of the Foundry Foremen Patternmakers some time during August. The same committee was also instructed to arrange for a joint meeting of the two organizations on September 2nd. The members of the Club who were to attend the New York Convention were present and were asked to bring back a report of the meeting for the special benefit of the Club. There was no regular paper, but a general discussion on foundry subjects.

Erie Foundry Foremen.

W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

On account of the national meeting in New York, the Erie Foundry Foremen omitted their June meeting. They were well represented at the national meeting, however, and expect to continue their regular monthly meetings throughout the summer.

Hamilton, Ont., Foundry Foremen's Association.

A. Chase, care Sawyer & Massey Co, Secretary and Treasurer.

The regular meeting of the Hamilton Foundry Foremen occurs the last Thursday in each month. The secretary reports that the organization, while not very strong as yet, is one in which the members are taking considerable interest and that they feel sure of a good healthy growth.

New York Foundry Foremen's Association.

S. M. Williams, Dist. Vice Pres., 221 Third Street Elizabeth, N. J.

The regular meeting of the New York Foundry Foremen was held in Jersey City, May 30. A paper upon "What is a Foundry Foreman?" was read by S. M. Williams. The coming meeting of the A. F. A. was also discussed. It was voted to discontinue the meetings until the last Saturday in September.

Mr. Hull, of the American Pig Iron Warrant Co., also gave a talk on the storage of pig iron.

Milwaukee Foundry Foremen.

Thomas Glasscock, Dist. Vice Pres., care Pawling & Harnischfeger Co., Milwaukee, Wis.

The regular monthly meeting was held on June 5. After the transaction of the regular business Mr. Sol. Shaw, of the Allis-Chalmers Co., read a paper on "Foundry Rigging." He explained a revolving gagger chill that he had just made in his shop. There was quite a discussion among the members in regard to loam work. It was decided to hold a meeting every two weeks after the meeting of July 3d, making the meetings the first and third Mondays of the month. July 3d will be the meeting for the election of officers.

Cincinnati Foundry Foremen.

The foundry foremen of Cincinnati and vicinity met May 27 and organized the Cincinnati Foundry Foremen's Association with 20 charter members. The following officers were elected: J. R. Reardon, president; J. H. Ryan, vice president; E. W. Cadwell, secretary; H. J. Holmes, treasurer. The society expects to hold meetings on the second and fourth Saturdays of each month, and there are a number of others to join at the next meeting.

NEW ENGLAND FOUNDRYMEN'S ASSOCIATION.

Fred F. Stockwell, Secretary, care of the Barbour-Stockwell Co., Cambridgeport, Mass.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

F. H. Zimmers, Secretary, care Union Foundry and Machine Co.

THE ASSOCIATED FOUNDRY FOREMEN.

Frank C. Everett, Secretary. 2113 Third Ave, New York, N. Y., care the J. L. Mott Iron Works.

PHILADELPHIA FOUNDRY FOREMEN.

W. P. Cunningham, Secretary, Pencoyd, Pa.

CHICAGO FOUNDRY FOREMEN.

David Spence, Dist. Vice Pres., 142 Bunker St.

INDIANAPOLIS FOUNDRY FOREMEN.

W. H. Holmes, Dist. Vice Pres., care American Foundry Co.

The Mexican Car & Foundry Co., of Mexico City, Mexico, held its annual meeting on April 20, and elected the following officers for the ensuing year. President, Isaac M. Hutchison; vice president, Lic. P. M. del Rio; secretary and treasurer, R. J. Gross. The principal plant of this company is located at Hutchison, Mexico.

METALS IN FOUNDRY PRACTICE

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Steel, Brass and Bronze.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.

J. B. Nau, Metallurgy of Steel and Steel Castings.

Dr. Richard Moldenke, Malleable Castings.

C. Vickers, Brass Castings.

We have also made arrangements with several others to act as special contributors upon Brass, Bronze and other subjects. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

MAKING SAD IRONS.

Can you give me the address of parties making machines for grinding and dressing sad irons and also how to avoid shrinkage on the face of the sad irons? What system is used for cleaning, that is, do they use acid in vats, what kind of acid is used and where can I purchase the vats?

Answer.—It is customary to cast the irons with the bottoms down in the mold and there is very little trouble with shrinkage on the face. You can construct the top of your pattern so that the sagging caused by shrinkage would look as though it was intended to be made that way. It would not pay to increase the cost of the iron to lessen shrinkage. They use the ordinary tumbling mill for cleaning. This is the cheapest way for cleaning castings.

Milling a longer time is cheaper than to use any pickle.

A very good pickle is that made by the Harshaw, Fuller & Goodwin Co., of Cleveland, but the expense for drying and of preventing of rust makes any pickle expensive.

If your sand burns on, you had better prevent that rather than resort to an expensive process for removing it. A sand blast would be better than a pickle for cleaning. The pickle would soften the surface slightly and help the polishing.

The best vat for holding pickle can be made by yourself out of two-inch pine with a one-inch lining and one-fourth inch of pitch between.

Every manufacturer of grinding machines makes those suitable for grinding sad irons.

The large makers use an automatic polishing machine and a good one is made by the Robinson Automatic Machine Co., at Detroit, Mich.

PURCHASING PIG IRON BY ANALYSIS.

Question.—We wish your opinion regarding an iron that has the following composition: Silicon, 2.25; sulphur, .018; phosphorus, .71; manganese, .40. Is this iron No. 1 or is it No. 2?

We have a contract with a furnace for No. 1 iron and another founder in this city has a contract for No. 2 and we find that we are both getting about the same analysis of iron. Our contention with them is that we should have a higher silicon, as we do not find this silicon sufficiently high for our purpose, although the sulphur is very low.

Answer.—The specifications adopted by the American Society for Testing Materials for pig iron in 1904 was for No. 1 pig iron, silicon, 2.75; sulphur, 0.035; for No. 2, silicon, 2.25; sulphur, 0.045. In the absence of a definite understanding a variation of 10 percent of the silicon either way shall be allowed, but for each 10 percent of the silicon below this a penalty of 1 percent in the price of the pig iron shall be required.

We have a contract for an iron having the identical analysis as your iron as to sulphur, phosphorus and manganese, and that no iron shall contain less than 2.25 percent silicon. All iron containing 2.25 and less than 2.50 percent silicon is No. 2, and all iron with more than 2.50 percent is No. 1.

Your iron is certainly No. 2, and you should pay a No. 2 price. An open fracture shows that the furnace is working well and that sulphur is low, but for your business silicon is a necessity.

BRASS FOUNDRY NOTES.

BY C. VICKERS.

PHOSPHOR BRONZE.

Question:

Could you give me a phosphor bronze mixture that would resist the acids used in a paper or sulphite mill? Also what is the best way to put the phosphorus into the mixture? Could you give any other formula for a bronze that would resist acids without the aid of phosphorus What is the difference between a brass and a bronze?

Answer:

A good alloy of phosphor bronze for the above is copper 90 percent, phosphor tin 10 percent.

Alloys of copper with zinc are known as brass, of copper with tin as bronze.

MANUFACTURE OF SASH WEIGHTS.

The writer has recently been asked the best way to make sash weights. There are so many factors which enter into this problem that it is practically impossible to state any best method under all conditions. To make sash weights at a profit each separate operation must be considered by itself and its cost reduced to a minimum. For any moderate tonnage of standard sizes most foundries prefer to use some form of stripping plate molding machine. In most cases special machines are fitted up which make a mold, the cope and drag of which are exactly alike, so that as these blocks of sand are packed up on top of the other, they form a series of molds, the upper face of each block being a drag and the lower face a cope. These molds are stacked up three feet or more in height and the whole pile poured at once. The Adams Co., of Dubuque, Ia., had one of these machines on exhibition in the Model Foundry at the Exposition at St. Louis, Mo. Where the tonnage is not sufficient to warrant the fitting up of a molding machine, and especially where a large number of sizes are required, the weights are usually made by attaching the half patterns to the opposite sides of a match board. In this case, of course, it is necessary to use pins such a length that they will extend through the match board and still keep the parts of the flask in line. After both cope and drag are rammed up, the cope is lifted up, the match board removed and the mold closed. Where a very large tonnage of standard sizes are to be made, water cooled chills are some times employed for making the smaller sizes. From two to four molds are formed in each chill. The two halves of the chill are hinged together and placed in a vertical condition. After the weights are poured and have solidified, the chill is opened, the weights removed and the screws broken off. It is all that is necessary to finish the pieces, provided the chills fit closely enough so that there are no thins. Such a set of chills are expensive to make and the investment would only be warranted in a foundry which made a specialty of sash weights.

HARRY MALONE.

Marion Denman, of Troy, O., and Wm. Doyle, will start a pattern shop at Piqua, O.

The Forsythe Pattern Co., of Youngstown, O., has been incorporated with a capital of $50,000. The incorporators are F. A. Runser, G. J. Renner Jr., W. H. Park, John Stambaugh, and Geo. Rudy Jr.

MAKING A MOLDER.*

BY H. M. LANE, CLEVELAND, O.

The molders of the past have been produced, first, by serving an apprenticeship, and second, by adding to the knowledge thus gained by traveling about and working in different shops. In the days when all foundries carried on a general line of work and but little machinery was used in the foundry, this procedure would produce an all-around molder.

In most cases these old-time molders were very good judges of the various local irons, and many of them would make creditable mixtures by judging the fracture. In the present day, however, a great many new factors have been introduced into the problem. In the first place the iron now furnished the foundryman varies between much wider limits and may contain greater quantities of impurities than that formerly furnished.

In the molding work itself two factors have entered the foundry trade which tend to produce specialists rather than all-round molders.

First, the various foundries have been led to specialize to the greatest possible extent. One of the first specialties to break away from the general foundry business was stove plate trade, and this has now become so thoroughly separated that it is recognized as a distinct branch of the trade, and stove plate experience would be of but little use to a man if he were placed in a general jobbing foundry doing light or medium weight work. Many other specialties have split off from the foundry business, such as cast iron pipe, soil pipe, ingot molds, radiators, bath tubs, and other sanitary plumbing fixtures, etc. In addition to this, the malleable industry has become so specialized that the molders belonging to this division of the craft do not generally pass back and forth between malleable and gray iron foundries.

Second, many factors have been introduced into the shops themselves, the principal among these being the molding machine. The result of all this is that the high-grade molder for light floor work does not find the demand for his services which formerly existed; at least in proportion to the tonnage for this class of work that is turned out. The heavy workmen have suf-

*Paper read at A. F. A. Convention.

fered less from the changes that have taken place, on account of the fact that the methods of producing castings in this department have not undergone such radical changes. An all-round molder, however, should have experience in both light and heavy work.

The rapid fluctuations in the amount of work of each character being done in the foundry have also had a serious effect on the apprenticeship question. While the shop may have work enough at one time to warrant their employing a considerable number of apprentices, within a year of that time the character of the work upon which they can use apprentices may have all gone to the other fellow.

Apprentices have also been affected by the "Big wages quick" mania. As a consequence, after the boy has spent about half of his time in one shop, he is very likely to bolt and go into another shop where he gets journeyman's wages, or, if he is taken under instruction, gets much higher wages than he received in the first shop. When the wages go up the amount of work he turns out must also go up, and hence he is kept as largely as possible on one class of work. The result is that he becomes a poor workman with a limited amount of experience.

One foundryman stated recently that while he employed over one hundred molders in his place, his work was so highly specialized that he could not conscientiously take on a single apprentice, as he knew he could not teach them the trade, no matter how much he might desire to do so.

Skilled molders will always be required for some classes of work and we must provide some means for keeping up the supply of this class of men. Another factor, and one which is in some ways more important is the question of our future foundry foremen. As the work in the different foundries is more highly specialized, and as the number of difficult problems in the line of equipment increases from year to year, it results in an ever-increasing demand on the ability of the foundry foreman. The trade of molding could not be learned from a book, but more book knowledge is required now than formerly. The problem of where our future foundry foremen are coming from affects other departments of the shop as well as the foundry, and hence some of our brightest men have been discussing the subject and proposing different plans for its solution.

What seems to the writer one of the most feasible plans is to install a plant for the manufacture of quite a broad line of machinery. The plant should be large enough to employ about one thousand hands in all departments. It might manufacture the following line of machine tools: lathes, planers, milling machines, drill presses, and grinding stands. It should also manufacture a line of gas engines and of steam engines. It might also be well to manufacture some sheet metal working machinery and some wood-working machinery.

This would give a broad range, including a large amount of foundry and blacksmith shop work. The line of machinery could be disposed of to advantage by selling the entire outfit to some large jobbing house like Manning, Maxwell & Moore. In the foundry it would also be well to make some specialties requiring no machine finish, as for instance, track plates, stove legs, or something of the kind which could be gotten out largely on molding machines.

Connected with the establishment there would be a corps of teachers; and a regular course would require four years, distributed somewhat as follows: The student upon entering would spend nine months in a series of shop work which would correspond very closely to the shop work given in a manual training school. This would include some wood work, some patternmaking, a little experience on light work in the foundry, a few weeks in the blacksmith shop, and some time in the machine shop. This work would be accompanied by an elementary course of lectures upon these subjects or by studying in textbooks along these lines.

When a boy enrolled he would be expected to pay down one hundred dollars. During the first nine months he would receive no pay; and if at the end of this period he decided he did not want to learn the trade, he would be allowed to go and be given back one-half of the money he had paid in. If at this time he did elect to learn a trade, he would have to choose which trade he wished to follow. If he wished to follow the foundry trade he would first be put onto a molding machine and taught how to make a large number of different classes of molds in this way. This work would include instruction in the theory of molding machine construction and manipulation.

From the molding machine he would pass to the core department. In this department he would receive instruction in the making of cores by hand, and with the use of various types of machines. He would also receive instruction upon the value of the different core compounds or binders.

From the core department the boy would go to the light work floor, where he would spend some time, and then to the heavy work floor, where he would receive instruction both in green sand and dry sand work, also in loam work. This general course would occupy approximately two years and three months. The boy would then select his specialty and spend the last year on it.

Some instruction would be given in mixing iron by analysis, etc., and if a boy wished to become a foundry chemist there would be a post graduate course for this purpose, extending through the fifth year. After the first nine months the boy would receive pay for his work at a certain fixed rate. Careful account would be kept of what he did, and if he exceeded a certain amount of work, he would be given a bonus above the fixed rate of pay, but all of this bonus would be kept back until he was through with his course. When he finished his course he would receive a certificate or diploma, would be paid back the original one hundred dollars which he deposited, with four percent interest, and would also be paid all accumulated bonuses, which in some cases might amount to several hundred dollars. The accumulation of this big bonus, together with the fact that if he left any time after the probationary nine months' period he would lose both the bonus and the hundred dollars, would serve as an incentive to keep the boy at work to the end of his course. In starting such a school it would be necessary to employ journeymen enough to run the entire factory, and it would always be necessary to employ some journeymen to act as head workmen and instructors, but after the third year it should not be necessary to employ more than ten percent of journeymen, as by this time the boys would become pretty expert mechanics.

The education necessary for entering such a school would be simply a good common school education. The studies given during the course would be the equivalent of a high school education, or at least of the portion of it required by workmen of this class. Such an institution as this should be self-supporting after the first year or so, as while the boys would undoubtedly spoil a large amount of material, this would be in large measure offset by the fact that the boys would work for work's sake, in other words, would not soldier. While such a plant as this would not have any dividends to pay, it would nevertheless have to support the teaching force, which would probably be equivalent to a fair dividend on the capital invested.

The boys would probably work on an eight-hour basis, but would have recitations taking all or a portion of some of the half days, for instance, one class would have their recitations on Monday, Tuesday, and Friday mornings, another on Tuesday, Thursday, and Saturday mornings. In like manner the others would have afternoons of the alternate days. The plant would run six days a week throughout the year, with the exception of the ten days or two weeks' shut-down at the holidays, and the granting of such holidays as Decoration Day, Labor Day, Independence Day, and Thanksgiving.

Such a school as this would make an excellent preparatory school for our technical schools and colleges, and while the graduate from this trade school would go to a technical school conditioned in foreign languages, he would receive credit for shop work which would more than balance his deficiencies in languages. For boys who wished to become foremen and managers, a fifth or post-graduate year could be arranged in which a course would be given on shop management, shop systems, etc. The students in this fifth year would be given positions as foremen or assistant foremen in different departments in the works.

One very important feature in this system would be the necessity of preparing a special course of text-books to fill the exact requirements of the case, and upon the preparation of such a series of books the success of the school would in large measure depend.

The ideal location for such a school is a subject which should receive considerable attention. If placed in a large city it would be possible to arrange visits to other works; the libraries of the city would be available to the students and there might be some support from other works. If located in a small town 25 or 30 miles from a large city, the high city taxes would be avoided, there would be less going on at night to take the boys' attention from study, and it is probable that the works could be built on a somewhat more extensive plan, with more yard room, dumping ground, etc., which is a point worthy of consideration.

MELTING STEEL WITH CAST IRON.*

BY R. P. CUNNINGHAM, HOLYOKE, MASS.

The demand for castings to stand great strength has increased to such an extent that foundrymen are often at a loss how to produce castings up to the required specifications. The manufacturers who are the most often called upon to produce castings of high strength are pump and engine builders, tool makers and car wheel manufacturers.

Take pump builders a few years ago; is was something very unusual to receive an order for a pump to stand a pressure of more than 1,000 lb. Today it is nothing uncommon to get an order for a pump to work under a pressure of 5,000 lb. and even higher. Engine builders are called upon to build engines to work under 200 lb. steam pressure, while it is only a very few years that 100 lb. pressure was considered about the limit.

I might say the same thing about tool making. The speed that the modern tools are run at today is nearly double that of a few years ago. Look at car wheels and compare the tests they are subjected to today with that required 25 years ago. The increase is over 100 percent. Yet car wheel makers have managed to make wheels that come up to the requirements. I might go on and enumerate many other branches of the trade that are doing what was once considered an impossibility. This goes to show that the foundrymen of today are alive to the requirements, and yet we often hear men say that the foundry has not progressed as fast as other branches of manufacturing.

On the contrary, considering the attention that has been paid to the foundry, we have managed to make castings that have been far above the specifications called for. Foundrymen do not always have the iron in their yard to make castings of any required strength, but by a judicious use of steel scrap we can produce castings of the strength desired.

Any one familiar with pump work will readily understand the necessity of having a perfect casting, not alone smooth and true to pattern, but clean, close grained, yet soft enough to machine easily. Many castings go through the machine shop and erecting room, but fail when put under test. This adds cost to the manufacturing cost, as often the machining is many times the cost of molding. By adding a percentage of steel scrap we have in a great measure overcome this difficulty if the trouble is caused by porosity of the metal.

When melting steel with cast iron there are many things that require close attention in order to obtain the very best results. In charging the cupola one cannot be too careful and should be absolutely certain that all the material called for in the charge is put in. The weight of each material specified should be correct, the fuel and fluxes should be analyzed so that the exact composition of all the materials going into the iron to be made may be known.

In making high grade metal we have to contend with the impurities of the fuel and fluxes charged into the cupola besides that we have estimated on in the metal. All impurities in excess tend to weaken the metal in tensile and transverse strength, for this reason there is more difficulty in making a successful cast when using a large percentage of steel scrap.

A high percentage of steel necessarily increases shrinkage, demands closer attention, requires more rapid handling in the foundry, and when very high tends to make all the operations connected with it draw away from those of a cupola metal and approach that of a steel casting. When this extreme point is reached melting in the cupola becomes very unsatisfactory.

The average thickness of a casting bears a relation to the percentage of steel desirable. For thin castings only a small percentage can be used, while for thick heavy castings a large percent is permissible. This is so because a thin casting has no self-annealing power on account of its rapid cooling, and the chilling effects of the mold. The thicker casting, on account of its slower cooling, anneals itself somewhat, and opens the grains of the metal perceptibly. The same metal in a thin casting, which is hard, would be quite soft in a heavy casting. My opinion is that it is more desirable tc have a mixture with the smallest

*Paper read at A. F. A. Convention.

percentage of steel that will give sufficient strength and solidity to the casting for all practical purposes.

We sometimes doubt the wisdom of the engineer when he calls for castings that will stand so many thousand pounds to the square inch, because the metal that will stand the highest test in the bar is not always the most desirable. It may be brittle or flaky, with no elasticity, and yet test high. What we aim for in practical foundry work is a high grade metal that will stand a fairly high test and machine easily. It is this kind of a casting that can be made with a percentage of steel scrap melted with your iron, provided the rules are accurately followed.

My method of charging a cupola is as follows: Let us say that we want to make a casting which will require 4,000 lb. of metal, with 25 percent steel. With a cupola that lines up 48 in., we put on the bed 1,200 lb. of coke, on top of this put 1,000 lb. of iron, then 500 lb. of steel, then 500 lb. of iron, then 150 lb. coke, 500 lb. steel, 1,500 lb. iron. The coke next above the metal charge should be greater than between the ordinary charges, and the pig iron in the next charge above the steel should be of the same chemical analysis as the iron used in the steel, so that if any metal should melt and run into the steel it will do no harm. With the last amount of steel we add 1¼ lb. of ferro-manganese to every 100 lb. of steel used. We also put the same amount of ferro-silicon into the ladle. This should be done after the first metal has been drawn into the ladle. This metal should be poured as soon as it becomes quiet in the ladle.

If the casting is uneven in thickness attention must be given the shrinkage. Setting a riser on the heavy parts and after the mold is full pouring slowly until the riser is full obviates trouble. If the casting is very heavy it will be necessary to feed it, but an ordinary casting will not require this.

We have found by using two brands of iron, one high in manganese and the other high in silicon, both low in sulphur, that we can get a much finer grained casting, with more elasticity, than we could if we depended on ferro-manganese and ferro-silicon to bring these two elements up to the desired percentage. I reason it in this way: If the manganese and silicon are in the pig they are more evenly distributed than when they are put into the cupola and depended upon to become thoroughly mixed in it or in the ladle. We have never yet depended upon the pig for the entire amount of manganese or silicon wanted, but have added each in the proportion given above.

We sometimes have trouble caused by wrought scrap or hard steel becoming mixed with the steel scrap. In either case satisfactory results cannot be obtained. With hard steel there are hard spots in the casting, while wrought iron increases porousness which is very bad if the casting is uneven in thickness.

My opinion is that mixtures of this kind will in the future be used to a greater extent than they have been in the past because the demand for this class of castings has increased and foundrymen will readily see that by this means they can build up their present mixtures to show greater strength and other desired qualities.

The result of eighteen casts with different percentages of steel showed that the highest amount of steel that could be used to an advantage is 33 percent. Above this showed excessive shrinkage and only a slight gain in strength. The highest point reached for tensile strength was 33,205, the lowest 31,890 for perfect bars. The highest transverse strength shown was 3,335, the lowest for a perfect bar was 3,180. Six bars were cast from each heat, two at the first part, two in the middle of the heat, and two at the end. In every case the two bars cast in the middle of the heat showed up best in tensile and transverse strength. The first bars were not uniform and showed small pin holes. The last bars showed up badly in every instance. Less trouble will be had with less than 33 percent than above that amount of steel scrap in the gray iron mixture.

For ordinary work 25 percent steel will give sufficient strength for all practical purposes, will machine easily and yet be close grained. This is the percent I would recommend foundry men to use unless it is for some special work. In conclusion I will say that I will be only too glad to answer any and all questions in regard to use of steel in cast iron, for I feel sure that when once tried, that great benefit can be derived.

THE USE OF PLASTER-OF-PARIS IN THE FOUNDRY.*

BY EDWARD B. GILMOUR, PEORIA, ILL.

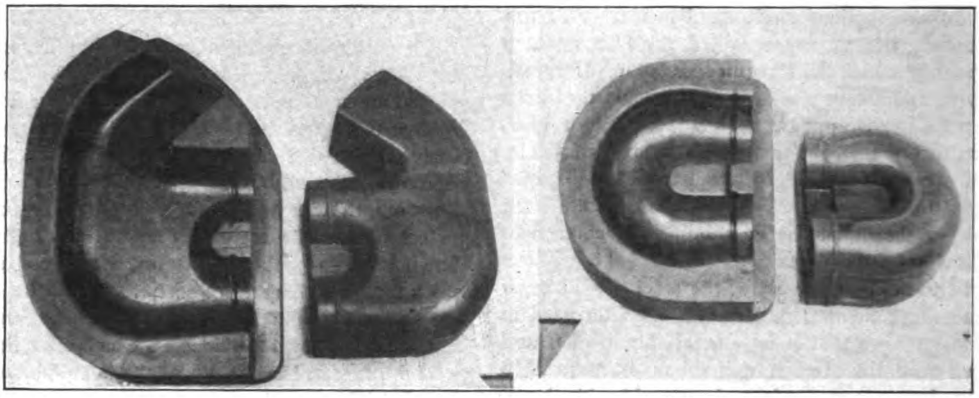
The title of this paper may seem a little strange but as plaster of Paris is used to a great extent in most of the arts, it will not be so surprising to find it occupying a little corner in the foundry.

*Paper read at A. F. A. Convention.

Plaster of Paris is gypsum burnt in a kiln at a temperature of 250 degrees and subsequently powdered and ground to a fine uniform flour. When so prepared it possesses the valuable property when mixed with water of setting into a solid mass. It receives its name from the fact that it is mined in great quantities in the environs of Paris and is used to a large extent in art work. It takes a place in the foundry in the form of patterns; some founders use it to a large extent in making match boards. These match boards are not very satisfactory if they are kept in constant use as they are brittle and consequently very easily broken. While upon this topic I would say that good match boards are made from a mixture of litherage 3 parts, parting sand 90 parts, and linseed oil 7 parts.

In a large agricultural establishment with which I was formerly connected we used as much as 20 barrels of plaster of Paris per month, so it can be readily seen to what extent the material was used in this one place. It was the means of saving thousands of dollars in producing their work. We used it principally in the making of patterns for drop hammer dies in order to straighten the malleable castings which had become warped in the process of annealing.

Our method of procedure was to take the original metal patterns before being gated up, place them in the sand as you would if you intended to cast them; viz., up to the joint, making the joint in the regular fashion and as straight as possible. It is good practice to prove the drawing of the patterns so as to get the joint in the best place in order to get out the malleables after having been straightened. Now get a common wooden box, place over the mold, see that it has plenty of taper so as to facilitate the drawing of the plaster cast from the sand. Coat the mold with oil, mix the plaster with warm water (as you will get better results in setting), to a consistency of thick cream. Pour it into the box or flask upon one-half of the mold, and when solidified roll it over and take away the sand which made the original mold, leaving the patterns in place. Dress up the joint, again coating over the mold with oil, and repeat the operation upon the plaster mold, which will give you a perfect impression of the casting which you have to straighten. It is essential to cast a nut or something similar into the plaster in order to draw the plaster pattern out of the sand after it has become hard enough. It is necessary to trim up the mold, separate it and withdraw the patterns, repair all of the defects, and give the casts a coating of shellac varnish. They are then ready for use.



THE USE OF PLASTER-OF-PARIS IN THE FOUNDRY.

Some one may wonder why we use the original patterns in order to make the plaster patterns. The reason is simply this, that when you cast the dies from the original patterns you have the shrinkage of the casting in the die, you have also the shrinkage upon the malleable casting. It will be said that malleable castings shrink more than grey iron, which they certainly do. In making the patterns for malleable castings we allowed the same shrinkage as in grey iron, viz., one-eighth inch to the foot, but with the process of annealing the castings expand enough to bring "malleable" to a uniform size with grey iron castings, consequently the castings are of the same size as the impression in the dies.

The accompanying cuts are two sets of drop dies for the pipe connections for a grain weighing machine, the smaller ones being used for the top dies. The method for making these plaster casts is a little more intricate, the molds being made as you would make a regular loam mold, with sweeps having a frame made of the flat section, with pin holes on the centers, so that the sweeps will work on the circle as you would make a regular elbow or Y pipe.

In order to get as true and perfect castings as possible we are very careful not to rap the patterns sideways, only a slight tap downwards being given. When the pattern is drawn no tools are used upon the face of the mold; simply take a camel's hair brush with wet blacking and carefully paint this on as regularly as possible; afterwards skin-dry the mold and you will have a perfect casting. We usually make these molds in iron flasks so that we can leave them over night in the sand as it tends to toughen the metal, which, in fact, is a high grade iron. These castings are subjected to very heavy strains on account of the continued pounding of the drop hammer.

PERSONALS.

C. R. H. Cunningham, formerly with the Chester Steel Castings Co., Chester, Pa., has severed his connection with that company, and is now associated with H. M. Shimer & Co., Philadelphia.

Joshua Peters, general manager of the Record Foundry & Machine Co., Moncton, N. B., has recently returned from a trip to the Pacific coast, where he established new agencies for his company.

George Whitehouse, of West Bramwick, Stratfordshire, England, foundry manager for the J. & S. Roberts Co., of West Bramwick, will spend three months with relatives at Lorain, O.

Geo. J. Chandler, formerly secretary and assistant treasurer of the Cleveland Steel Casting Co., of Cleveland, has become associated with the Sterling Steel Foundry Co., of Pittsburg, as general sales agent.

Mr. Jas. Hall, foreman of the molding department of the Mississippi Valley Stove Works, of Fulton, Ill., has resigned his position to accept a similar position at the Riverside Stove Works, of Rock Island, Ill.

Chas. A. G. Winther, for many years general superintendent of the Chapman Valve Mfg. Co., of Indian Orchard, Mass., has accepted a similar position with the Roe Stephens Mfg. Co., of Detroit, Mich.

Charles R. Darrow has resigned as president and general manager of the Mahoning Foundry & Machine Co., Youngstown. He is still a stockholder and a director of the company. F. G. Evans is in temporary charge of the company's affairs.

DEATHS.

Isaac Wardwell, for 50 years associated with Geo. Waring in the foundry business and who later organized the Stamford Foundry Co., died at his home in Stamford, Conn., May 20. He was born in 1815.

FIRES.

The foundry plant of Kilburn, Lincoln & Co., of Fall River, Mass., was damaged by fire to the extent of $40,000 on May 17. This is one of the oldest and best known plants in the region and has long been noted for the looms which bear its name. J. Thayer Lincoln, one of the owners, succeeded in saving a box of drawings which represent the work of years and are of great value to the company.

A small patttern storage building, belonging to the Kerr-Murray Mfg. Co., founders, of Fort Wayne, Ind., was destroyed by fire on May 14. The principal loss to the company was the patterns, some of which were valuable.

The foundry plant of F. A. Potts & Co., of Indianapolis, Ind., sustained a loss of $4,000 by fire on May 26.

The plant of the Ohio Brass Co., of Mansfield, O., was damaged by fire to the extent of $100,000 on May 24. The loss is fully covered by insurance.

Guest & Co.'s foundry at Pottstown, Pa., was damaged by fire to the extent of $1,500 on May 25.

A three-story brick building belonging to the Gobeille Pattern Co., at the corner of Leonard and Winter streets, Cleveland, was damaged by fire on June 8. The loss is estimated at about $12,000.

The plant of the Elizabeth Iron Works, of Norfolk, Va., was seriously damaged by fire on May 10th. The fire started in the pattern shop. The most serious loss was the destruction of a large stock of patterns, which had been accumulating for many years.

The Chalmers-Williams Co. has taken possession of the U. S. Foundry & Supply Co.'s building in Chicago Heights, Ill. The plant will be enlarged and devoted to the manufacture of railway and mining supplies.

NEW CONSTRUCTION.

The White-Warner Co., of Taunton, Mass., manufacturer of furnaces, stoves and ranges, is to erect a new foundry building to replace the one destroyed by fire last year. The building will be 62 x 167 ft.

Wm. Wharton Jr. & Co., Inc., Philadelphia, through Ballinger & Perrot, architects, have completed plans for a two-story fireproof pattern shop and storage building, 60 x 247 ft. at the corner of Twenty-fifth and Ellsworth streets, Philadelphia.

The Best Foundry Co., of Cleveland, O., will erect a large foundry building for the production of stove parts at Bedford, O., and has commenced the construction of the buildings. The contract for designing and constructing the buildings has been let to The Interstate Engineering Co., of Bedford, O.

J. R. Baker & Sons, of Kendallville, Ind., are constructing an addition to their foundry which will increase their molding room so as to accommodate more men. The plant is located at Kendallville.

Deere & Co., Moline, Ill., have had plans prepared for the construction of an addition to their foundry 60 x 150 ft This will make their foundry 120 x 150 ft.

The Janesville Machine Co., of Janesville, Wis., will expend $25,000 in additions to its plant, which will include an extensive addition to its foundry.

The Southern Co-operative Foundry Co., of Rome, Ga., will double the capacity of its plant by making additions and installing new equipment.

A car wheel foundry will be erected as an addition to the plant of the Wm. J. Oliver Mfg. Co., of Knoxville, Tenn., and Mr. Oliver states that about $60,000 will be expended in the construction of the plant.

The Wichita Mfg. Co., of Wichita, Kansas, will expend $8,000 in the construction of a new foundry building.

J. G. and Geo. A. Enos are completing a building 50 x 60 ft. with an "L" 16 x 16 ft. at Waterloo, Ia. The building is to be used as a foundry and will be under the direct supervision of Mr. J. G. Enos.

Davis, Stewart & Co., of Lowell, Mass., are building an addition to their foundry 30 by 40 feet.

The St. Albans Foundry & Implement Co., of St. Albans, Vt., is enlarging its plant and installing new machinery to enable it to manufacture a special line of gasoline engines.

The contract has been awarded for the construction of a second section of the foundry of the Brown & Sharpe Mfg. Co., of Providence, R. I.

The plant of the Record Foundry & Machine Co., at Livermore Falls, Me., is to be extended.

The American Locomotive Co. has completed arrangements whereby it will manufacture for the United States and Canada the Berliet automobile, a French car. Although one or two foreign designed cars are built in the United States, this will be the first experience of an American concern making a foreign car with American material and American labor complete in every detail. The American Locomotive Co. is one of the largest builders of machinery in the world. It is the intention of the company to make automobiles an important branch of its present manufacturing system. The first plant will be built in Providence, R. I., adjacent to the Rhode Island Locomotive Works.

The American Locomotive Co. has commenced the construction of a brick foundry 175 x 650 ft., in connection with the Brooks Locomotive Works at Dunkirk, N. Y. The foundry is to cost $150,000.

R. D. Wood & Co., iron founders, Philadelphia, have purchased the Quinn & Sharpless building, and will erect a modern office building over the present structure.

The Hayes Mfg. Co., of Erie, Pa., will erect two new buildings, one of which is to be a foundry.

The Taylor-Wilson Mfg. Co., of Allegheny, Pa., has completed its concrete machine shop at McKees Rocks, Pa., and is now erecting a foundry adjoining the same.

The Globe Iron Foundry Co., of Johnstown, Pa., has found it necessary to increase its equipment to keep pace with its rapidly growing business. A new cupola and electric crane and some additional equipment is to be added.

The contractors are pushing the work on the improvements of the Reading Stove Works at Reading, Pa., which include an annex to the foundry and several other buildings.

The North Lebanon Foundry Co., of Lebanon, Pa., which was organized about April 1, has its new buildings well under way and expects to be in operation about July 1.

John Snell is erecting a new foundry at Columbia, Pa.

The Mason Heater & Foundry Co., of Bellaire, O., has its new plant in successful operation, the first castings having been made June 8.

The company will increase the capacity of its plant by the addition of a small brass foundry.

The Reder Foundry Co. will construct a $100,000 foundry plant at Cincinnati, O.

A brass foundry department will be added to the plant of the Pittsburg Valve & Fittings Co., of Barberton, O.

Work was commenced at New Castle, Ind., on the building to be occupied by John S. Allan and others for a brass and iron foundry and machine shop. The building is 40 x 120 ft., and the plant is expected to begin operations within 90 days.

The Buckeye Engine & Foundry Co., Rockdale, Ill., has outgrown its present building, and will construct additions for a new office and pattern shop and additional machine shop space.

The Reidy Foundry Co., Chicago, Ill., is building a new foundry at North Forty-seventh avenue and Cornelia street after plans by W. L. Stebbins. The building will be large and of irregular ground dimensions. It will cost about $50,000 and will be of brick and iron construction.

The Aurora Foundry Co., of Aurora, Ill., is erecting an addition to its plant, 70 by 70 ft.

The new foundry of McCarthy & Malanski, Cairo, Ill., is almost complete, and will be occupied within a few weeks. The latest improved Whiting furnace will be installed.

The Chicago Hardware Foundry Co., of North Chicago, Ill., is making several extensions and additions to its plant.

The Northwestern Engineering Co., of Duluth, Minn., is now making plans and specifications for a 20-ton steel foundry, to be located in Duluth, West Duluth or Superior. The foundry is to be built for a company organized by Duluth, St. Paul and Milwaukee capitalists. The company will be capitalized for $250,000.

The Lusk Foundry Co., of Jackson, Mich., poured its first iron on May 10. The business starts with very bright prospects.

Work on the new molding room of the Malleable Iron Works, Beaver Dam, Wis., is being rushed to completion. The new addition will be 40 x 200 ft. and adjoins the present plant of the company. It will be used for floor molding and will contain a furnace and stack.

Plans for the erection of a new steel casting plant for the Prescott Co., at Menominee, Mich., are now being prepared and the work will commence July 1.

The Grand Rapids Foundry Co., Grand Rapids, Mich., is preparing to start the work on its new shop. The new building will be constructed of concrete blocks.

The Portage Lake Foundry & Machine Co., of Hancock, Mich., has nearly completed the additions to its plant which were started some time ago.

The La Crosse Plow Co. is making improvements in its foundry at La Crosse, Wis., which will cost about $7,000.

The city of Baltimore has created a special committee for the encouragement of manufacturing plants to locate there. The object of the body is to provide ways and means for the establishment of new manufacturing industries and to conduct a systematic campaign of advertising the advantages to be enjoyed by new industries in Baltimore.

The Atlanta Iron & Brass Bed Co., Atlanta, Ga., recently incorporated, has completed its organization with John L. Coleman, president; W. R. Ware, vice president; N. T. Sprate, secretary. A two-story building, 100 x 200 ft. is being erected.

Ernest M. Loeb has purchased the plant of the Consumers' Ice Co., of New Orleans, La., and expects to erect a large foundry and iron works on the site.

The Sheffield Cast Iron Pipe & Foundry Co., of Sheffield, Ala., has a large force of men engaged in the construction of its new plant. The contract for the buildings has been awarded to Harry B. Austin.

The Richmond Foundry & Mfg. Co., of Richmond, Va., is installing additional machinery for the manufacture of specialties.

The Wm. J. Oliver Mfg. Co., Knoxville, Tenn., has decided to double the capacity of its plant, and operation will be started as soon as possible. A new foundry will be added and the present foundry building will be used for additional machine work.

The contract for excavations and foundations of the new Gray & Dudley foundry, Nashville, Tenn., has been let to Foster & Creighton, and work will be started at once. The building will be 200 x 110 ft., and will be completed about Aug. 1.

The frame work for the pattern and general wood working department of the El Paso Foundry & Machine Co., of El Paso, Texas, has been completed and the building is being pushed forward to completion as rapidly as possible.

The foundry of the Hartwell Iron Works, Houston, Tex., is now being operated at its new plant.

Noah Erickson, of Fairfield, Ia., is pushing the construction of his new foundry as rapidly as possible and hopes to be turning out iron castings in the near future.

The Adams Co., of Dubuque, Ia., has purchased the Hotel Paris, of that city, and as soon as the lease of the present holder runs out, will remodel the building for foundry purposes.

The national artillery foundry of Mexico City, Mexico, is being improved and enlarged. The work is under the charge of Colonel Ibarra.

GENERAL INDUSTRIAL.

Mr. Wm. J. Roche, of Lake street, New Britain, Conn., has opened up a new brass foundry with eight or ten molders and reports that he is doing a very good business.

E. C. Childs, for 38 years employed in the brass foundry of the Fairbanks Scale Works, St. Johnsbury, Vt., has resigned his position in order to enter into partnership with E. T. Woods in conducting a brass foundry at Lyndonville, Vt.

The name of the Imperial Foundries Co., of Calais, Me., has been changed to the McAdamite Foundries Co.

The American Wood Working Machinery Co. has decided to consolidate two or three of its present branches into one company, and has purchased real estate at Rochester, N. Y., for the construction of a large foundry, machine shop, pattern shop and general offices. The company expects to put up first-class modern buildings, fire-proof or slow-burning construction, and its new location will give it the necessary shipping facilities.

The Bernstein Mfg. Co., Philadelphia, has completed plans for an addition, 60 x 135 ft., to the foundry building.

The Brylgon Steel Casting Co., New Castle, Pa., is building two ovens in addition to the three now in operation, and will shortly build two more.

The Kennett Foundry & Machine Co., of Kennett Square, Reading, Pa., has been incorporated with a capital of $50,000.

The entire property of the Fleetwood Foundry & Machine Co., of Fleetwood, Pa., with the exception of one building previously sold, has been disposed of to J. W. Johnson, of Reading, Pa., and Ephriam Hartman, of Oley.

The Aultman Co.'s plant at Canton, O., was sold recently to E. G. Tillotson, president of the Cleveland Trust Co., who represented the creditors, for $262,500. The total liabilities of the concern are about $4,000,000 and it is stated that the creditors will get about 5 percent of their claims.

The Bayless Stove & Range Co., of Cincinnati, O., has been incorporated with a capital of $50,000. The incorporators are D. B. Bayless, W. M. Allen, F. L. Garrison, N. S. Bayless and N. J. Utter

The foundry recently erected by L. J. Jackson at the rear of the McLaughlin Iron Works, Ashtabula, O., is in operation.

The Cincinnati Foundry Co., of Cincinnati, O., has beeen incorporated with a captal of $10,000 by John W. Schwoever, P. A. Schwoever, L. C. Ultrck, John D. Berger and W. H. Bowers.

The Lawton Foundry & Machine Works, of Wabash, Ind., has been sold to the Wabash National Bank for $8,500 by John H. Dicken, trustee. The plant has been in operation ever since the death of Mr. Lawton, but what will be done with it in the future is not known.

The Potter & Johnson Machine Co., of Providence, R. I., are making several additions to their works, including a pattern shop 35 by 38 ft.

The business which has in the past been carried on under the name of Law Bros. & Co., Caledonia Foundry, New Edinburgh, Canada, has undergone a change of management, by which the partnership has been dissolved, though the business will be carried on by one of the brothers.

The Cheboygan Boiler Works, of Cheboygan, Mich., will add a machine shop and foundry to their plant, which will give employment to 12 or 15 more men.

Buck & Mullen, contractors, of Muskegon, Mich., are erecting a new foundry building, 73 by 236 ft., for the Muskegon Boiler Works, Muskegon, Mich.

Plans have been sent out for a one-story addition to be erected to the plant of the Montford Machine Casting Co., of Baltimore, Md.

The contract has been awarded by the Mississippi Foundry & Machinery Co., Jackson, Miss., for the construction of an addition to its plant, 50 x 100 ft.

The Bessemer Foundry & Machine Co., Bessemer, Ala., has received a new 25-ton traveling crane to be installed at once. The company will build an addition to its plant, 150 ft. long. When the new structure is completed the entire building will be 400 ft. long.

The Hoover Stove & Casting Co., of Kansas City, Mo., will build a brick addition to its foundry, to cost $2,500.

The Atlas Brass Mfg. Co., of Cleveland, O., has been incorporated with a capital of $50,000. The incorporators are E. Rickersberg, S. P. Fisher, L. Rickersberg, J. H. Fisher and Sol. H. Rickersberg

The Dayton Pneumatic Tool Co., of Dayton, O., has opened an office in San Francisco, Cal., at 421 Market street, which will be in charge of Mr. Henry Engels.

The old Middletown foundry and machine shop, of Middletown, Ind., is being dismantled and much of the machinery and material moved to Newcastle, Ind., where Jonathan Allen is installing a foundry.

The charter of the Evansville Foundry Association, Evansville, Ind., expired in 1898. Some months ago one of the owners brought suit for accounting of the co-partnership which has existed since that time. This resulted in the appointing of R. D. Richardson as trustee. On May 18th the trustee sold the plant to Geo. Dauble and Marcus Sonntag for $109,500. The purchasers, headed by Geo. Dauble, will discontinue the use of the corporation name of the Evansville Foundry Association and will do business under the name of the Advance Stove Co. The other stockholders, who have sold their interests, have formed a new corporation called the Evansville Foundry Association, and will build a new plant. The foundry was not closed during the litigation.

The P. H. & F. M. Roots Co., of Connersille, Ind., reports a very remarkable performance of one of its blowers. One of its men visited the Stamford Foundry Co's plant at Stamford, Conn., and was shown a No. 4 Roots Foundry Blower that was installed in July, 1868, and has been in constant use since that time, melting from 5 to 6 tons of iron per hour six days in the week. The engineer who made the installation is still in charge and the company has never had to purchase a dollar's worth of repairs.

W. H. Oetting and Larry Dauer, of Chester, Ill., have purchased the Baronowsky Foundry, of Chester, Ill., and expect to operate it to its full capacity.

The Illinois Foundry & Engineering Co., of Granite City, Ill., has just completed a pattern storage of steel construction which gives the company 4,000 feet of additional floor space for pattern storage. It also reports that business is extremely good and that it has a large number of orders on its books for the future.

W. Toepfer & Sons, Milwaukee, founders of the brewers and maltsters' iron works, on May 17, celebrated their fiftieth anniversary. Wenzel Toepfer, who laid the foundations of the buildings in 1855, was an inventor and a mechanical genius.

Carroll Bros., iron founders and machinists, Houghton, Mich., are planning the installation of steel foundries during the summer. The company has just completed a new foundry, 70 x 190 ft. A machine and blacksmith shop will also be constructed.

The Hofeller-Brooks Aluminum & Brass Foundry Co., Detroit, Mich., has been organized to manufacture all kinds of metal and metallic compounds, with a capital of $6,000. The stockholders are Gordon D. Brooks, William J. Brooks, Theodore Hofeller and Julius Hofeller.

As reported in the issue of June 1, the Nordberg Mfg. Co., Milwaukee, has leased the foundry of the William Bayley & Sons Co. and secured possession long before the last named company became bankrupt.

The Neenah Brass Co., of Neenah, Wis., has been incorporated with a capital of $10,000. The incorporators are William Walker, Wilhelm Kahler, Henry Horkman and Alfred B. Meyer.

The name of the Bicknell Hardware Co., of Janesville, Wis., has been changed to that of the Bicknell Mfg. & Supply Co., the change being made to indicate more clearly the line manufactured, as the company is now interested in heavy jobbing lines.

The plant of the Three Rivers foundry, Three Rivers, Mich., has been greatly increased and the office has been moved to a new building. The change became necessary by reason of the increasing business.

At the annual meeting of the stockholders of the South Baltimore Steel Car & Foundry Co., Baltimore, Md., the directors were reelected for the coming year. Mr. Howard Carlton has been elected president and Mr. Chas. T. Crane as chairman of the board.

The Phoenix Foundry Co., 78 Garfield avenue, Jersey City, N. J., has been incorporated to manufacture iron, castings, fittings, etc. The capital stock is $50,000. The incorporators are: William D. Bliss, 116 Scotland street, Orange, N. J.; William W. Batly, 313 East Ferry street, Newark, N. J.; Thomas Owen, 515 East Ferry street, Newark, N. J.

The Bessemer Foundry & Machine Co., Bessemer, Ala., is making arrangements to install $20,000 worth of new machinery in its plant, the large orders which the company is constantly receiving making it necessary to increase the capacity of the plant.

The Bacon Equipment Co., of Albany, Ga., now has its new plant, including the foundry, in operation.

B. F. Avery & Sons, Louisville, Ky., are negotiating for the purchase of 50 acres of land to increase their plant, but the plans are not sufficiently matured to justify publication.

The Davis Foundry & Machine Co., Rome, Ga., has been organized with a $25,000 capital for the manufacture of turbine water wheels and ore washers and to do a general repair and machinery supply business. The company will erect a plant in Rome, Ga.

The Pipe Building Machine Co., Charlotte, N. C., has been incorporated with $100,000, capital stock. The incorporators are: J. W. Conway, W. H. Sneads and H. S. Hall. The objects of this concern are to conduct a general machine shop and foundry business, and to manufacture and deal in pipe bending machines.

The Buena Vista Foundry Co., of Clifton Forge, Va., has been incorporated with a capital of $25,000. The incorporators are: W. W. Taylor, president and director, J. L. Buzzard, secretary and treasurer, both of Clifton Forge, Va., and R. L. Parrish, director, of Covington, Va.

The Union Machine Co., of Nashville, Tenn., has made application to amend its charter, changing the name to the Union Machine & Supply Co. and increasing the capital stock from $25,000 to $60,000. Both the shops and the foundry will be enlarged. The officers are T. H. Warren, president; W. H. Gordon, secretary and treasurer, and Geo. Hare, general manager.

A deal has been consummated by which the Radford Pipe Works, of Radford, Va., have passed into the possession of the Lynchburg Foundry Co., of Lynchburg, Va., of which Henry E. McWane is president. The Radford plant is now being operated by the Glamorgan Foundry Co., of Lynchburg, Va.

Robert S. Moore, for 25 years with the Risdon Iron Works, and John T. Scott, for ten years with the Union Iron Works, have purchased the National Iron Works, of San Francisco, from Marschutz & Cantrell, and have already taken possession. The plant under the new management will make a specialty of marine repairs and continue the business formerly conducted.

The Wiggins Sad Iron & Foundry Co., of Waco, Tex., has been incorporated with a capital of $10,000, to manufacture sad irons, sash weights, etc. The incorporators are O. B. Wiggins, Chas. P. Wiggins, R. D. Powell and J. D Williamson, all of Waco.

The Duffy-Trowbridge Stove Mfg. Co., of Hannibal, Mo., has elected the following directors for the ensuing year: C. H. Trowbridge, C. A. Trowbridge, Morris Cochran, Geo. W. Dulany and W. F. Chamberlain.

The Oxnard Foundry & Iron Works, of Oxnard, Cal., has been incorporated with a capital of $25,000. Its directors include J. A. Driffil, J. F. Fulkerson, M. V. Carr, John Kastle, and W. S. Saviers, all residents of Oxnard.

The Standard Iron Works, of Prescott, Ariz., has amended its charter, changing the name to the Prescott Iron Works, and making such other changes in the charter as were necessary for the transaction of its business. The company was formerly located at Phoenix, Ariz.

The Marshalltown Aluminum & Brass Foundry Co., of Marshalltown, Ia., has been incorporated with a capital of $5,000. The incorporators are Chas. Glick, I. T. Forbes, P. M. Bentley, E. L. Williams and Robert Wishert.

The Guthrie Commercial Club, of Guthrie, Okla. has accepted the proposition of the Oak Hill Foundry & Machine Co., of Oak Hill, O., to remove its plant to Guthrie. The company receives a site and a bonus of $5,000 for the transfer.

The Fargo Foundry Co., of Fargo, N. D., has been incorporated with a capital of $50,000. The incorporators are Thos. L. Sykes, of Fargo, and H. J. Kellman and F. W. Parsons, of Litchfield, Minn.

The Terrell Foundry & Machine Co., of Terrell, Texas., has increased its capital stock from $10,000 to $15,000.

Brown & McKie, owners of the Boundary Iron Works, of Grand Forks, B. C., are turning their business into a joint stock company with a capital of $25,000. The firm started business three years ago in a small way, but has been very successful.

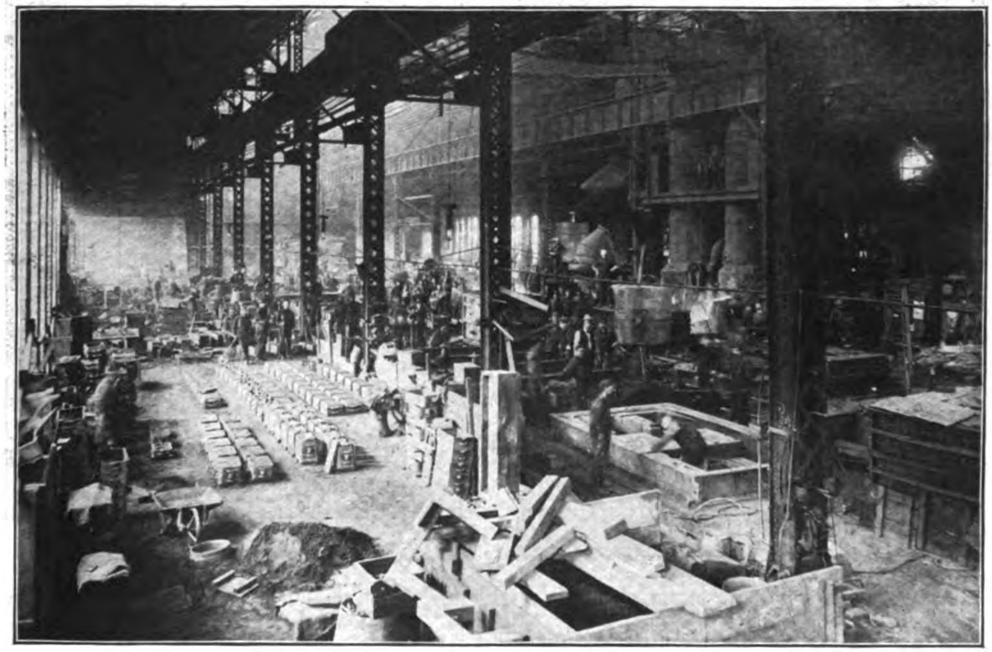
The York Pattern Works, of York City, Pa., has taken out a permit for the building of a modern pattern plant which will be equipped with the latest of modern machinery.

THE FOUNDRY

Vol. 26, No. 6. *CLEVELAND, OHIO, AUGUST 1905.* *Whole No. 156*

Foundry Department of The National Transit Co., Oil City, Pennsylvania.

This is one of the foundry departments that it does a foundryman's heart good to visit. First, on account of the large volume of work handled and second on account of the fact that every piece of equipment and all of the departments show that everything is carefully planned and the work under the best possible supervision. It is an especially interesting plant on account of the fact that in one foundry are turned out ordinary grey iron castings, steel castings, and brass and bronze castings, all of high quality and many of them of exceedingly intricate design.



GENERAL VIEW OF FOUNDRY.

Grey Iron Foundry Equipment.

The main foundry is 120 ft. wide by 420 ft. long. The central span is equipped with three traveling cranes, two of which are 25-ton capacity each, and one 15-ton capacity. In addition to these there are a large number of jib cranes equipped with pneumatic hoists. As much of the work is duplicate it has been possible to make special rigging in the shape of well made iron flasks, specially prepared pits, etc. The foundry is located between two machine shops and hence as far as possible the work for each machine shop is confined to the end of the foundry adjacent thereto. There are two cleaning departments, each with its full equipment of tumbling barrels, grinding wheels, etc. One of these is located at each end of the foundry and in each the small castings for the adjacent machine shop are cleaned, thus reducing handling to a minimum. The cleaning department for the large castings is at one end of the foundry and under the main crane runway. As most of the large castings are used in the machine shop next the heavy work cleaning room this does not necessitate the carrying of many castings the whole length of the foundry after they are cleaned.

There are over a dozen molding machines located in the side bay of the foundry for getting out light work.

The core-oven equipment consists of four large ovens of the following dimensions: One, 16 x 24 ft.; one, 12 x 30 ft.; one, 14 x 30 ft.; one, 10 x 30 ft., all being 8 ft. high. There is also a millet oven. The core department is located in the side bay opposite the molding machine floor and next the cupolas.

The melting equipment consists of two Callou cupolas, one 65 and the other 42 in. inside the lining. The stock of iron, coke, etc., is stored in sheds and in a yard at the side of the

STEEL CONVERTER IN BLAST.

foundry and is raised to the cupola platform by an hydraulic elevator.

Storage bins are placed on one side of the foundry large enough for the entire year's supply of molding sand, sea coal, coke, and other foundry supplies.

For mixing and tempering the sand there are two pneumatic riddles and two power riddles. All the machinery about the plant is direct driven by electric motors.

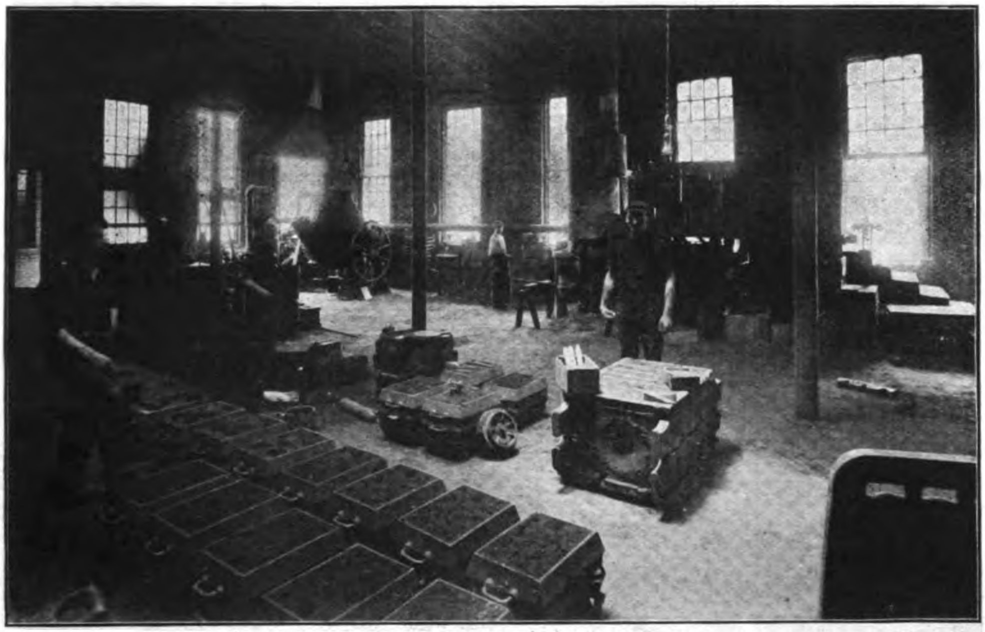
Steel Melting Equipment.

Mr. J. E. Fisher, the superintendent of this foundry, is one of the pioneers in the Baby Bessemer Converter Practice, and has done a large amount of research work along this line. The steel melting equipment consists of a 4-ton converter made by Mr. Fisher. The molds for the steel castings are made on the floor and in the side bay adjoining the converter. Metal for the converter is melted in the smaller one of the cupolas and by suitable additions in the ladles all classes of special

ROLL OVER SLING.

alloy steels, including nickel steel, aluminum steel, etc., that are required in their work can readily be obtained.

One of the most interesting facts about the entire plant is the extremely small amount to remelt in the form of gates, risers, etc. They nearly always realize over 70 percent good castings and frequently come in the neighborhood of 80 percent. Mr. Fisher explained this on the ground that steel blown in this way is exceedingly hot and, hence, does not require as large gates and risers as would be the case with colder metal. Some of the intricate castings, such as cages for air com-



BRASS FOUNDRY.

pressor valves, etc., which have been made from nickel steel, certainly show remarkably good work.

In connection with the steel department, Mr. Fisher has developed an adjustable flask clamp which consists of two parts, one side of each being notched and the notches have a slight rake forward, so that when placed together and strained by wedging, the notches will tend to grip deeper. This device has proven so efficient that Mr. Fisher has put it on the market through the S. Obermayer Co., of Cincinnati and Pittsburg.

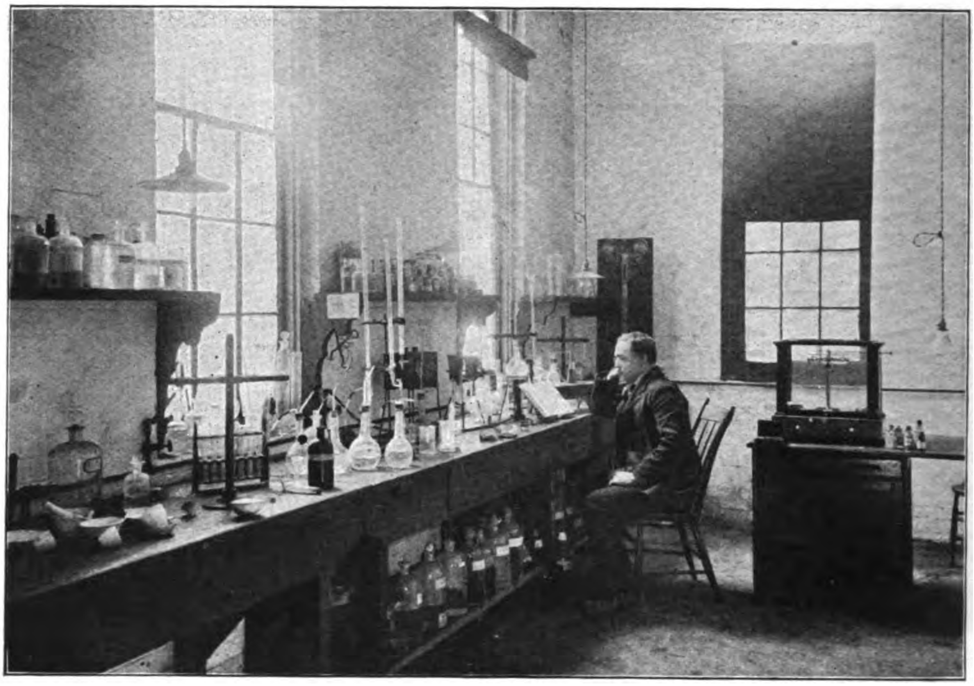
Handling Appliances.

In addition to the cranes, trucks, etc., ordinarily used in handling there is a special device in use in this foundry gotten up by Mr. Fisher a good many years ago. This device was illustrated in *The Foundry* several years ago, but as it does not seem to be generally known we deem it is worthy of special mention. This is a roll or sling, which is shown clearly in one of the illustrations. It consists of a beam from which are suspended two sheaves over which run two chain slings. When a large flask is to be rolled over the boards are clamped on, the flask hoisted and then simply rolled over as it hangs suspended in the slings. When this kind of a sling is used, it is not necessary to depend upon trunnions on the flasks and all foundry men know how difficult it is to locate the trunions in such a way as to roll over the work with ease, while with the roll over sling the work adjusts itself in such a way that it is not difficult to turn it over even though it is of irregular form.

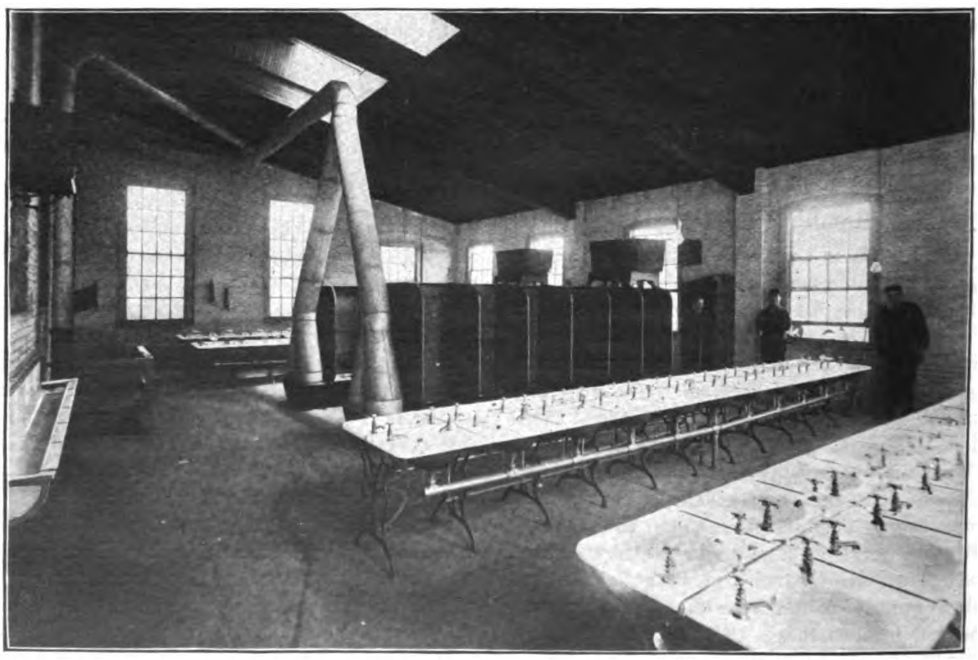
Brass Melting Equipment.

As the writer approached this foundry from the outside he stopped and studied the array of cupola tops, stacks, etc., showing on the outside. First there were two large ones which were iron cupolas, next to them was the stack from the converter. Then in the lower part of the roof next the railway there was a little cupola which was evidently used for melting brass, but from the small amount of oxide about the top it was hard to determine whether it was only used for an occasional charge or whether they had some special good practice in connection with it. An inspection of the brass melting department from the inside revealed still more interesting facts. This department is equipped with a cupola and a Schwartz melting furnace, but they find the cupola so efficient that practically all the brass and bronze used is melted. in it. There is also a crucible furnace used for special mixtures when they are required.

The cupola in question is 24 in. inside diameter and the tuyeres are 8 in. from the bed. A fan pressure of about two ounces is used



CHEMICAL LABORATORY.



TOILET ROOM.

for blast. The charging door is situated 30 in. above the tuyeres and an excess of coke is used in melting, so as to insure a reducing flame under all conditions. In most cases the ingot copper only is melted in the cupola and the other ingredients that make up the alloy are added in the ladle. In some cases, however, ingot brass or bronze or heavy scrap are melted down in the cupola with perfect success. The 1,000-lb. Schwartz furnace is rarely used except for large castings, while the cupola is in operation every day.

For exceedingly heavy castings the steel converter is employed. This converter is provided with oil burners which project the burning oil through the tuyeres. These oil burners are generally used for heating the converter previous to a blow. When it is desired to melt brass or bronze in the converter it is turned down on its side and the proper amount of ingot metal charged. It is then melted down with a blast from the oil burners and the contents poured into a ladle which has been previously heated by an oil burner.

Chemical Laboratory.

An old saying is "Be sure you are right and then go ahead." In order to make sure that he is right in everything Mr. Fisher has a very complete laboratory in which analyses are made for checking all the work and in this laboratory will be found the secret of his success in the steel foundry and brass foundry practice, as well as in his gray iron practice.

NEW BOOKS.

"Engineers' Turning," by Jos. Homer, published by Crosby Lockwood & Son, Stationer's Hall Court, London, England. Price 9 shillings net.

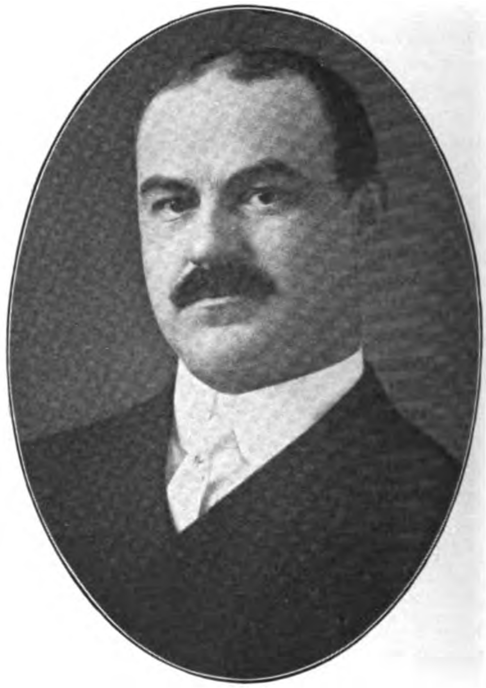
This well known writer has brought out two books recently entitled "Tools for Engineers and Woodworkers" dealing with the small tools used in all departments of engineering work. The present books deals with what in this country is called lathe work. Comparatively little attention is paid to the practical style of the lathe itself. First the author calls attention to the fact that lathe design is now undergoing rapid changes due to the introduction of new high speed tool steels. The work contains over 400 pages and nearly 500 illustrations showing various classes of tools and appliances used in connection with lathe work, the methods of screwing and holding work during turning and a great many other very useful points in connection with this branch of shop work. In his preface the author calls attention to the fact that thus far there has been no book dealing specially with this department of shop work. Among the points of special interest are his treatment of turret lathes and turret work and what he has to say in regard to the new high speed tool steels. The work is certainly one which every progressive machinist will want and also one which should be in the hands of any one having this class of work in charge.

"Organizing a Factory," by C. E. Woods, published by the System Co., of Chicago and New York. Price $1.50.

This is the second of a series of books comprising "The Business Man's Library," which are being put out by the System Co. The matter contained in the book is largely drawn from a series of articles written by Mr. Woods and published in System. The author, however, has gone back over the work very carefully and has added whatever was necessary to make a connective story of the entire volume. In the preface the publisher states that as a rule we cannot learn to do a thing by merely being told how it is done, but that such knowledge greatly facilitates our learning how to do it when once we get into practical work. It affords him a strong foundation, barren and useless in itself, but a firm basis upon which to build the structure of business experience. Book learning, abstract knowledge, is like a fertilizer: it does not, of itself, produce anything, but it stimulates growth and advance when the live seed, practical experience, is instilled in the soil of work. Following this idea the author has aimed to give in the fewest possible words a comprehensive treatment of the new art of organizing a factory. Some of the chapters are as follows: The Necessity of System and New Methods, The Organization Elements and Authorities of an Industrial Body, The Accounting of Expenses and Costs, Analysis of Different Methods of Paying Labor, Depreciation of Tools and its Relation to Costs, The Machinery of Cost Getting, Perpetual Inventories, How the Executive may keep in touch with the Factory, etc. The volume contains 156 pages of good solid meat.

The Des Moines Bridge & Iron Works, Des Moines, Ia., are to build a $35,000 addition to their plant, to be used as a foundry.

A. W. SLOCUM
National Car Wheel Co., Pittsburg, Vice President of A. F. A. for Pennsylvania, Delaware, Maryland, and District of Columbia.



HENRY A. CARPENTER
A. Carpenter & Sons, Providence, R. I., Vice President of A. F. A. for New England States.

A. K. BECKWITH
Est. of P. B. Beckwith, Dowagiac, Mich., Vice President of A. F. A. for Michigan, Ohio, Kentucky and Tennessee.

T. J. BEST
Warden, King & Co., Montreal, Canada, Vice President of A. F. A. for Canada.

H. E. DILLER
Western Electric Co., Chicago, Ill., Secretary of Metallurgical Section of A. F. A.

F. C. EVERITT
New York, Secretary of the Associated Foundry Foremen.

A COMPARISON OF STANDARD METHODS FOR TESTING CAST IRON.*

BY DR. RICHARD MOLDENKE.

In reviewing the situation as it exists today, we see that all the work carried through in connection with the testing of cast iron, lies in the direction of standard specifications. The only nations which have accomplished something definite are Germany and the United States. The others are still working at the problem.

As pig iron is the basis of the foundry industry, our attention is first directed to it, and we find two general specifications in use—the American ones, and lately a pig iron contract drawn up in England. In the American specifications we have the direct recommendation that all iron be purchased by analysis. Next detailed instructions for sampling. The course to pursue in case of a disagreement in the analytical work. An important omission, and one which it will take much time to supply, is the lack of standard methods for analysis. Without these, even the best specifications still leave a loop-hole for controversy. Incidentally it may be said that the American organization of foundrymen is taking this matter up, and has already prepared a standard method for determining silicon in pig iron and cast iron. Total carbon is to follow, then sulphur, and so on. As these methods are tested out in practice outside of the foundrymen's organization, we will learn their practical value for specification purposes better.

Continuing with the American pig iron specifications, we next come to the allowances and penalties. Here there is given the limit of difference allowable in the pig iron delivered from that specified, and the penalty that may be exacted where the limit is exceeded, and yet not be too great to absolutely reject the metal. These provisions enable foundries to purchase pig iron with a reasonable assurance that they get what they want nearly enough, without causing the slightest trouble in the shop routine. The cash penalty further prevents the furnace from taking chances on shipments to people who watch their supplies carefully.

For the benefit of the trade in general,

*Read at the Atlantic City meeting of the American Society for Testing Materials.

inasmuch as only the minority of foundries are equipped with laboratories, or have expert advice, there is given a table of base analyses of grades, so that if a man pins the specifications to his order, and calls for a number three iron, he will get just what a number three iron should be in composition, so far as the silicon and sulphur are concerned. When the use of chemistry in the foundry is so general, and the furnaces are run in such a way that one iron is as good as another, we may see these specifications extended to include the other elements. At present the phosphorus, manganese, and carbons, are questions of brand and locality largely, the furnace industry being quite settled in classes for pig iron distribution.

Germany has not yet seen fit to standardize pig irons, and reports from the other side indicate that conditions are not so favorable there, the application of our American specifications being out of the question for German irons. A man calling for pig iron with the sulphur we give, and be it said that our sulphur limit is high, would have to pay fancy prices in Germany, for they are badly troubled with that element over there. The same may be said for England, and on looking over the new pig iron contract issued by the London Metal Exchange, we find that while the sulphur allowed is not much larger than ours, yet the very much higher silicon that goes with it practically makes a big difference. Thus while we have a No. 2 pig iron run 2.25 silicon, with a variation of 10 percent either way or 2.00 to 2.50, and this has a maximum of 0.045 sulphur allowed, the English standard, with the same sulphur, allows the silicon to vary from 2.50 to 3.50 percent which would correspond to our No. 1 with a higher sulphur. The English specifications also give rules for sampling, but lay much stress upon the brand names.

Incidentally it may be mentioned that America is taking up the question of standardizing foundry coke, which is a step in advance, and will have a far-reaching influence not only in foundry practice but on the blast furnace.

To turn now to specifications for testing cast iron. In America we have adopted a set for pipe, for locomotive cylinders, for malleable castings, and there are pending those for castings in general, and for car wheels. Over here we take out from the general work the special groups which can stand by themselves and have properties peculiarly their own, which may be determined by specific tests. In Germany they have specifications for machinery castings, for columns, which we are trying to get away from as quickly as possible; and for pipe.

In dividing the classes of castings relative to their thickness, for this is the important point to consider when specifying breaking strength, we have adopted a little wider limit than the Germans. Thus we have small castings at ½ in. and less. They have 0.6 in. and less, or a little more. For medium castings, however, we have from ½ in. to 2 in. The Germans have from 0.6 in. to only 1 in. For heavy castings we have over 2 in. in thickness, and they have over 1 in., which shows that our conception of heavy castings is a little different, or else that German customs lay more stress on smaller limits for medium castings.

A further difference between the American and the German specifications may be found in the chemical end. We specify the upper limit for sulphur, so as to secure reasonable strength against shock. This is not looked after in the German specifications, possibly because of the difficulty in getting low sulphur irons for the foundry.

The point that interests us most, however, is the method by which the metal is judged. That is the test bars employed. Comparing the general specifications advanced for Germany with our own, now pending, we see that special pains are taken in both cases to get representative test bars, and these are not to be cast on the piece. Herein there is a distinct advance, cutting off the old coupon. The transverse test is prescribed, which agrees with our experience. The tensile test is omitted entirely in Germany, and it is to be hoped that we may follow suit in this some day also, as no good end is served when no two testing machines may agree in the alignment and grip on the specimens.

We find a radical difference in the length of the test bars used. Our own are comparatively short, and this has caused comment on the other side, our German brethren concluding that we do not lay as much stress on the transverse test as we should. We, on the other hand, believe that with the long bars in use formerly, much of the sensitiveness of the transverse test is gone, for even poor iron will show good results, if the test is carried out slowly and carefully. On the other hand with a comparatively quick test on short bars, the iron must be of good quality to show a good deflection and strength.

Three bars are provided by the Germans. For small castings the diameter is 0.8 in. and the distance between supports 16 in. For the medium castings the figures are 1.2 in. diameter and 24 in. between supports. For the heavy castings the diameter is 1.6 in. and the testing distance 32 in.

It will be noted that the German aim is evidently to get as near the size of the castings to be represented as possible, and this is to be commended in a way. However, we realize over here that the lack of homogeneity in the structure of cast iron is such an element in the problem that the records of several sized test bars are not mathematically comparable, as would be the case in steel. Hence we would not feel safe to accept the result of a long and thick bar as compared with a shorter and thinner one, in order to judge whether the iron in one is better than that in the other.

While realizing that it is desirable to vary the diameter of the bars, but not the length, we reluctantly confined ourselves to one bar for all purposes, aiming only to get at the actual quality of the metal with given standard conditions identical for each test, so far as foundry practice can accomplish this. We can therefore discriminate between metal wanted for light, medium and heavy castings at a glance, and without making a comparative calculation, the results of which are open to doubt.

The German specifications for casting the test bars go us one better in requiring the vertical pour but from bottom up. We await their results on this, with interest, as we use the ordinary top pour, but so arranged that the metal drops to the bottom through a funnel-shaped gate, and the mold is thus made cheaper.

German specifications call for the bars to be made in flasks that are not parted, if possible, so that the test bars have no seams. If, however, this is unavoidable, the test bar is to be so placed that when tested the seam lies in the neutral axis. We prefer to prevent the making of test bars with seams altogether by giving complete specifications for the flask itself, which any foundry can arrange for without particular trouble.

Both specifications agree in having the bars cast in dry sand, and the cooling of the bars in the flask. Furthermore, only brushing is allowed in cleaning the bars, and no machining is to be done.

In judging the tests themselves there is a difference between the two specifications in question. We specify just when the tests are to be arranged for in the heat, and that one of the two bars cast at the various casting intervals must pass the requirements. The German specifications call for three bars, the average of which must be taken, defective bars to be excluded. In both cases the expense of testing falls upon the founder. In our added tensile test, this when required by the purchaser, is to be paid for by him.

The clause in our specifications wherein we allow the buyer the freest run of our establishments, in order that he may be satisfied that the material is gotten out in the best manner possible, does not appear in the German specifications. Only in the case of pipe is there mention made of facilities to be given the inspector to watch the testing of this material.

It is still a little early to draw conclusions from the specifications advanced, for they have either not been officially adopted by their respective countries, or they are still in the trial stage. This much can be said, however, that a marked advance can be recorded, for in everything presented so far the attempt has been made to build on our increasing knowledge of the properties of cast iron as a metal. Much has of course to be yielded to business expediency, for the industrial customs of a nation cannot be radically disturbed without laying ourselves open to the charge of being idealists and dreamers.

The buying of pig iron by analysis, and now by specification, may be said to be the most radical advance the foundry has ever made. The adoption of specification for the castings is gradually coming into vogue also, and we will soon see the allied industries, such as the fuel, sand, facings, etc., become a subject for study and final specification.

It is to be hoped that at Brussels next year, we not only may report final specifications for all we have undertaken in the way of cast iron, but that Germany, England, France and Austria may be similarly situated. Then we can compare notes, and possibly adjust some of the items so as to have a greater conformity in practice.

THE WATT CUPOLA TUYERE.

The Watt tuyeres have now been in use for a number of years, but many foundrymen are not familiar with them. Any tuyere which introduces into the cupola large jets of air at high pressure is liable to chill the slag and iron as it descends past the tuyere, while accretions are liable to form between the tuyeres, sometimes to such an extent as to ultimately bridge the cupola. Many attempts have been made to produce a continuous tuyere which would not interfere with the support of the cupola lining and which would give the blast an equal opportunity at all points of the inside of the lining.

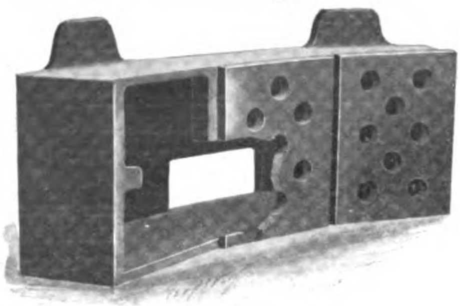


FIG. 1. BLOCK FOR TUYERE.

In the Watt tuyere this is accomplished by having an outside wind box, and inside of the lining a series of cast iron blocks or boxes, each of which is supplied with air through an opening in the back, as shown in Fig. 1. The front of this block is closed with metal plates which are provided with lugs on the back side, which simply hook over corresponding lugs in the block. These plates are perforated with holes as shown. The result is a very large number of small jets of air, which approximates a continuous tuyere closely enough for all practical purposes. These perforated plates can be quickly lifted out and replaced. The main blocks serve to support the lining, and the fact that the perforated plates are always kept cool by the flow of air through them prevents the

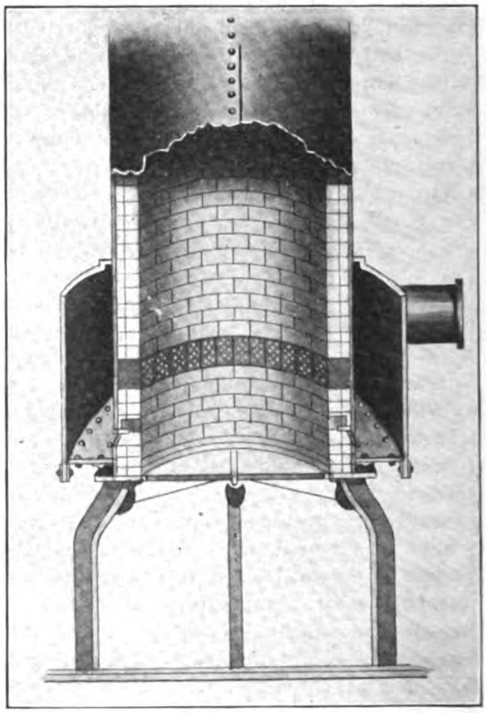


FIG. 2. SECTION OF CUPOLA.

burning away of the lining at the upper edge of the tuyeres.

Parties who have used this tuyere for some time report perfect success in maintaining a uniform blast and in keeping the tuyere in repair. They also claim that their cupolas work much better, and melt faster and cleaner than with the old style of tuyeres. A section of a cupola fitted with Watt tuyeres is shown in Fig. 2.

These tuyeres are made by the Watt Cupola Tuyere Co., Barnesville, O.

TRADE PUBLICATIONS.

The American Engine Co., of Boundbrook, N. J., is sending out a map of the United States and its island possessions, together with a small map of Cuba, beneath which there is a calendar covering a period from July 1, 1905 to December 31, 1906. The map is surrounded by the portraits of all the presidents of the United States above, and in the lower corners there is a small amount of advertising matter covering the products manufactured by the American Engine Co.

The Northern Engineering Works, Detroit, Mich., have issued a new edition of their crane catalogue, No. 20, containing illustrations of cranes for all purposes both for indoor and outdoor use. The catalogue first contains a statement as to what is necessary when sending in inquiries or quotations on cranes. This is followed by a description of the standard traveling cranes including illustrations of the entire crane and of the trolleys, also of some of the crane details. There are many styles illustrated, including cranes especially designed for location in which the head room is limited. Electric yard cranes are next taken up and dwelt on very fully, showing the various applications and the manner of installing the cranes. Some of the cranes illustrated for indoor and outdoor use are arranged so as to be operated from the floor, while others are operated from a cage. The transfer tables made by this company are next illustrated, both for transferring railroad and other cars and for transferring trolley hoists. Under the subject of trolley hoists a very large variety of equipment of this kind is described and fully illustrated, showing the advantage of the different classes, including those in which the operator accompanies the trolley in a cage and those which are operated from the floor. Pneumatic hoists of various types are also fuly treated. Various types of jib cranes for indoor and outdoor work are illustrated, several of the illustrations being taken from photographs of those in use in foundries. Under the head of Pillar Cranes quite a variety of machines is illustrated, some equipped for hand power, others with pneumatic hoists and still others operated with steam or electricity. Various types of locomotives and truck cranes are also fully illustrated. The crane user should be able to select equipment for almost any of the varying conditions met with about plants from the types illustrated in this catalogue.

The Ingersoll-Sergeant Drill Co., 26 Cortlandt street, New York City, has issued a catalogue dealing with the "Little Jap" Hammer Drill, showing how this tool may be applied to drilling stone as well as to work of an ordinary pneumatic hammer.

The Smooth-On Mfg. Co., 572 Communipaw avenue, Jersey City, N J., has issued a new catalogue especially devoted to its Smooth-On elastic cement. The publication is entitled the "Smooth-On Elastic Cement Instruction Book." This material is the latest development as a result of this company's experiments with metallic fillers for repairing all classes of iron and steel work. The book describes the material fully and illustrates its use of a number of examples.

The Brown & Sharpe Mfg. Co., of Providence, R. I., have issued their 1905 catalogue of machinery and tools. This catalogue has been revised and a good many new machines and devices illustrated in it. Some of the old matter has been re-written and arranged in a better form. This catalogue contains so many handy tables and so much useful information that it should be in the hands of all who have to deal with metal work, and especially in the hands of metal patternmakers.

A. M. Thompson, of Penn 10156 Wallace street, Chicago, Ill., has published a catalogue describing the Thompson Adjustable Clamps. There are numerous illustrations showing various applications of these useful appliances and a large number of letters from foundrymen who have found the use of these clamps advantageous.

SPECIAL NUMBER OF THE HORSELESS AGE.

The Horseless Age, published in New York, has brought out a special number devoted to commercial automobiles. It contains eighty pages of reading matter upon this subject, to which very little attention has thus far been given. It brings out the progress which has been made in this way, in a remarkable manner. Not only are the many different classes of trucks and vans described, but the engines and gearings for some of them are very fully illustrated. There is also an article on commercial motor car tires. One very interesting article treats of the running cost of commercial automobiles.

RUTHLESS RHYMES.

Bill, the apprentice, spit into a sprue
He wanted to see what the iron would do.
At the funeral the neighbors sighed:
"Bill was a good boy. Too bad he died."

A helper too near the cupola strayed
He wanted to see how iron was made.
He didn't know hot iron would burn;
Isn't it strange how some people learn?

Tom poured hot iron into a mold
Then stripped the flask before it was cold.
Though the boss was irritated,
All the men were quite elated.

—W. S. Zimmerman.

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CONTENTS.

TRADE OUTLOOK.

During the first part of the past month there was little change in the foundry situation, but during the last portion of the month there has been a marked increase in the buying of pig iron, large orders having been placed in Chicago, Cleveland and Cincinnati. It is true that much of this buying has been at very low prices, but nevertheless it has served to strengthen the pig iron market and to make some of the pig iron interests hold for higher prices. It is to be hoped, however, that the furnaces will not attempt to run up the price too much and thus bring on another period of dullness in all the manufacturing interests dependent upon pig iron as a base.

Number 2 foundry iron is quoted at the Valley furnaces from $14.00 to $14.35 per ton for immediate delivery. None of the furnaces, however, will sell for future delivery below from $14.25 to $14.50 per ton. Southern iron is now held at $11 furnace, for No. 2 foundry, and some interests are holding for $11.50.

There seems to be a good demand for foundry coke and it is held at from $2.25 to $2.40 per ton at the ovens in the Connellsville region.

The conditions with regard to the division of work in the foundry industry remain very much as they have during the past few months. Some of the special foundries, steel works, malleable foundries, etc., are running full time or over time. The light hardware foundries are picking up to quite an extent, though few of them are running full handed. The general jobbing foundries are as a rule fairly busy on heavy work, and some of them have a considerable amount of light work on hand also.

HARD CAST IRON.*

By Henry Souther.

A consulting metallurgical engineer in contact with machine shops is accustomed to hearing complaints from the operators of machine tools of hardness of material being machined. Sometimes it develops, especially with steel, that the trouble is not that the steel is hard; but, on the con-

*Presented at the Atlantic City meeting of the American Society for Testing Materials. Mr. Souther is of the Henry Souther Engineering Co., of Hartford, Conn.

trary, that it is exceedingly soft. The softness is of such a character that the edged tool does not succeed in cutting the steel keenly, but rather tears it off, some of the particles clinging to the edge of the tool, causing excessive friction and rubbing, and drawing the temper of the tool and dullness soon follows. The effect as far as the machine operator is concerned is that of a hard steel; the tool is spoiled. This not only applies to low carbons but to a peculiar physical condition of higher carbons, say, in the neighborhood of .50, due to bad annealing.

Then there is the legitimate hard steel, which is really hard in the true sense of the term.

Cast iron that chills may be called hard in the truest sense of the word. That is the complaint that is most often met when the term hardness is used in connection with machining cast iron. Iron chills because of high sulphur or low silicon, or a combination of both, and machine tools simply can not cut it. This kind of hardness is more often found in thin work than in thick work. For example, the hardware people casting very thin material have to use the softest of iron, high silicon and low sulphur, in order that the small amount of machining they do may be done at all.

In the last five or six years three separate complaints of hard iron have reached the writer and proved of so baffling a character that in each case visits were made to the machine shops working the iron, and the complaint carefully investigated. Analysis or test did not reveal the cause.

The most instructive case covers them all. This instance was most informing because it occurred on a multiple drill where several different sizes of standard drills were used and several thicknesses of metal were involved. On approaching the machine it was noticeable at once that there was trouble, because the drills were screeching in an unusual way.

It developed that small drills, ¼ in. or thereabouts, were standing up with this iron just as well as any other, but the larger drills in the neighborhood of ½ in. and ¾ in. were dulling exactly as though the iron were charged with emery. The edges were being ground off and would last only a fraction of the time usual for the same drills in the same machine.

Here was an unusual condition, thin iron working easily; thick iron on the same castings working with difficulty.

The chemical results were normal, except manganese—silicon 2.50, phosphorus .70, sulphur about .080, total carbon 3.50 and manganese .16.

The fracture of the iron was good and, moreover, it was quite normal as far as could be seen with eye or microscope. A Keep's test drill was used and developed nothing unusual, no signs of hardness, thick and thin iron showing a normal curve. There was no opportunity to test the tool wearing qualities on the Keep machine, because the drill was sharpened after every hole drilled.

Inasmuch as the only abnormal part in the analysis was shown in the manganese, that element was suspected, although there seemed to be no metallurgical reason for so doing. Means were taken to raise it to the neighborhood of .50 and as soon as this was done the difficulty disappeared in the machine shop and has not reappeared after some months.

It is a complaint which reached me, as I said above, from two other sources, and in both of those sources the complaint was described by the machine shop people by saying that the iron was "gritty." They were fully convinced that there was sand in it, but examination showed that to be out of the question and the iron was as clean as any iron.

This leads me to believe that there must be some carbide of iron or carbide of silicon that forms in the absence of a reasonable amount of manganese, and that does not form with manganese present. What this chemical combination may be I can not surmise, but the problem presented is an interesting one from a theoretical and practical standpoint. Apparently its cure has been found, but the question remains, Why?

The actual castings causing this trouble were put through and no specimens kept, so that the writer can furnish no samples for study, but this is doubtless something that comes before the other members of the society and although specimens may not be easy to get, they can doubtless be found.

SWEEPING A CYLINDRICAL AND CONICAL DRUM.

BY H. J. M'CASLIN.

The accompanying illustrations show a combined cylindrical and conical hoisting drum with a variable pitch score, and also one method of sweeping the same in loam. These drums, two in number, form a right and left when placed together, and were designed by the Wellman-Seaver-Morgan Co. and cast by the Interstate Foundry Co., under the supervision of Mr. A. L. Hott. They were used in the construction of an electric automatic water hoist, in an anthracite coal mine near Scranton, Pa. This design of hoisting drum is employed in winding heavy loads from deep mines. When the skip or load is at the bottom of the mine, ready to be hauled up, the winding of the cable begins at the small cylindrical end. This prevents the load from starting too suddenly, and allows the slack cable in the shaft to be gradually taken up at the beginning of the hoist. The motor or engine also gains a decided advantage when these drums are employed, as the winding starts at a slow speed and gradually increases, thus giving the motive power a better chance to do its work, and reducing the strain to a minimum.

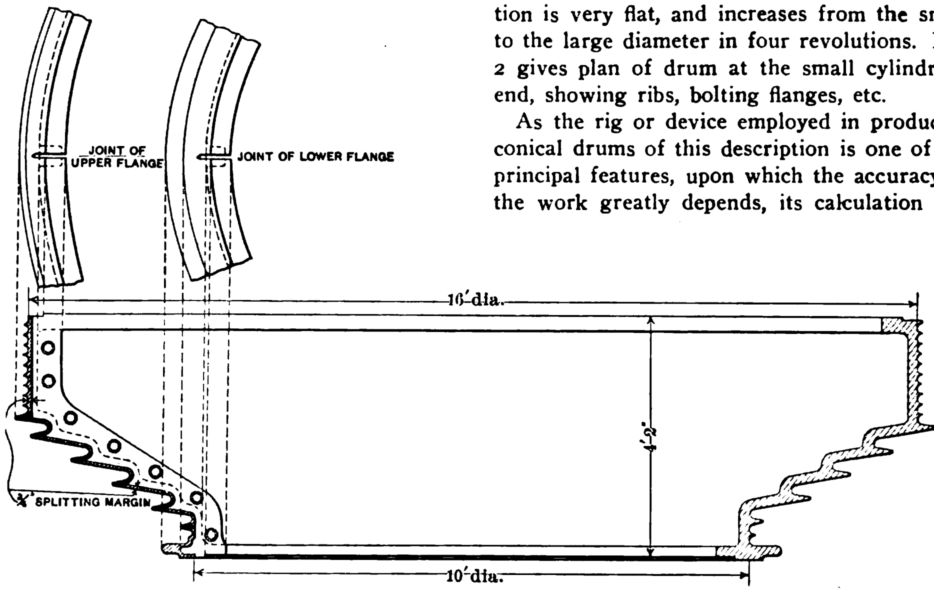


Fig. 1

Fig. 1 gives a cross section of the drum; to the right is shown the metal thickness, and to the left the bolting flange with its splitting margin along the joint and around the bolt holes. The drum is cast practically entire, and subsequently split in two. It will be seen that the drum is 16 ft. in diameter at the large end, and 10 ft. at the small end. The conical section is very flat, and increases from the small to the large diameter in four revolutions. Fig. 2 gives plan of drum at the small cylindrical end, showing ribs, bolting flanges, etc.

As the rig or device employed in producing conical drums of this description is one of the principal features, upon which the accuracy of the work greatly depends, its calculation and construction usually receive the initial attention, therefore we shall proceed likewise.

The variation in the axial pitch of the drum score was produced by a variable pitch thread cut upon the cast iron hollow spindle, as illustrated in Fig. 3. This thread receives the conical roller A, which is provided with a roller bearing bracket, B, as shown in plan and section, Fig. 4. The outer diameter of the Spindle is turned to the required dimension, six inches, the variable pitch thread is laid off, and holes drilled at the points where the pitch of thread changes. The spindle is then returned to the lathe, and the required pitch of thread between the drilled holes cut, the spindle being finished at the top and bottom as shown.

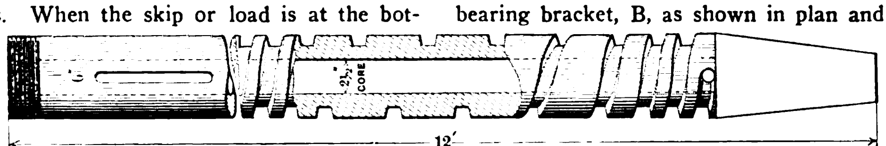


Fig. 3

Three views of the assembled device are

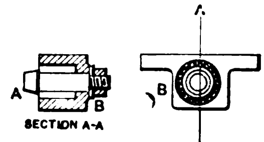


Fig. 4

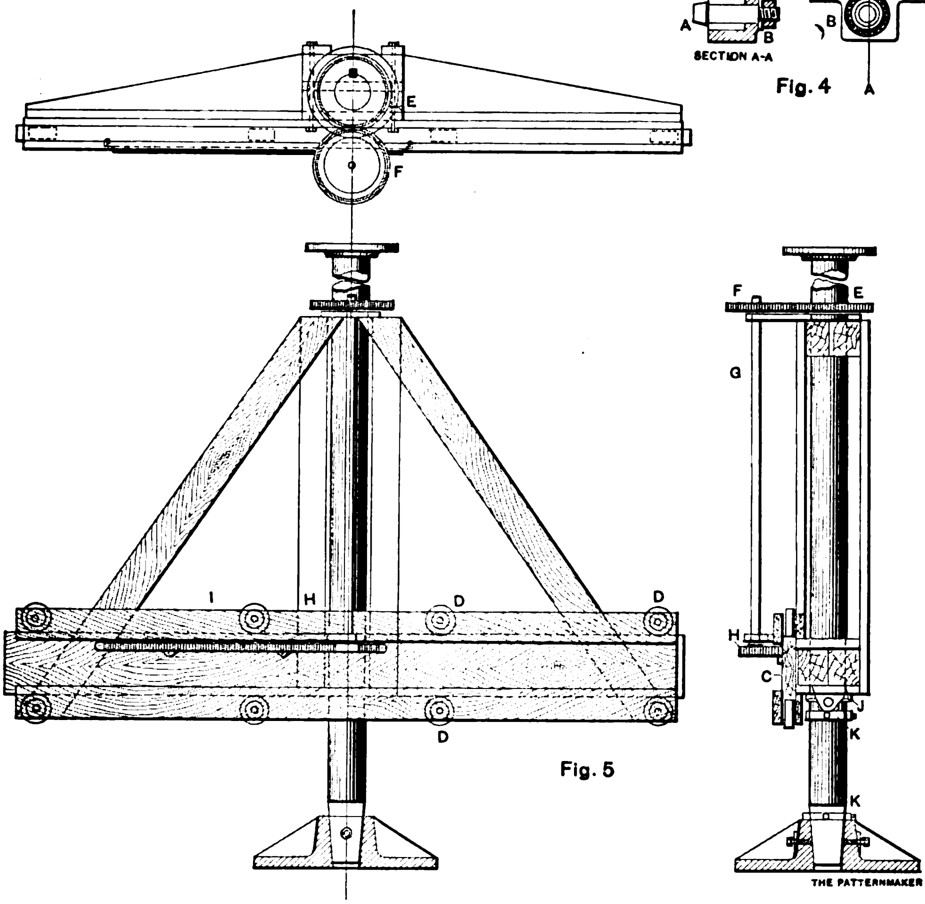


Fig. 5

THE PATTERNMAKER

shown in Fig. 5, giving the general construction of the frame. The material used is hard wood. The sliding arm C is held in place as shown, and with the aid of rollers D, is allowed to travel or slide freely. Gear E at the top of the frame is attached to the spindle with a feather key, permitting it to travel up and down the spindle as the frame is raised or lowered. As the frame is revolved around the spindle, gear E drives gear F, which, by means of shaft G, pinion H, and rack I, causes the sliding arm C to travel radially backward or forward, as the case requires. The raising or lowering of the frame is governed by the engagement of the conical roller A, with the thread of the spindle. The bracket B is located and secured to the lower part of the frame at J. The proportion of gears governing the travel of arm C during the sweeping of the conical section of drum is as follows: The angle of the conical section is 120 degrees, giving a 9-in. throw to the 5-in. pitch; that is, the frame would rise 5 in. in one revolution, while the arm C would travel outward 9 in.

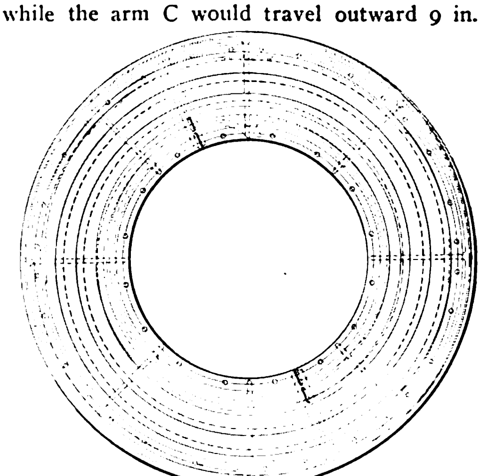
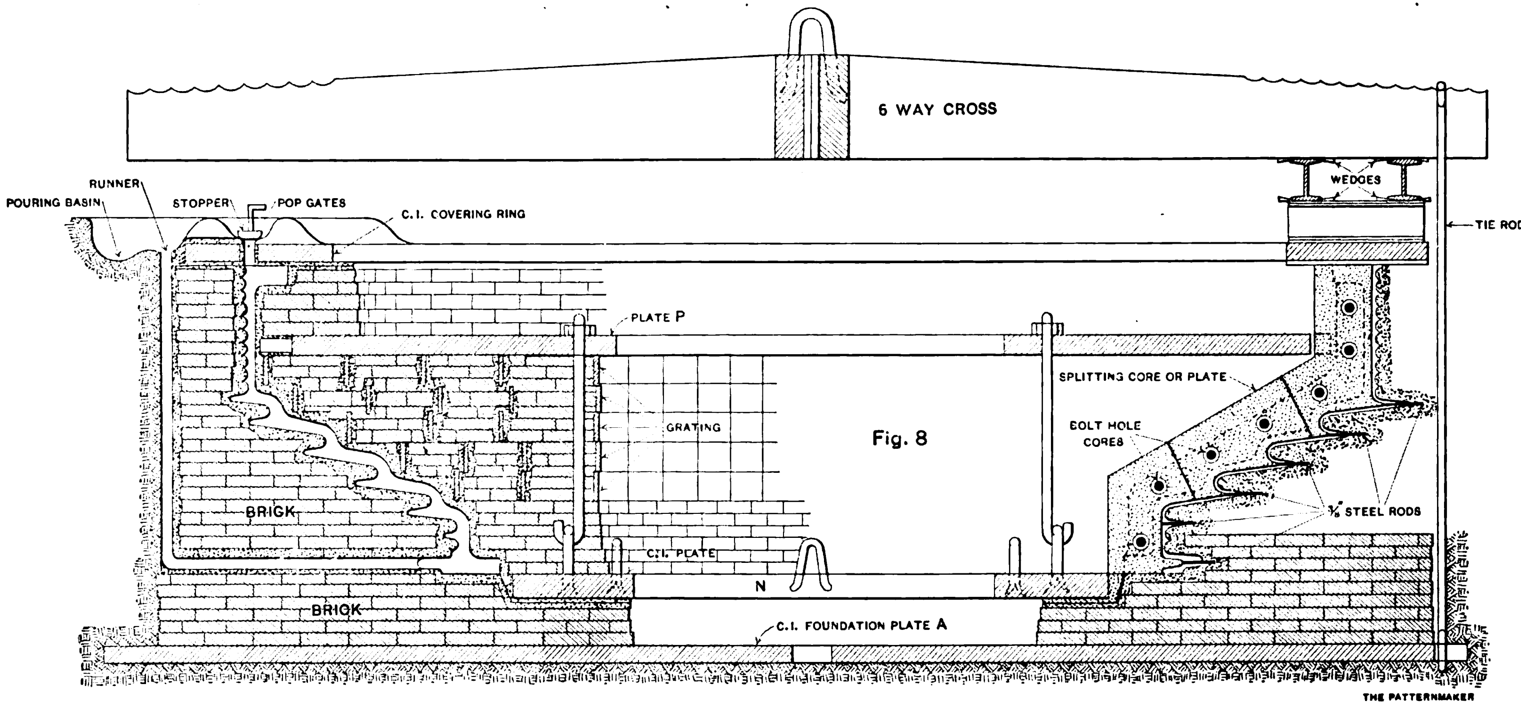


Fig. 2 THE PATTERNMAKER



The gears are of ½ circular pitch, gear E and F having a pitch diameter of 10.15 in., and 64 teeth; gear H contains 18 teeth with a pitch diameter of 2.86 in. These proportions give the gears the same number of revolutions as the frame.

When using the frame with the arm C stationary, as in the sweeping of the cylindrical sections, gear E is thrown out of mesh with gear F by being raised up and a block or support placed underneath it. This also requires the disengaging of the roller from the thread of the spindle. The frame is now held suspended and revolved upon the collar K; the collar being dropped down upon the spindle socket when not in use, as shown in dotted lines.

Sweeping the Mold.

The pit having been dug to the depth of the drum, a bed is struck off for foundation plate A, which is placed in position and leveled up with the spindle socket attached, as illustrated in Fig. 6. The socket is bushed as shown, to receive an ordinary spindle, to which is attached the sweep C. The brick work is now built up to the required height in the usual manner, and a heavy facing of loam applied and struck off to the form of the sweep. The cutting edge of the sweep forms the seat for the core, and also a surface and guide for placing flange D, which is shown in position to the left.

Fig. 7 illustrates the rig in operation, showing the arm with the various cutters and strikes attached, which are employed at the different stages of sweeping the mold. To the right are shown the cutters G, H and I, required in forming the score. They are made of ⅜-in. steel plate, dressed to form and the back beveled off, forming a comparatively sharp edge. To the left are shown the strikes J and Z, employed in sweeping on a body of sand the equivalent of the metal thickness.

With the seat for core prepared and flange D in position, the scoring of the mold is in order. Following the plumbing of the spindle, the frame is lowered down over it, and the upper end secured with guy rods attached to flange L. With the roller engaged with the thread of the spindle, and gear E thrown out of mesh with gear F, the frame is placed in position at the starting point, this being governed by the thread of the spindle. The slide with cutter G attached is next adjusted to the required diameter of score, and the slide locked in position, as shown to the right at the starting point. The brick work with a heavy loam facing is struck off to the form of cutter along its helical path, is now laid until the conical section is reached. Cutter H is now attached to the slide as shown, gear E dropped into mesh with gear F, causing the slide to travel outward as the frame is revolved. As the changing of these cutters and pitch of scoring is rather abrupt, a little doctoring or making up of score becomes necessary at this point, and is accomplished with the aid of a segment representing a section of scoring. The segment is so dressed that it works from one section to the other. This mending up also becomes necessary when the large conical and cylindrical sections meet, at which time cutter I is attached, and the bricking and scoring completed to the top.

At the top a surface to receive the covering ring is struck off with the aid of strike M, attached to the slide, as shown to the left. This necessitates the throwing out of the gears and conical roller, the frame being supported and revolved upon the collar K. With this portion of the mold completed and air-dried, a body of ordinary sand, equivalent to the metal thick-

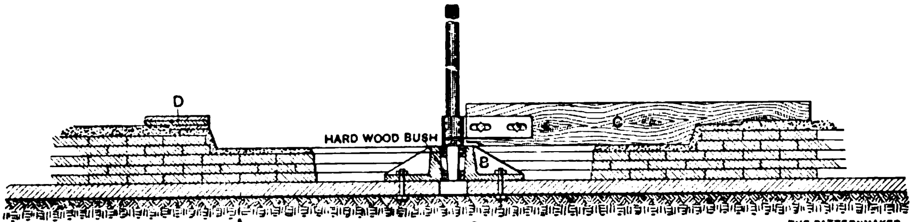


Fig. 6

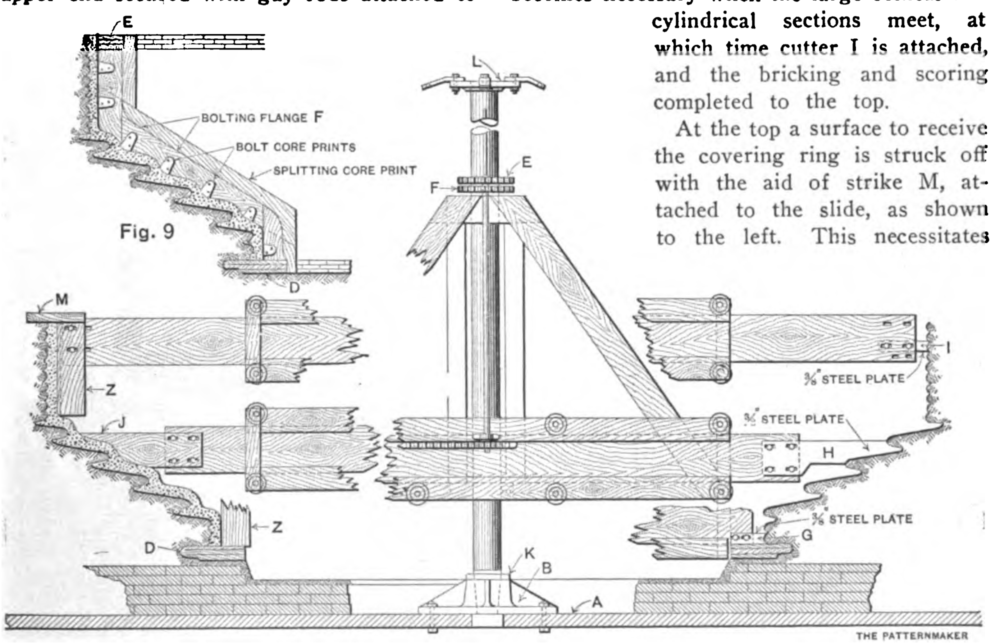


Fig. 7

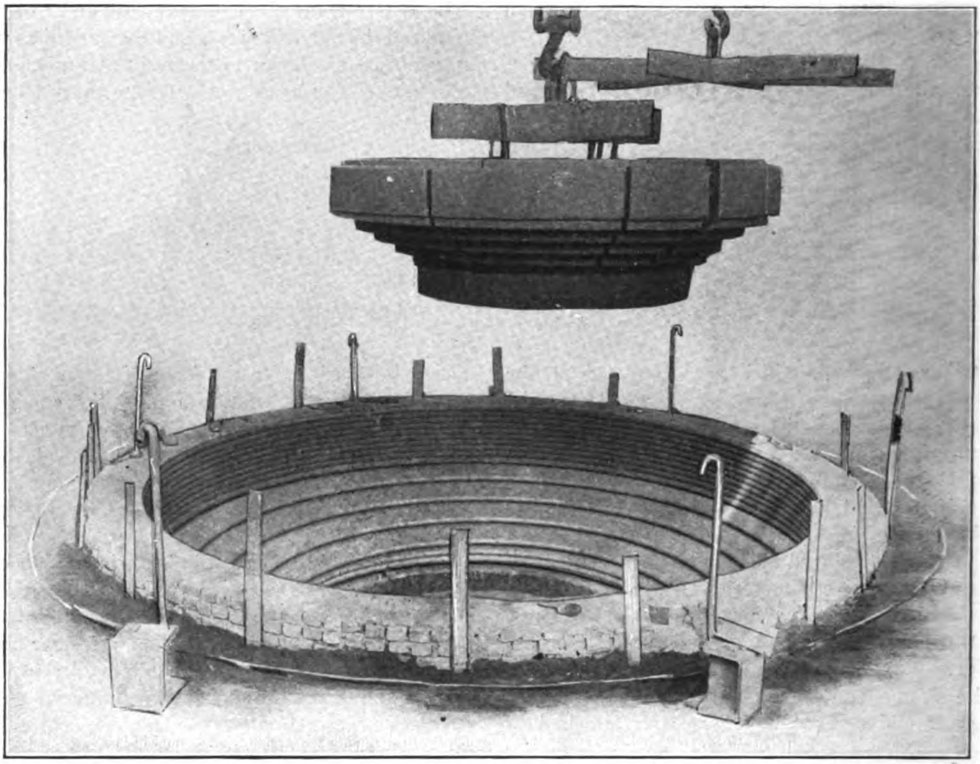


FIG. 12. MOLD WITH CORE SUSPENDED ABOVE IT AND SIX-WAY CROSS FOR CLAMPING ALSO HANGING ABOVE.

ness, is then swept on. The gears and conical roller having been disengaged, the strike Z attached, and the slide locked to the inside diameter, the frame is lowered until the strike clears the flange D, and the collar K adjusted. This thickness of sand is now swept up on the small cylindrical section of the mold, as shown.

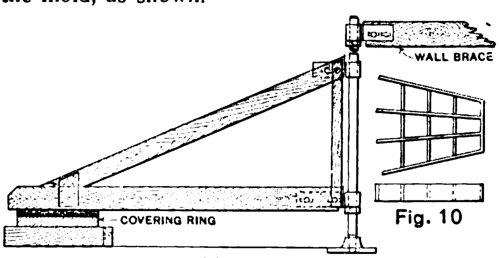


Fig. 11

The conical section being reached, the strike J is attached, the conical roller engaged with the thread of the spindle, and the gears dropped into mesh and this thickness of sand swept on the conical section. The large cylindrical section is treated like the small section, strike Z being employed. The frame and spindle are now removed, paper applied to the seat for the core, a heavy loam facing spread over it, and the lifting plate N, upon which the core is built, as shown in cross section of mold, Fig. 8, pressed down upon it;

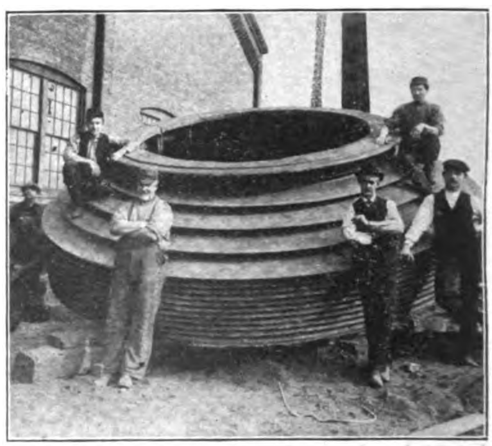


FIG. 14. FINISHED DRUM.

to which it adheres, forming a seat and guide for locating the core when returned to the mold. The ribs and bolting flanges F, with

FIG. 13. MOLD WITH SWEEPING RIG IN PLACE.

splitting and bolt core prints attached, are now placed in position. They support the flange E, as shown in Fig. 9. This flange and flange D are in sections, which allows their being drawn in or back, as the case requires. The arrangement of ribs, etc., is screwed together, the screws being removed as the building of the core progresses.

Building the Core.

The bricking, strengthened with rods and plates, having a thickness of loam between it and the molding sand thickness, which represents the metal thickness of the drum, is now placed upon the lifting plate N, Fig 8, until the conical section is reached. Open sand grates, as shown in Fig. 10, are now employed to secure the overhanging brick and loam, the grates increasing in length as the building of the core progresses. The small end is kept somewhat in line, allowing the sixteen clamping bolts to pass up through them. The height of the conical section is built up in this manner; plate P is placed upon the grating with its filling of brick and loam, and this portion of the core securely clamped together. Brick and loam are now applied to the top of the plate, and the remaining portion of the core completed and the top finished, as shown. A center line for splitting core is now laid off across the top of the core and outer wall of the mold. The lifting plate is provided with four staples, as shown. The core is lifted from its seat with the aid of a four-way cross, as shown in Fig. 12, and placed upon a car, the ribs and flanges drawn, the core dressed and placed in the oven and dried. The lower flange is drawn and the sand forming the metal thickness is removed from the mold, it is then treated in the usual manner, and thoroughly dried by the aid of coke fires placed in it. Owing to the deep scoring of the conical section of the drum, the splitting of the projecting metal between the score is an object to be considered. This can be overcome to a nicety with ⅜-in. steel rods in the following manner.

By the aid of a plumb-bob and straight-edge across the top of the mold, the center line of the drum at the splitting core is projected down the side of the mold, and ⅜-in. machine steel rods driven in opposite these projections, as shown to the right in Fig. 8. Fig. 8 also shows the splitting and bolt cores in position. The bolt cores are placed through the splitting core, but independent of it, being secured by the tail prints, leaving a ¾-in. metal thickness around the bolt holes. The splitting core consists of a perforated ¼-in. cast iron plate, covered with loam, forming a core of about ⅝ in. in thickness. To facilitate the handling and setting of these cores, and to lessen the danger of the cast iron plate warping or expanding when heated from the metal, thus causing the loam to crack and chip from the plate, the cores are made in three sections. A complete core box is used, the cores being separated by the introduction of pieces of tin at the desired lengths. The splitting preparations being completed, the mold is ready to be assembled.

The core is lowered into place, and the cope ring placed on. The ring consists of a cast iron prickered semi-ring, or plate, provided with lifting lugs and openings for gates. To the prickered surface a heavy facing of loam is applied, and struck off with the aid of a spindle and sweep, as shown in Fig. 11. The clamping of the mold is accompanied with the assistance of a six-way cross in a very positive manner. Foundation plate A is provided with lugs corresponding with the arms of the cross, and the tie rods are attached to it, as shown. The crane is now hooked on to the cross, and given a heavy lift, and while being subjected to this strain, the blocking between the covering ring and cross is placed in position and securely wedged up. The intervening space between the wall of the mold and the side of the pit is firmly rammed in with sand. The runners, two in number, are located opposite each other, and are prepared during this ramming or backing up.

The gating to the lower flange is not on a radial line, as shown to the left, Fig. 8 (this being simply for illustration), but is carried farther around the flange so as to cause the metal to whirl or circulate as it rises in the mold; this provision being necessary to offset the tendency of the metal to become sluggish or chilled as it nears the top.

The pouring of the mold does not depend entirely upon the gating from below, as the mold is provided with a series of pop gates closed with cast iron stoppers and connected with the pouring basin, as shown. During the pouring, and when the metal has reached the top of the conical section, the ladles are tipped, choking the runners, and causing the metal to back up over the pop gates to the depth of three or four inches. The stoppers are now lifted out, causing the metal to drop into the mold.

A photograph of the mold during the operation of sweeping is shown in Fig. 13.

A view of the mold with the core suspended from one crane immediately behind it and the six-way cross for tying down the cope suspended from the other crane near it, is shown in Fig. 12. The finished casting is shown in Fig. 14.

PRACTICAL ALLOYING. I.

Metal Refining: Ancient and Modern.

BY J. F. BUCHANAN.

To the average individual the universe is a mass of organic and inorganic substances regulated by the inscrutable laws of an All-wise Providence; to the philosopher, it is simply "harmonious matter:" but to the student of applied sciences it presents an inexhaustible medley of forces and elements which lend themselves to analytic and synthetic arrangement. Thus, in the view of the scientist, the spectroscope and the balance may be said to prove all things, whilst the blowpipe and the melting pot enable him to hold fast that which is good. It is the province of science to investigate. The chemist and the physicist have to determine the nature and limits of all the material things in their ultimate relations. We may take pride, therefore, in the long and ever increasing list* of elementary substances compiled by the noble army of workers who have endeavored to unravel for us the mysteries of earth and space. The ancients supposed fire, air, earth and water to be the fundamental constituents of the universe, and these compounds are still known in literature as "the elements." Modern science, however, defines the simple or elementary bodies as "those substances which do not admit of analysis." Up to the present time over seventy such substances have been isolated. They are recognized as metallic and non-metallic bodies, but the metals are an overwhelming majority. The distinction between a metal and a metalloid (which is the technical designation of a non-metal), is a purely artificial one, based on physical rather than chemical standards. The metals are characterized by the possession, in varying degrees, of a wide range of properties, as ductility, malleability, fusibility, metallic lustre, sonorousness and thermal and electrical conductivities. The useful metals are electro-positive and with few exceptions they readily combine with electronegative bodies, such as oxygen, sulphur, chlorine, etc. Consequently, the largest bulk of the metals in the earth exist in the mineral state, as ores, requiring a separation of the components before they can be put to any practical use. It is with metals as with everything else in nature—the useful members exist in greater abundance than do those of more superficial qualities.

Copper, lead, tin, iron, gold, silver and mercury appear to have been known from a remote antiquity. They are mentioned in Holy Writ and there is every reason to believe that they were applied in many ways by the Egyptians, Persians, Hindoos and Chinese, in the earlier epochs of human history. Obviously the crude methods employed by the ancients for the reduction of the metals greatly restricted their application. Their rude furnaces would reduce only the richest ores in small quantities and very imperfectly. The early history of metallurgy is somewhat obscure. Egypt—the birthplace of astrology, alchemy and the liberal arts, and the first of old-world empires—is known historically and by exploration as the home of many manufacturing processes, indicating a comprehensive knowledge of refractory materials, especially earths and metals. The Egyptian potters and refiners have been the models for artists in form and color down the generations. Pre-historic metal workers were undoubtedly engaged in fashioning such metals as are known to exist in the "free" or native condition. The seven elements already mentioned, with possibly a copper calamine compound, sometimes called golden-copper or native brass, comprised the stock-in-trade of the metal workers up to the beginning of the Christian era. Sacred and profane histories and the ancient mythologies contain many references to the metals and metal workers of that early period, so that Tubal Cain, Vulcan, or The Cyclops, are names typical of metal workers unto this day. Exactly how much knowledge of metallurgic processes the early artificers possessed it would be difficult to surmise; but their skill in handicrafting metals for architectural and decorative purposes is beyond dispute. The Bible has made us familiar with some of the early metal refining processes, products and appliances.

The fire, the pure metal, and the dross are always related as cause and effect. Gold is mentioned as being refined with silver (which sounds like the first alloy on record), and Job says: "Surely there is a place for gold where they find it;" and again, "Iron is taken out of the earth and brass is molten out of the stone." Here let me explain that the word "refining" is applied, in technical circles, only to the later stages of the metal extraction processes, indicating the separation of impurities from metallic compounds; but, it has an older and more comprehensive significance, making it embrace all the operations of reducing as well as purifying and alloying metals; and in order to avoid tedious distinctions, I take the liberty of using the term in its widest application.

Practical alloying, or the art of refining metals and alloys of metals, is an ancient pursuit which has led to many important discoveries; it has also been greatly instrumental in furthering the progress of mechanical science. It is always interesting and instructive to trace the arts and inventions to their origins. A new idea may cause a sectional uneasiness, but an old one never loses its power to guide and uplift the activities of the race. When the world was young and the children of men had leisure to dream, the interpreter of visions was a power in the land; magic became a fine art and astrology the first science—music and hieroglyphics following in natural sequence. Husbandry was the essential occupation of mankind until he learned that he could not live by bread alone. Worship made calls on his better nature, and these were answered, mistakenly, but sincerely, in the graven images of the semi-barbarous peoples. Even Israel, the chosen race, lapsed into idolatry. Thus, Aaron's golden calf became the forerunner of frequent failures as well as the first recorded work in metal founding. Such a beginning was befitting this industry, for there are heaps of gold and many misguided workers engaged in founding metals, even now. Did not Jeremiah establish his reputation as a prophet when he said: "Every founder is confounded by the graven image." Incidentally, the destruction of this golden calf sheds some light on the manner of reducing metals in those early days. Moses "took the calf and burnt it in the fire, and ground it to powder, and strewed it upon the water." These processes are characteristic of some ancient methods of gold refining, and the granulation of metals by strewing them upon water is still practiced in the manufacture of hard solders and shot metal, as well as in some of the modern methods of extracting metals from the earthly matter with which they are generally associated.

In all ages it has been the aim of the metal refiner to bring out and enlarge the useful qualities of the metals, and the progress of metallurgic processes in recent times demonstrates the desirability of having the practical arts based upon scientific principles. We have learned that the chemical properties of most metals are such that only their salts are found in nature; but the ancient refiner, with his four "elements" and many empirical laws, made slow advances and few discoveries in the working of metals. Up to the time of Pliny, or the beginning of the Christian era, the metals were reduced, smelted and mixed with scarcely any definite application of chemical knowledge and with little or no effort to get rid of impurities, excepting, perhaps, in the case of the precious metals—gold and silver. Casting operations were necessarily restricted. Alloys other than the natural product of the ordinary smelting operations were practically unknown. A few mechanical processes, as the calcination and cupellation of metals, served fór the separation of the noble and ignoble elements; and the proper use of fluxes had not yet been discovered. In the middle ages the alchemists were fired with the hallucination of making gold. They formed into leagues; worked in secret upon some mystical formula; adopted signs, zodiacal and religious; and aimed, at different periods, to discover, first, an alkahest, or universal solvent; second, the philosopher's stone—a substance for transmuting base metals into gold; and third, the elixir of life—a liquor supposed to have the power of prolonging man's existence.

These dreams of the alchemists—like the dream of perpetual motion—are still unfulfilled, but Utopia is always in the future, and every new discovery seems to stir up hope in the prophetic truth of human imaginings. Scientific, like other history, repeats itself. Men pursue old fancies and discover new forces by the way. Recent researches seem to be overturning laws which scientists of former periods were at great pains to determine. Thus, with the advent of radium, Dalton's atomic theory is said to be in danger, the law of the permanence of matter is in a precarious position, and if it be true that uranium and other metals develop radio-activity, the greatest dream of the alchemists—the transmutation of metals is likely to materialize.

The desire for gold is much older than King Midas. The mystics and magicians of the early Egyptian and Persian civilizations indulged in transmutation theories. It took centuries of alchemical research to dissolutionize the later schools about the gold-in-everything craze. The disappearance of the Magi and the fall of the Roman Empire opened up the way for the development of systematic chemistry and the introduction of the new industrialism. Our increased knowledge of the cosmos has been of infinitely greater value than the mere discovery of an alkahest; nevertheless, we are indebted to the alchemists, and to the minuteness of their searchings, for the philosopher's stone, for the discovery of many invaluable processes and startling phenomena in the realms of chemistry and physics, and also for introducing to us that group of interesting bodies, termed the metallic alloys.

Chemistry and metallurgy are so intimately related that they require collateral study; they are allied as theory and practice in metal refining processes. Chemical science may be said to lay down the law, and be the theoretical basis of metallurgic operations, while metallurgy, viewed as a manufacturing art, and by right of its historical precedence, may be considered as the practical foundation of chemistry. Art and empiricism have always preceded science and dogma. Astrology precedes astronomy. Alchemy preceded chemistry, and the ancient metal refining processes paved the way for the more complete metallurgy of today.

Passing from the ancient to the modern aspects of metal refining, we are confronted with the immensity of the subject. A brief summary of the processes involved in the reduction and refining of one of the metals would require a book—and a better writer. Having regard, then, to the scope of these articles, we must be content with a general survey of the vast field, focussing the simple principles and the more important methods of smelting and alloying metals, down to our own times. Ores may be described as chemical compounds of metallic and non-metallic elements, from which the metals are generally obtained "by promoting a change in the chemical equilibrium." The nature of the operations by which metals are extracted from their ores depends on the chemical affinities of the metals to be extracted.

Nature works by a system of laws and affinities; and, in treating metals, the best results have been obtained by imitating the processes by which metallic compounds are built up or dissociated in nature. Of necessity the metallurgist is forced to observe the chemical reactions following upon the elaborate processes involved in the separation of gangue or earthy matter from the purely metallic constituents of an ore. The ores from which most of the metals are obtained occur in such great variety of combination and in such diverse conditions that no general system of treatment could be devised for the reduction of any one class.

Metallic oxides, sulphides, carbonates and silicates constitute the majority of the minerals yielding the useful metals.

The value of an ore depends upon the metals it contains and upon its susceptibility to metallurgic treatment. Very often the presence of the "precious" metals influences the choice of a refining process and necessitates more careful handling and more exhaustive treatment of the ores. But the metallic content is not always the most important consideration in the treatment of an ore. Some ores contain sufficient suitable fluxing material to reduce the metallic contents in the form of "coarse" metal; others lack this excellent property and have to be fed with artificial fluxes. In recent years, many low grade ores, which could not be economically reduced in former times, have, owing to the more exhaustive and economical reactions of modern metallurgy, and the manufacture of practical by-products from the materials of reduction, been increased in value beyond their intrinsic worth.

Metals may exist in any of the three states of matter, solid, liquid or gaseous, the condition varying with and being nearly always determined by the temperature. The possibilities in the way of metallic combinations are infinite. Metals combine with each other and with other elements in nature, producing compounds the decomposition of which demands a close observance of chemical and physical laws, as well as an intimate acquaintance with the mechanical processes of refining. The association of different elements and the chemical conditions binding them together can only be broken up by the application of suitable chemical reagents. Heat is the principal agency by which the cohesive force of materials is diminished, and it is because the application of heat promotes the operation of the laws of chemical energy that the metallurgist is so strongly addicted to the agency of fire.

The treatment of the ores for obtaining the metals is mechanical and chemical. The mechanical treatment is preliminary to the roasting and reduction processes and consists in crushing, washing and classifying the ores according to their richness and the nature of the gangue. The process is known as concentration and its action is based upon the different specific gravities of the substances which are associated in the ore, advantage being taken of the different speeds at which their particles will subside in a column of water. Ores which are mineralized in large masses, or crystals, are adapted for coarse concentration; on the contrary, ores which contain the valuable mineral in a finely divided state must be crushed finer in order to liberate the finer particles.

The degree of fineness to which an ore should be crushed depends on the nature of the mineralized ingredients. The solvent action of water eliminates worthless substances, diminishes the labor of dressing and leaves the metalliferous contents in a concentrated form. Many ores of lead, zinc, copper and iron are prepared for heat treatment, or chemical processes, by the "coarse" method of concentration, but the ores of silver, gold and tin usually require more careful dressing and "fine" concentration.

When the chemical nature of the ore is known it is generally easy to arrange conditions which will assist in the reduction of the metal. It is thus the concentrates obtained from the mills are prepared for the further processes of roasting and smelting, or, if the precious metals are involved, chlorination, cyanidation and amalgamation.

The local facilities, the chemical susceptibilities of the concentrates, determine the smelting process most likely to be successful. In most melting operations the reduction is effected by the abstraction of oxygen from some oxidized compound of a metal, or, as it is technically termed, deoxidation. On the other hand, oxidation is frequently important in metallurgical processes, as it is a means by which substances that are readily oxidized may be separated from others which are less readily oxidized.

Many ores contain substances which generate volatile combinations under the influence of heat and air. This process is technically known as "roasting;" it removes volatile impurities and is generally preliminary to the fusion or smelting operations by which the reduction of the metals contained in the ores is accomplished.

Some ores and alloys are separated by the process of liquation, i. e., by taking advantage of the difference in fusibility of the components. For example, when an ore is exposed to a gentle heat sufficient only to melt the most fusible constituent of the mass, it is separated from the unmelted residue, or in the case of alloys, if the elements do not enter into chemical union, there is always a tendency for them to separate out according to their densities and in relation to their fusible properties.

The solvent action of certain liquids oftentimes affords a convenient means of separating metals from the earthy matter enveloping them, consequently many of the ores are treated with acid or other liquids previous to the precipitation and reduction of the metals contained therein.

It would be a hard matter to go into the details of metal manufacture since the operations vary with the nature of the ores and the value of the metals which they contain. Prof. Roberts Austen, in his "Introduction to Metallurgy," has given a general summary of the methods of extracting and reducing metals from the ores, under the following heads, viz., 1. Liquation. 2. Distillation and Sublination. 3. By the reduction of metallic oxides at high temperatures (as $2\ PbO + C = 2\ Pb + CO^2$). 4. By the decomposition of metallic sulphides by means of iron at a high temperature, as seen in the equation, $Pb\ S + Fe = Pb + Fe\ S$. 5. By cupellation, which is probably the oldest method of extracting metals from their ores. When lead is molten it oxidizes rapidly, forming litharge which has the property of dissolving other metallic oxides and combining with them into a slag. 6. By amalgamation, i. e., by taking advantage of the powerful solvent properties of mercury. 7. By electrolysis. 8. By crystallization, as in Pattison's method of extracting silver. 9. By the "wet" way—dissolving in acids and precipitating; or forming compounds which can be acted upon by suitable reagents. This by no means exhausts the list of methods by which metals may be extracted; there are many auxiliary processes and combination methods which could only be dealt with by describing the complete metallurgy of the metals.

This is especially true as regards the recovery of the "noble" metals. Metal refiners have such a wide range of methods to select from that it is sometimes a hard matter to decide which is the best treatment for a particular ore. The fact is, many good mines have failed to pay dividends because the economies of the extraction processes did not receive proper attention.

Whatever method of decomposing the mineral may be adopted—"wet" or "dry," all the labors of metallurgical processes are directed to the same end—to reduce the substance to the metallic condition and to separate impurities from the metals recovered. Every new reaction or change of the chemical relations of the material, contributing to its decomposition, may be turned to account for the recovery of the metal, or for the manufacture of some commercial product. Hence the increase in the number of metallurgic processes and the adoption of combination methods giving better control of the commercial values.

Perhaps the most prominent feature of modern metallurgy is the thoroughness with which the various elements contained in the ores, or in the resulting metals, are marshalled and utilized. In these days the methods of isolating and purifying the metals are better understood, the complex ores can be more fully treated, and the results regulated with more precision than ever before. There are few negligible quantities contained in the ores nowadays. The metallurgic methods are so comprehensive and the chemical reactions so well controlled that the real value of the various ores is not to be gauged by the proportions of the metals they contain. There is no doubt that the metal refining industry, or, to be precise, applied metallurgy, is undergoing a revolution. More is being taken out of the ores now than was possible a few years back; the quality of the metals produced is superior, the grades are more uniform and the cost of production is being steadily reduced.

To illustrate this point I quote this paragraph from a current newspaper: "Broken Hill ores, which hitherto have only been treated for the silver and lead content, are now to be worked for zinc and sulphur also." Thus, from the residue of an older metallurgical process, a new industry is to be created; and by the additional profit from zinc (16%), which was formerly ignored, and the manufacture of sulphuric acid, increased prosperity, in this instance, is assured.

Yet another example of remarkable development made in recent years is the smelting of concentrator slimes, which were practically refuse. By a simple process of sintering, or kiln roasting, and then smelting, thousands of tons are being converted into marketable metals —and profit!

As illustrating a modern process designed to economize the products of ores containing precious metals combined with volatile metals and elements, take Dr. Hoepfuerer's method of recovering zinc from argentiferous blends in which the percentage of iron is too large to permit the ordinary distillation method being used. "The ores are at first roasted with common salt, resulting in the producing of zinc chloride and sodium sulphate. These two soluble salts are then leached out, and the latter separated from the former by crystallization in the cold. The zinc chloride is then treated electrolytically, using carbon anodes and for cathodes a revolving plate of zinc. The chlorine as it escapes is absorbed by lime—making it a marketable product. The precious metals remain in the leached residues in the tanks." If rich enough these may be sent direct to the smelter; if not, they would require concentration.

This example is typical of the modern improvements and economies effected by studying the properties and capabilities of the associated minerals, ores, fluxes and fuels, and the obvious advantage of employing electricity for the reduction and separation of the metals.

To sum up: the modern methods of producing metals for the market are characterized by: 1st, the systematic observance of chemical principles; 2nd, the adoption of a large scale of laboratory methods; 3d, economy of power and material; and 4th, the introduction of electricity as a means of decomposing metallic compounds. Electro-technology has made enormous strides in the last decade. Electrolysis and the electric furnace have added many interesting products to the metal workers' store-house. The former has solved the problem of producing pure metals on a commercial basis, while the latter has rendered possible the reduction and union of many refractory metals which formerly were not feasible. The progress made in the manufacture of self-hardening steels since the adoption of the electric furnace for the commercial reduction of chromium, tungsten and other hardly feasible metals, affords a striking proof of the improvements effected.

But besides furnishing power for the engineer, heat for the metallurgist, attraction for the chemist, light for the world and "vitality for weak men"—as the electropathist puts it—electricity has many other uses awaiting development. Dr. Borchers says "there is no metal incapable of being reduced by electrically heated carbon," i. e., the electric arc. Electricity has long been known to be a potent factor in the decomposition of metallic substances, but metallurgists are only beginning to take advantage of the fact. Electro-conductivity has been proposed as a means of testing the purity of the metals; indeed, this has already been accomplished with copper and aluminum. So it is only a matter of time till a standard of conductivity is tabulated for all the metals in a state of purity. We shall then have established a cheap test of the purity of metals.

Other proposals connected with the electrolysis of dissolved or fused metals or metallic compounds are also meeting with practical application, but this is hardly the place for a statement of electro-chemical theories. Certain it is that electricity has proved an economical power in metallurgy. It can be made to subdue the elements to the last atom. It may be said to fulfil the functions of the elixir of life and the philosopher's stone in one act, and now that modern scientists have wedded the sparking Vesta to the strenuous Vulcan, we may expect a numerous and gifted offspring. A well-known London humorist deplores the abolition of London fog by means of electricity! He says: "Electricians must learn sooner or later that not everything which can be done by electricity ought to be done." Metallurgists must learn this too, and no doubt many of the old-fashioned metal refiners, who have not yet acquired the electric habit, will agree with the sentiment even if they fail to recognize the humor. The changes which have taken place in the general treatment of ores—even in the preliminary dressing and mechanical processes, would astonish the most informed refiner of a previous generation, for just as the introduction of the hot blast in the early days of iron and steel development created new conditions of working iron ores, so the later improvements in mechanical appliances and the newer applications of chemical and electrical principles have advanced and extended the operations and productions along the whole range of the metals.

CORE SANDS.*

BY J. S. ROBESON, CAMDEN, N. J.

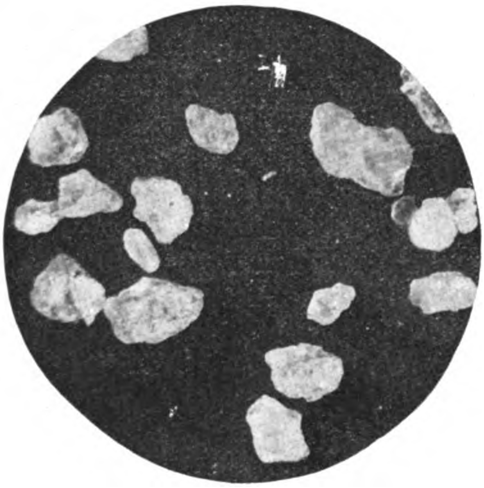
Though it is far from my intention to exploit by advertisement before and through you the company with which I am connected, still some reference to it must, perforce, be made if a proper understanding of the few facts I am able to present is to be had.

For this reason I want you to know that this company has been engaged in the manufacture of a core sand binder for the past 12 years and, as this product forms the bulk of its output, naturally, a great deal of time and money has been spent in studying the question of binders; whether these had best be solid or liquid; made of dextrine, flour, rosin or oil, etc., etc.

Some of the tests made in this investigation, and what I believe to be the results proved by

*Paper read at A. F. A. Convention, New York City, June, 1905.

them, have already been published. As, for instance, when I had the honor of reading a paper before the Foundrymen's Association of Pittsburg on Feb. 6 last, attention was drawn to the fact that a liquid binder gives more satisfactory and economical results than a dry binder and others, I hope to bring to the attention of the workers in the art of founding as they develop.



NO. I. YELLOW SILICA SAND.

When this work was commenced almost the first problem for which an answer was requested was, why the different core sand binders or compounds acted differently in different foundries, or more pertinently and personally why was not our binder a success in each and every shop?

This failure in one place and success in another is a fact that is true of every material used as a core sand binder, whether it be a proprietary article or not.

It is more marked—or perhaps it is better to say, more noticed—with the proprietary articles than it is with the three most commonly used materials, flour, oil and rosin.

What is the reason for this difference?

Foundries use for molding and core making purposes sand and loam.

Sand may be defined as water-worn disintegrated rock without plasticity or adhesiveness.

Clay as the remains of disintegrated rock that is both plastic and adhesive.

Loam as a mixture of clay and sand.

As none of these three are ever met with in a pure state in nature, so the variations in composition are as great and uncountable as the sands of the sea.

It is almost within the bounds of the strict truth to say that every foundry uses its own particular sand or sand mixture for making cores.

Now, while sand is sand, so is food food, and yet I take it that you will agree that there is a very great difference between the lunch you have but just now enjoyed and the usual mid-day meal of the owners of this island before it was discovered by Tammany and famed by Columbia.

Just as great is the difference in the sands of your individual foundries.

Sands vary in their chemical composition as to the amount of silica, alumina, iron, etc., that they contain and also as to the size of the grains.

This variation in the sand, not so much as to the actual size of the grains as to the relative amounts of each sized grain present and the amount and kind of clay has more to do with the very dissimilar results obtained in making cores than has the binder.

The photomicrographs and the table of sieved results give a better idea than can be conveyed in words of the variations as to the size and proportions of the grains.

NO. 2. DUNBAR SAND.

These photomicrographs are of sands that are commonly used in core making in different sections of the country.

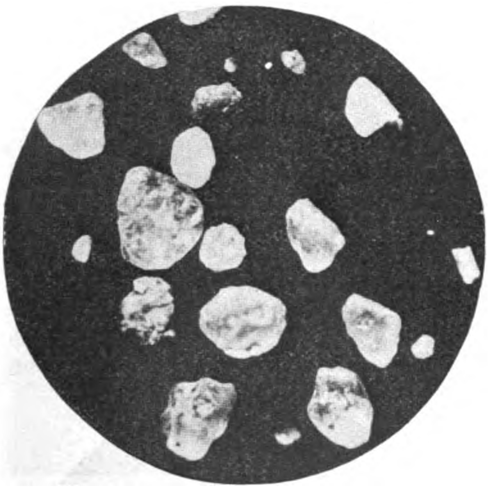
It is almost unnecessary to state that, although the pictures are of individual sands, the usual practice is to make mixtures of the different kinds in order to obtain the proper result.

Each sample has been enlarged to about the same extent, 1,600 times, so that some comparative idea may be had.

A very strong effort has been made to have the strength of these test cores comparatively equal. The same operator has made them, under the same conditions each time. They have been frequently checked and they are all made with one part of the same binder. Gluetrin, mixed with five parts of water to 50 parts of the sand. They are ⅞ in. round, made in a metal box, baked for the same length of time at the same temperature, supported on knife edges 8 in. apart for the breaking and the weight applied in the center.

In this connection it may be interesting to state that a core having a strength of one-half pound to the square inch is fully strong enough for any ordinary work.

1. Yellow Silica Sand: This makes the



NO. 3. ITHICA GLASS SAND.

strongest core of any that have been tested, giving 6.47 pounds per square inch.

The proportions of the various sizes are such that the voids are well filled.

The clay is evidently also in about the proper amount, neither too much nor too little, for the one will weaken the core as well as the other.

A core made from the sand, washed free from clay, had a strength of only 0.27 pounds per square inch.

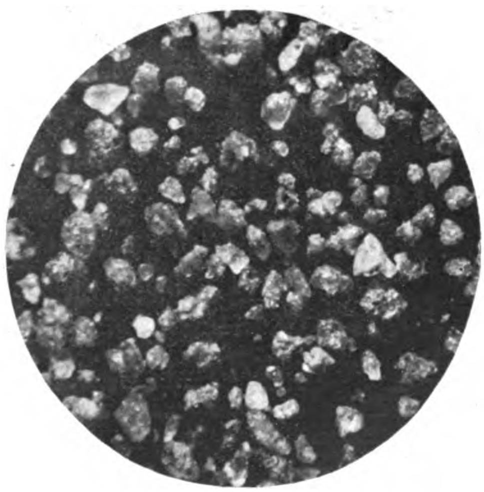
No. 2. Dunbar Silica Sand: This has a strength of 6.18 pounds per square inch, almost equaling No. 1 and, in the main, the proportions of the various sizes are about the same, but in this the percentage of the larger sizes is greater.

No. 3. Ithaca Glass Sand: This gives a strength of only 2.19 pounds per square inch. The proportions of the various sizes are different from No. 1 and No. 2 and there is less clay present.

NO. 5. BURLINGTON ISLAND SAND.

No. 4. Welsh Mountain Crushed Rock: This gives a strength of 2.05 pounds per square inch, practically the same as No. 3. This is, however, a very different sand, inasmuch as it is made by crushing a pure silica rock. This contains no clay and any binding qualities that it has in a core come from the proportions of the size of the grains and the binder.

No. 5. Burlington Island: This gives a



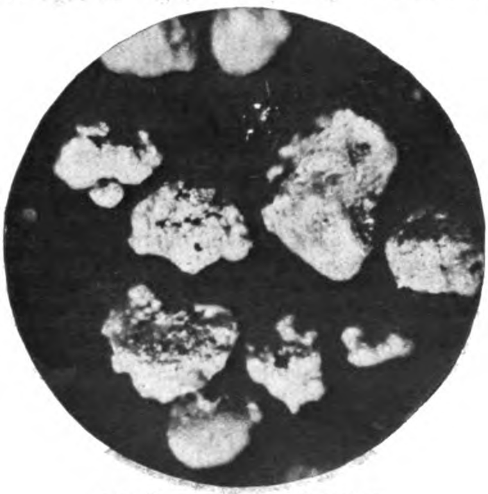
NO. 7. FINE MOLDING SAND FROM PITTSBURG.

strength of 2 pounds per square inch and it will be at once noticed that there are only three sized grains in this sand and that two of them are practically equal in amount. The binding quality of this sand comes largely from the clay contained in it. This clay or loam is attached to and surrounds the grains of quartz in a different way than from any other of the loamy sands here shown.

No. 6. Jersey Glass Sand: This gives a strength of 1.98 pounds per square inch and here we find practically only two sizes of grains and but little loam.

No. 7. Fine Molding Sand From Pittsburg: This gives a strength of 1.95 pounds per square inch, practically the same as No. 4, No. 5 and No. 6 and in this case there are again practically only two sizes of grains, but it will be noticed that the smallest size is present in a very much larger amount than in the sands just preceding.

No. 8. Allegheny Loam: This gives a strength of 1.83 pounds per square inch and



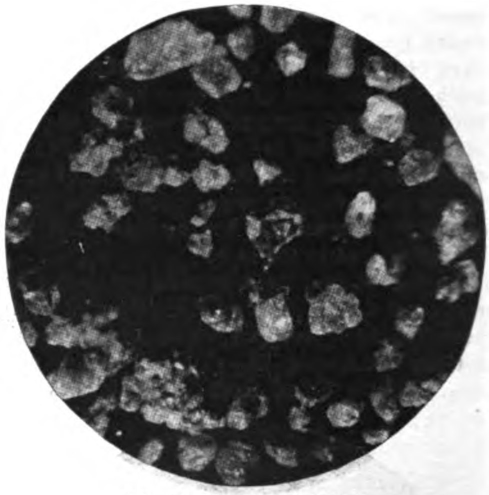
NO. 8. ALLEGHENY LOAM.

here there are four different sizes of grains. The loam in this sand is of a very adhesive character, but there is too large a quantity present. If this sand is mixed with a sand that is free from loam, the core resulting from the combination shows a much greater strength.

No. 9 and No. 10. Latta Brook No. 1 and No. 2: These sands are from the same locality, have practically the same strength—1.68 and 1.65 pounds per square inch, but contain very different proportions of the various sized grains. No. 9 contains more loam than No. 10.

No. 11. Tullytown Sand: This gives a strength of 1.58 pounds per square inch and contains a considerable amount of loam, as well as a large percentage of the smallest sized grains.

No. 12. Albany Sand: This gives a strength of 1.46 pounds per square inch and it will be at once noticed that there is a large percentage of one size, the smallest, grain present.



NO. 12. ALBANY SAND.

No. 13. Ganister Rock: This gives a strength of 1.46 pounds per square inch and is a crushed silica rock, almost the same in chemical composition as No. 4. The proportions of the various sized grains are different, however, from No. 4, which accounts for its comparative weakness.

No. 14. Old Foundry Sand: This gives a strength of 1.25 pounds to the square inch. It is shown here more as a matter of curiosity

NO. 13. CRUSHED GANISTER ROCK.

than for any other reason, since this sand varies in every shop.

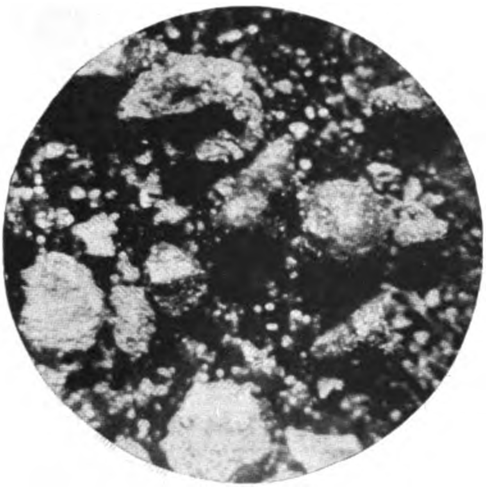
No. 15. Pittsburg River Sand: This gives a strength of 1.12 pounds to the square inch.

This sand contains practically no loam; its strength is entirely due to the proportion of the various sized grains.

No. 16. Millville Gravel: This gives a strength of 1.09 pounds to the square inch and contains a very large amount of loam. The different sized grains are badly proportioned and the strength is largely due to the adhesive character of the loam.

No. 17. Providence Fine Core Sand: This gives a strength of 0.9 pounds per square inch and is a typical bank sand of New England. It contains a considerable amount of clay and it will be noticed that the greatest amount of the grains are in the smallest class.

No. 18. Sodus Point: This gives a strength of 0.87 pounds per square inch and contains little or no clay. Such strength as it has is obtained largely from the fact that the bulk of it is composed of about equal proportions of the two smallest sizes, so that the voids are fairly well filled.



NO. 14. OLD FOUNDRY SAND.

No. 19. Pittsburg Bank Sand: This gives a strength of 0.75 pounds to the square inch. This sand contains a great deal of loam and would evidently have a greater strength if there was a larger percentage of the finer sizes present.

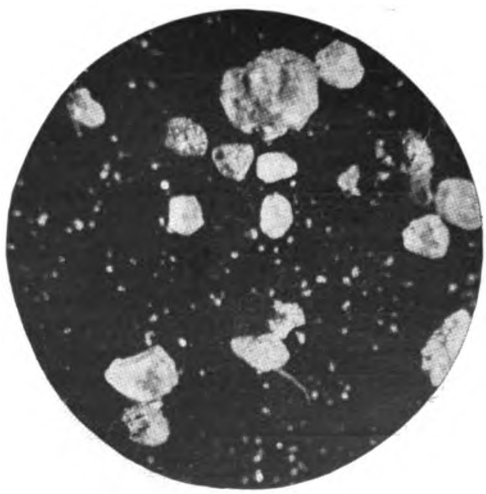
No. 20. Lumberton Sand: This gives a strength of 0.71 pounds to the square inch and contains a large amount of loam. This sand has about the same strength of No. 19, but it will be noticed that it has a larger percentage of the smallest sized grains, and it might, therefore, be supposed that it would be stronger. The grains, however, in this sand are all rounded, whilst those of No. 19 are decidedly angular. This comparison as to the shape of the grains also applies to No. 16.

No. 21. Pennbryn White Silica: This gives a strength of 0.56 pounds to the square inch and contains practically no clay or loam, it being a washed sand. The proportions of the three sized grains present are bad, which accounts for its comparative weakness.

NO. 15. PITTSBURG RIVER SAND.

No. 22. Rockaway Beach: This gives the same strength per square inch as No. 21 and the same remarks are true concerning it.

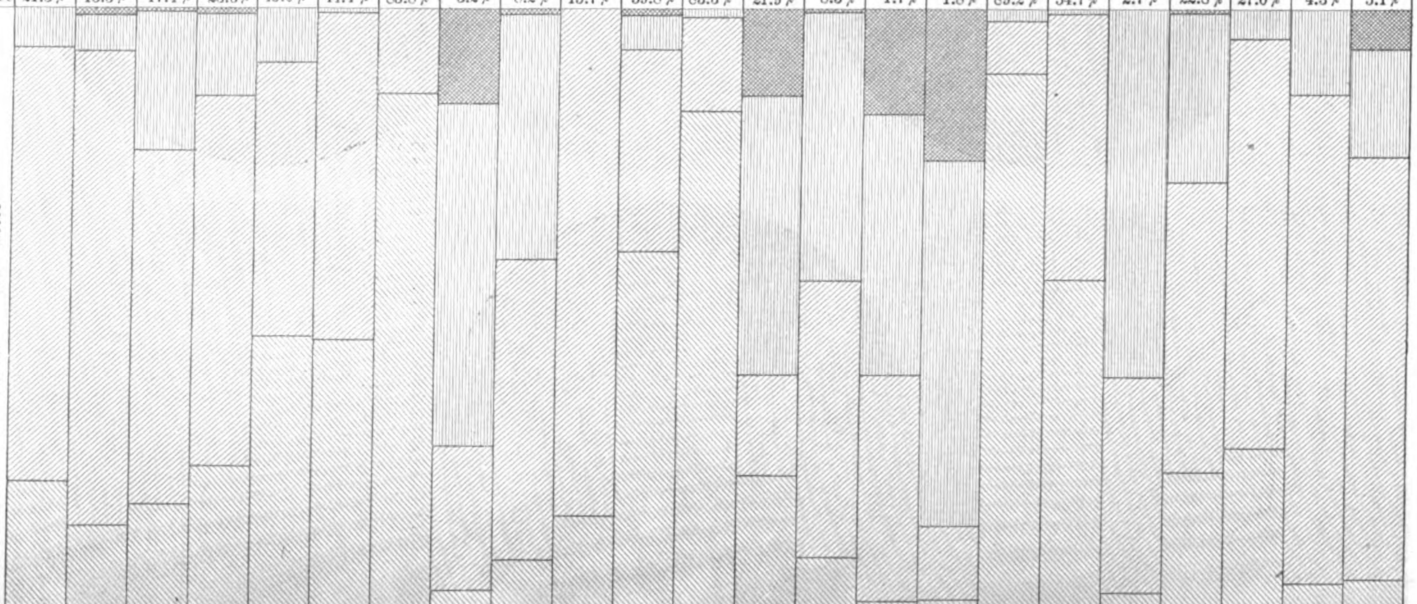
No. 23. Scranton Sand: This gives a strength of 0.56 pounds to the square inch. It contains little loam or clay and would be a very much stronger sand were it not for the fact that the proportion of large sized grains is too great.



NO. 16. MILLVILLE GRAVEL.

SIEVE ANALYSIS OF SANDS AND TENSILE STRENGTH OF CORES MADE WITH GLUETRIN.

No. of Sieves used	#1 Yellow Silica	#2 Dunbar	#3 Ithaca Glass	#4 Welsh Mt. Crushed Rock	#5 Burlington Island	#6 New Jersey Glass	#7 Fine Moulding Sand Pittsburg	#8 Alleghany Loam	#9 Latta Brook #1	#10 Latta Brook #2	#11 Tully Town	#12 Albany	#13 Crushed Ganister Rock	#14 Old Foundry	#15 Pittsburg River	#16 Millville Gravel	#17 Providence Fine Core Sand	#18 Sodus Point	#19 Pittsburg Bank	#20 Lumberton	#21 Penn-bryon White Silica	#22 Rockaway Beach	#23 Scranton
#2, #4,	0.00%	1.10%	0.4%	0.7%	0.00%	0.00%	0.00%	15.8%	0.40%	0.00%	0.6%	0.00%	14.5%	0.1%	17.4%	25.5%	0.00%	0.00%	0.00%	0.3%	0.00%	0.00%	6.6%
#8, #16, #20	6.9%	5.9%	23.4%	14.3%	9.3%	0.10%	0.00%	57.3%	41.5%	1.5%	5.7%	1.0%	46.5%	45.3%	44.3%	60.6%	1.8%	0.3%	61.1%	28.4%	4.9%	14.1%	18.4%
#40, #60, #80	71.8%	79.7%	58.8%	61.4%	45.7%	55.5%	14.2%	23.7%	49.9%	82.8%	33.9%	15.7%	17.1%	46.3%	36.6%	12.1%	9.0%	45.0%	36.2%	48.5%	68.1%	81.6%	69.9%
#100, #150, #200	21.3%	13.3%	17.4%	23.6%	45.0%	44.4%	85.8%	3.2%	8.2%	15.7%	59.8%	83.3%	21.9%	8.3%	1.7%	1.8%	89.2%	54.7%	2.7%	22.8%	27.0%	4.3%	5.1%
Tensile Strength in pounds sq. inch	6.47	6.18	2.19	2.02	2.00	1.98	1.95	1.83	1.68	1.65	1.58	1.46	1.46	1.25	1.12	1.09	0.90	0.87	0.75	0.71	0.56	0.56	0.56



Largest diameter of grains passing through Sieves in fractions of an inch.

#2 — 0.435″ #16 — 0.0417″ #60 — 0.009016″ #150 — 0.003″
#4 — 0.201″ #20 — 0.0335″ #80 — 0.00675″ #200 — 0.002″
#8 — 0.0955″ #40 — 0.01475″ #100 — 0.0055″

The Foundry

In the table is shown the amounts, graphically and in percentages, of the different sized grains in each of these twenty-three sands.

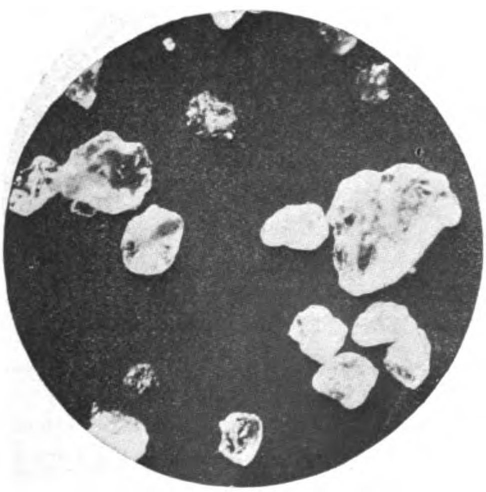
From the figures as to strength given in the table it is evident that any single one of these sands will make a core that is strong enough to do the work.

NO. 17. PROVIDENCE FINE CORE SAND.

There are, however, other points to be considered besides mere strength in a core.

Following the requirements as set down for a good binder in the Pittsburg article of Feb. 6, 1905, a good core

No. 1.—Must be strong both green and dry.



NO. 18. SODUS POINT SAND.

No. 2.—Must be weak and rotten after the casting is cooled.

No. 3.—Must not be easily affected by moisture.

No. 4.—Must give off but little gas.

No. 5.—Must dry quickly.

No. 6.—Must not change in size.

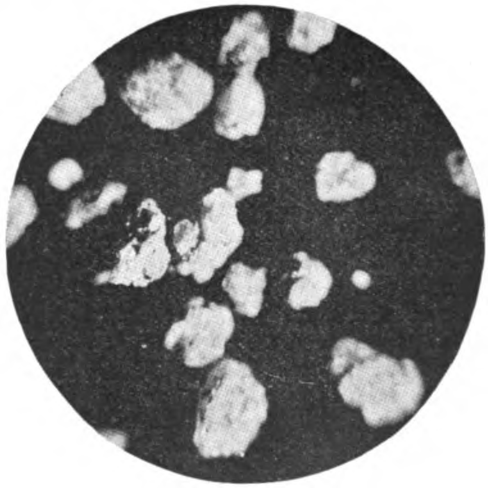
No. 7—Must have a low cost.

Now cores made of a single sand, in most cases, will not give the best results under all of these heads.

If, for instance, a sand is too low in clay a

NO. 19. PITTSBURG BANK SAND.

larger amount of the binder must be used to give the necessary strength and this, perhaps, will be too great a quantity to burn out during the pouring of the metal so that the core will not be weak but hard and difficult to remove from the casting.



NO. 20. LUMBERTON SAND.

Likewise the binder in such a core will cost entirely too much per ton of sand mixed.

In such a case a mixture of sand must be made so as to add loam or clay and the amount of binder reduced.

On the other hand, if the sand contains too much clay, only a small amount of binder will be required, but the core may be like a brick and so dense and compact as to blow.

In such a case add a sand containing less clay and increase the amount of binder.

NO. 21. PENNBRYN WHITE SILICA SAND.

This sounds, in a way, as very simple, but when you recollect that the size and proportions of the various sized grains have much to do with the question, as well as the clay, it is no wonder that the coremaker is often puzzled over his sand mixtures or dislikes to change them once they be established to his satisfaction.

As the binders act in a different way, there is here another variable brought into the story.

Flour swells and pushes its way between the grains, but does not move from the place where it was left in the mass by the mixing and ramming.

Rosin, under the influence of the heat of the core oven, melts and runs somewhat through the mass, though a large part of the original grain remains in the last position of rest.

Oil and gluetrin, because they are liquid, spread more evenly throughout the mass and over each grain during the mixing than do the solids, and when the heat is applied thin and spread still further.

Thus the sand mixture may often have to be changed when the binder is changed if the best results are to be obtained.

As an example of this, the following mixture worked fairly well, though with occasional trouble from blowing:

2 parts loamy sand
1 part sharp sand
Flour, 1.15.

Gluetrin at 1-50 was tried as a substitute for the flour, mainly because it was claimed that it would not blow. The cores did, however, both blow and scab.

The sand mixture was changed and successful results are now obtained from this:

1 part loamy sand.
1 part sharp sand.
Gluetrin mixed with 2 parts of water, at 1-70.

This likewise reduced the cost of the binder per ton very considerably.

In another case, a foundry making small cores used the following:

5 buckets burnt cores.
42 " gangway sand or sweepings.
8 " coarse sharp sand.
10 " fine Albany sand.
½ " Gluetrin, mixed in 5 buckets water.

This is 1 part of binder to 30 parts of sand and they claimed that the cores were difficult to clean from the castings.

It was suggested that they try the following mixture:

5 buckets burnt cores.
52 " gangway sand or sweepings.
8 " coarse sharp sand.
½ " Gluetrin, mixed with 5 buckets water.

With this they had uniformly successful results.

The trouble had been laid at the door of the binder and if they had not been willing to make this change in their sands another would

NO. 22. ROCKAWAY BEACH SAND.

have been added to the already long column of mysterious failures.

The binder would have once more been blamed for the fault of the sand and an opportunity to save money both on the sand and the binder lost.

USE OF THERMIT.

In your edition of The Foundry for April I notice a communication from Mr. Patrick Redington on mending castings with Thermit. This article is very clear in its descriptions, and shows that the writer has a very good and quite a broad understanding of the use of Thermit, and practically illustrates what can be done in shop practice with so convenient a help as Thermit has proved itself to be.

I would emphasize particularly what Mr. Redington says describing how the mold boxes were made. This information would prove of great assistance to others in performing similar work, and while he has not followed entirely the instructions given by the Thermit people, it shows that one can (with a fertile mind and ingenuity similar to Mr. Redington's) get results in ways, possibly, even better than those described by the promoters of Thermit. Of course it will be understood that it is difficult in any work to lay down cast iron rules to fit any mode or method of procedure in any art; as you find different minds so you will find different methods of accomplishing certain results.

There is no doubt in my mind that the Thermit people have provided a very comprehensive set of rules to work from, and as has been developed in my experience, by following closely their instructions—although deviations may be necessary with some of the details—the results may be accomplished through following out the instructions they have given.

In the reference made by Mr. Redington to the quantity of Thermit required for a given operation, again I would state that the rules laid down by the Thermit people unquestionably are provisional, and the engineer should use his judgment largely as to the conditions, the size, and the character of the repair to be made. In my experience I have found that small jobs require a larger quantity proportionately than the larger jobs, as the "Thermit energy," wasted in radiation in the molds, the articles to be repaired, etc., is greater proportionately in the small jobs than in the larger jobs.

The reference Mr. Redington makes to the use of wood in preparing the mold boxes also shows that it is not absolutely necessary to follow the instructions laid down by the Thermit people, but the writer will state that this method cannot be followed in all cases, but in such large welds it is possible where the work can be performed on a shop floor, and there is not much handling necessary, that the mold boxes could be made of wood, as described. In usual practice, where the Thermit has to be taken to the work,—in other words, where the job cannot be taken to the forge or foundry,—considerable handling of the mold boxes is necessary, and in such cases it is essential to have the mold boxes lined and thoroughly dried, in which case the wooden boxes would not stand the heat necessary to dry them. One of the essential features in all repair jobs with Thermit is that not only the work to be prepared, but also the mold boxes should be prepared by being heated to as high a temperature as it would be possible to obtain, even heating the parts to be repaired to a red heat, (if it is possible).

It is peculiar to relate that I had arrived at the same conclusions that Mr. Redington had as regards welding cast iron, and I used the factor of three as he states, but I believe that even better results can be obtained by still further increasing the quantity, and that a factor of four will ensure a better weld than with the smaller quantity.

For the benefit of your readers I would say that I have experienced the same results from experimental welding as described by Mr. Redington, wherein he bares a portion of his cast iron core to the Thermit, and also suggesting a wrought iron rod. The wrought iron being clean and free from scale welds at a lower temperature than cast iron, which had in Mr. Redington's case, I assume, a surface scale, and the scale which forms on the outside of cast iron requiring a greater heat to displace than that which is on wrought iron. Could this scale be removed before a cast iron weld is attempted a smaller amount of Thermit may be used.

I would say that Mr. Redington's reference to the value of Thermit in the foundry is logical. In no instances where castings are small or easily obtainable would it pay to use any repair methods. No one would use a repair method when a new casting can be gotten for possibly an equal cost. The use of any repair methods obtains in cases where a casting is large, costly, and difficult to procure, and even in many cases where the castings are small they may be repaired for less money than the cost of new ones where machine work is a consideration. I do not believe that anyone would consider the acceptance of a repaired casting, whether repaired by Thermit or any other method, where it is part of any new machine. I think this portion of the article is out of the question.

Thermit has many uses which we are learning daily, and it will be interesting to readers of The Foundry to learn of any new uses that it may be put to, and I trust that experimenters in this line will not be backward in bringing its uses to the front. One very valuable service Thermit can perform in foundry practice is to place it in the risers in intricate castings, where it may be put into operation, and where it will regenerate the metal that is being used, permitting a better flow of the metal, promoting circulation and producing as a result castings freer of blow holes.

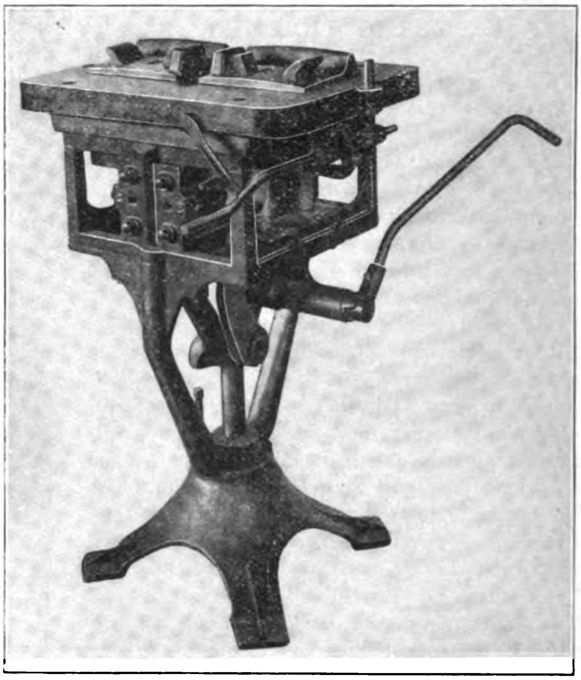
I must compliment Mr. Redington upon his article, and commend it to your readers, and would say that it clearly demonstrates how readily the use of Thermit can be grasped, and while it has only been on the market such a short time, it is quite interesting to note the progress it has made in the field of mechanical arts.

H. L. DesAnges.

A MOLDING MACHINE PATENT.

John A. Brodin, of Chicago, has patented a device which is here illustrated as applied to a Pridmore molding machine. Fig. 1 is a plan view of the molding machine with the pattern in place. Fig. 2 is an inverted plan view of the pattern carrier and the pattern. Fig. 3 is a vertical section on the line a-a of Fig. 1. Fig. 4 is a vertical section on the same line with the parts in another position, showing the pattern ready to be lowered after the mold has been made. Fig. 5 depicts the apparatus mounted on a Pridmore machine. Identical letters signify like parts on each of the line drawings.

The stripping plate carrying the flask is secured to it by the pin A at one side. This projects upward from the stripping plate and passes through a hole in the rim of the flask. At the other side the parts are held by the pin B extending through another lug. A rectangular frame C is braced underneath by horizontal arms and carries the pattern, the combination resting on a vertical support moving freely in the main frame of the machine to



PRIDMORE MOLDING MACHINE WITH BRODIN ATTACHMENT.

allow the pattern to be raised and lowered through openings in the stripping plate. The pattern is secured to the carrier C by bolts and has two movable hook-shaped parts D

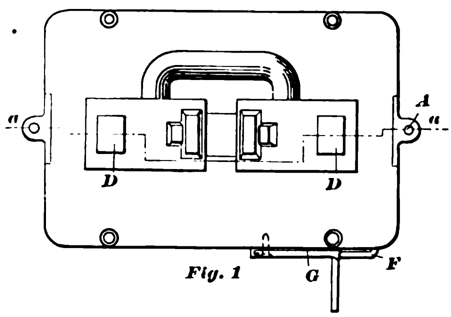


Fig. 1

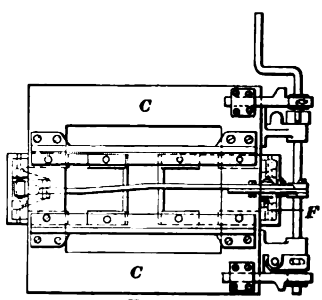


Fig. 2 THE IRON TRADE REVIEW

PLAN VIEWS OF PATTERN AND PATTERN CARRIER.

turned in opposite directions. The latter gives the desired contour to the mold at these places The projecting parts D are suitably linked to a bent bar E having a hub at the center embracing the shaft F to which it is firmly secured. The shaft F has stop lugs adjusted with set screws to limit the rotary movement in either direction. The shaft also has a crank and handle. Upon the crank rests the grooved end of the latch G.

This form of the machine is particularly adapted for making the upper portion of molds for casting interlocking brakeshoes, and especially the peculiar opening in the mold for forming the hooks on the castings. In the

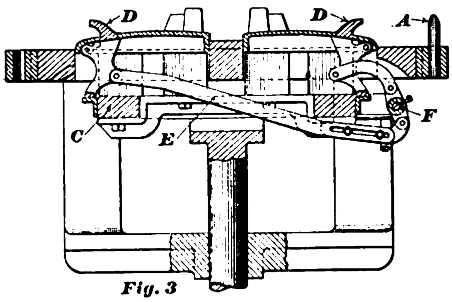


Fig. 3

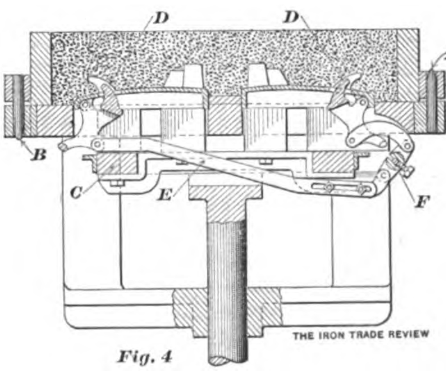


Fig. 4

SECTIONAL VIEWS OF MOLDING MACHINE.

case illustrated the device will obviate the necessity of coring, a part of the pattern being first withdrawn, then the pattern as a whole is freely separated from the mold.

The projecting parts D are first set by turning the crank handle until the convex faces of the links rest in the angle irons, the rotation of the main shaft being arrested at this instant by one of the stop lugs contacting with its setscrew. The latch G, the grooved end following the crank, prevents the projecting parts D from being forced back by the impact of the sand in the process of making the mold. When this process is completed, the latch G is lifted and the hand crank turned in the opposite direction, withdrawing the hooks D far enough to allow the pattern to be lowered without injury to the mold. The backward turn is arrested at the proper point by the contact of the other stop lug with its setscrew.

GENERAL INDUSTRIAL NOTES.

The Pittsburg Railway Supply Co., of Pittsburg, Pa., has been incorporated to manufacture journals, journal boxes, and other railroad supplies.

The new soft iron foundry of the Pennsylvania Railroad Co., at S. Altoona, Pa., is now in operation. H. H. Stone is foreman and Philip McGarvey assistant foreman.

The stockholders of the Sharon Foundry Co., of Sharon, Pa., have voted to increase the indebtedness of the company $100,000. The money is to be used in building an open-hearth steel plant in connection with the steel casting department.

W. W. Lindsay & Co., Philadelphia, Pa., have opened a new warehouse at 2231 Wood street, which will be devoted exclusively to the carrying of a large stock of chaplets.

The Birdsboro Steel & Foundry Co., Birdsboro, Pa., has opened an office at 718 Real Estate building, Philadelphia, and placed J. W. Warfel in charge. Mr. Warfel has been the company's Eastern representative for several years.

The National Cast Steel Co., Allegheny, Pa., has been incorporated to deal in steel, iron and other metals. The capital stock is $300,000.

The S. Obermayer Co., manufacturer of Foundry Facings and Supplies, of Cincinnati, Chicago and Pittsburg, announces that it has opened an office at 120 Liberty street, New York. Mr. Edgar Seaman, who has represented the company at Pittsburg for some years, has charge of the New York office.

The Dornfeld-Kunert Co., of Watertown, Wis., has been incorporated to carry on an iron and brass foundry business. The incorporators are Daniel H. Kiese and Chas. Kunert.

The Columbia Heights Foundry Co., of Minneapolis, Minn., has been incorporated with a capital of $50,000. The officers are Henry H. Orme, president; James E. Orme, vice-president, and Francis W. Orme, secretary and treasurer.

METALS IN FOUNDRY PRACTICE

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Steel, Brass and Bronze.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.

J. B. Nau, Metallurgy of Steel and Steel Castings.

Dr. Richard Moldenke, Malleable Castings.

C. Vickers, Brass Castings.

We have also made arrangements with several others to act as special contributors upon Brass, Bronze and other subjects. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

BUOYANCY OF CAST IRON.

For the last six months quite an interesting discussion of this subject has appeared in the columns of the *Ironmonger.*

Every founder who has noticed has seen, when he threw a piece of cold cast iron into a ladle of liquid iron, that the solid iron sank out of sight because each degree of heat that the liquid iron has absorbed has increased its bulk. For equal bulks the cold iron is heavier and sinks.

In a moment or two the iron, still solid but white hot, rises and floats on the surface which is proof that it has expanded more than the melted iron and is lighter.

The piece is rapidly becoming smaller and sinks to the surface as the last portion melts showing that just at melting it is not as light as when it floated higher on the surafce.

We find that white iron does not float and that gray iron floats more above the surface as its silicon increases. Let us examine a reversal of this process.

When a mold is filled with fluid cast iron a very thin skin forms next to the surface of the mold. Other particles cling to its inner surface, but the shell is still pliable. As the fluid metal in this shell loses heat it decreases in volume and sinks at the gates and often as the metal settles away from the upper surface of the mold the pliable skin follows it and leaves a sink hole in the casting, while other parts being more rigid retain the form of the mold. The additions of grains on the inside of this shell finally stiffens it so that it can retain its shape. The fluid metal in the interior continues to decrease in bulk and to form on the inner surface of the shell and finally leaves at the center a porous spongy spot if the molder does not feed fresh fluid metal to fill the cavities. The cooling mass has been shrinking constantly. There has never been any moment of solidification because this has taken place particle by particle and there has been no expansion that could help force the metal into the sharp configuration of the mold. The sharp casting is caused by the fluidity and the weight of the liquid metal.

The shrinking external and internal continues with the loss of heat until the casting is cold.

In 1895 I was able to measure these changes and discovered the following facts: The carbon in the iron remained in the combined state until the casting had become perfectly solid and was at a red heat, and there a complete change in the crystallization took place and the carbon was changed into graphite which was deposited between the crystals already formed.

This change of crystallization caused an expansion more or less great. In very graphitic iron with high silicon the expansion increased the bulk of the mass so that it was larger than the original mold. This expansion is permanent.

The shrinkage of the iron on account of cooling less the swell from the change of crystallization, equals the final shrinkage of the iron. As the shrinkage from loss of heat is probably the same for all irons, the amount of final shrinkage depends upon the amount of expansion and this depends upon the percentages of silicon and carbon.

Remember that this expansion takes place after the metal is solid. In a test bar cooled in the mold the greatest expansion is reached in a test bar 1 in. square in about 15 minutes after the mold is filled, but in a test bar 4 in. square it does not stop expanding for 1½ hours, and for this reason the final shrinkage of a large casting is less than that of a smaller casting.

SPONGY SPOTS IN THIN CASTINGS.

Several small parts of a casting have been sent to me that are about 3-16 inch thick. The surface appears perfect but when the polishing wheel cuts away the surface one or more small ragged shrink holes appear about 1-16 in. in diameter which reach too near the opposite surface and therefore cannot be cut out with the polishing wheel. The softer the iron the worse the holes. Therefore the molder says that it is dirty iron.

The castings sent me have one spot a trifle thicker than the rest and the shrunk hole occurs in the thickest part. The thickening was probably done to strengthen the portions of the casting which seems to have served the purpose of legs to a lamp base.

By making the pattern uniformly ⅛ in. thick and strengthening it by a narrow rib would remove the shrink spots.

It is a fact with iron containing towards 3.00 percent silicon, such as is used for such light castings with a smooth and clean face, that the thinner the casting the softer and the more dense the grain, while portions that are thicker have a surface so hard that sometimes the polishing wheel cannot be made to cut.

The reason for these hard surfaces in thickened castings has never been explained. A pickle of hydrofluoric acid will soften such a surface indicating that the high silicon has something to do with the hardness.

MALLEABLE CAST IRON NOTES.

BY DR. RICHARD MOLDENKE.

MALLEABLE MIXTURES.

Your reader asks the process by which malleable iron is made, or if the mixture required in making is a secret and not to be obtained. Presumably the inquirer is a foundryman who knows that malleable iron can be made in the cupola, and that it must be annealed before being fit to use. The first part of the rather general inquiry can be answered thus: Good malleable castings can be made in the cupola, but better ones in the air furnace, or open-hearth. All malleable castings must be properly annealed, and the furnace iron anneals better than that made in the cupola.

As to the mixture question. This will always be a mysterious thing to the man not familiar with the properties of malleable cast iron, and he who does not fully understand the nature of the business, would do well to either loaf around a malleable shop for a year or so, if they will let him, or else stay out and save his money.

Where, however, a man knows what he will run up against, the mere question of the mixture is an exceedingly simple one. It is only a question of analysis, and the buying of properly made pig irons. Thus for the latter only the regularly made "Bessemer Malleables" are to be used, and not any old iron with the given composition. Of coarse, charcoal irons are the best to use, but the work obtained by competition will not usually allow this except in the territory about the charcoal furnaces.

The mixture is made up of pig iron, one-half in amount or a little less. Then the sprues of the previous heats, and finally additions of malleable scrap and steel scrap. The composition of the charge will be about as follows: Silicon 0.80 to 1.30, depending upon the weight of the castings, the thick ones with the lower silicon, the very thin ones with the upper limit. Sulphur not over 0.05; Manganese preferably not over 0.40; Phosphorus not over 0.200.

In general the specifications for pig iron for malleable castings purposes, where good work is wanted should be as follows: Silicon 0.75 to 1.50, the particular point wanted to be specified exactly, thus silicon 1.30, which should allow the iron to come 1.20 to 1.40 only. Sulphur should be specified 0.04 and under, though 0.05 may be accepted, if one can do no better. Manganese should not be taken over 0.60, unless other irons running very low in this element are mixed in to cut down the average in the mixture below 0.60 in the pig iron part, and 0.40 in the pig iron plus sprues. Phosphorus is best specified as not over 0.200, though for charcoal irons 0.225 is admissible.

The percentage of steel allowed into the mixture is small, as otherwise excessive shrinkage results. Thus about 1,000 lbs. in a 20,000 lb. charge is enough, especially when say 3,000 lbs. of this consists of malleable scrap.

A typical mixture for malleable castings would be as follows:

Mabel (silicon, 1.00)	4,000 lbs.
Briar Hill (silicon, 1.50)	2,000 lbs.
Hinckle (silicon, 0.50)	1,000 lbs.
Ella (silicon, 1.25)	3,000 lbs.
Sprues (silicon, 0.65)	6,500 lbs.
Malleable scrap, 0.40	2,500 lbs.
Steel scrap, 0.00	1,000 lbs.

The Alabama Great Southern Railway has taken charge of the old Southern Car & Foundry Works at Gadsden, Ala., and has commenced the work of repairing and rebuilding the plant, and hopes to have it in operation early in August.

The wheel foundry plant of the American Car & Foundry Co., at St. Charles, Mo., has resumed operations after a period of idleness, during which a number of improvements have been made.

BRASS FOUNDRY NOTES.

BY C. VICKERS.

SOFT METAL.

Question—Will you please give me the composition of a soft metal for casting ornaments, small figures, plaques, medallions, etc. One that will not shrink too much?

Answer—No. 1—Tin, 25 lbs.; antimony, 3 lbs.; copper, 1½ lbs.

No. 2—Tin, 50 lbs.; lead, 30 lbs.; antimony, 10 lbs.

No. 3—Lead, 25 lbs.; antimony, 3 lbs.; tin, 2 lbs.

No. 4—Zinc, 80 lbs.; copper, 10 lbs.; aluminum, 3 lbs.

USING FILINGS.

Inquiry—We have a considerable amount of bronze and brass filings which when swept up contain some iron filings and some sand. We wish a flux that when the filings are melted will cause the iron and other impurities to rise to the surface so that they may be skimmed off before pouring the metal into the ingots. Can you please tell us of a flux which should be used for this purpose?

Answer—The filings must be cleaned before melting. Magnetic machines can be obtained that will remove all iron, or hand magnets may be used. No flux is at present known that will do what this inquirer wishes.

C. VICKERS.

BRONZE PINIONS.

Question:—I am having trouble with bronze pinions for street cars. These pinions are 5 in. in diameter, 4½ in. face, 14 teeth, and weigh 20 lb. They are used to run against a steel wheel. When the motorman turns on the current too suddenly, one or two teeth generally break out. I make these pinions of the following alloy:

Copper	90	parts
Tin	9	"
Zinc	4	"

I also add one stick of phosphorus to each crucible of metal. No ingot copper is used as the company furnishes plenty of scrap copper wire. Can you please state what the trouble is and if there is a better alloy? If so, please give it.

Answer:—Make the alloy tougher by decreasing the tin or try some of the manganese alloys published in this column.

Bronze gears for this purpose are obsolete rolled steel having superseded it.

SHOT IRON.

Question:—On page 177 of the June issue of The Foundry in the article on "Shot Iron," mention is made that the first six days of running the mill (Sly Mill) showed the following weights of good, clean shot iron: First day, 1,570 lb., etc. It does not appear whether or not this was recovered from the daily drop of the cupola, or whether the mill used the daily drop and in addition some material from the foundry dump in order to keep the Sly Mill running the full number of hours mentioned in the article. If the latter were the case, it would be interesting to know how much of the iron was recovered from the daily drop of the cupola and how much from the cinders on the dump.

A READER.

Answer:—Turning to my records on the cinder mill, I find that the amounts credited for the first six days running of the mill are the amounts recovered from the daily drop. For the first ten days, the mill was run entirely on the daily drop. Then we conceived the idea of working over the dump, but found it would take too long to do it by simply using the spare time of the working mill. Hence, a second mill with an electric motor to drive it, was placed on the dump.

We had some difficulty when we first started the Sly Mill, caused by the tendency of the man in charge to fill it too full, thus making it work slow and waste iron. Also we did not have sufficient water supply. We also had the mill running somewhat too fast at the beginning to obtain the best results. At present we would not be without it for anything.

W. P. WOODEN.

CEMENT FOR SIDEWALK GLASS.

Inquiry—Can you give me a good recipe for a good cement for fastening glass into the cast iron frames used for side walk lights?

Answer—One firm doing a large amount of work along this line uses the following mixture for it: One-half gallon of gas tar and six gallons of melted sulphur.

HOT CRACKS IN STEEL CASTINGS.

By Arthur Simonson.

An attempt will be made in the following article to outline the principal causes of one of the greatest difficulties that a steel founder has to contend with, and to suggest some means by which it may be overcome, at least partially. Cracks in steel castings are of two kinds, which differ in their appearance and cause very materially. Hot cracks take place at the time of solidification of the metal or very soon after; cold cracks are formed while the metal is below red heat. The former take the appearance of a tear, are very ragged and there is a sinking of the metal at the edges; they are generally quite wide and have a film of blue or black oxide on their fractured surfaces. Cold cracks, while they may be open occasionally, are generally very fine, clean cut as with a knife, and unless the castings are carefully inspected may sometimes escape observation. Ringing the castings with a hammer will often reveal the presence of cold cracks which are almost invisible. It is with the former, or hot cracks, that the present article is intended to deal.

The two principal causes of hot cracks are obstructions to the free contraction of the metal, and unsuitable composition of the metal itself. First then look into the causes which may prevent the unrestricted contraction of the metal. They are chiefly the rigidity of the mould and the varying thicknesses of section of the casting. The mould has to be made sufficiently strong to stand the weight of the steel and the fluid pressure of the head of metal while it is being poured. Moulds for steel castings are generally made in dried sand, which consists of silica sand mixed with a certain proportion of clay to bind it together. And though it is very weak in its green or damp condition, it becomes quite hard and firm after baking. The moulds are faced with a wash made of silica flour and molasses water, which gives a very hard, refractory skin. It is therefore important that while the mould should be strong enough to stand all the pressure it is to receive, it should not be any stronger than is necessary for the above purpose. Means may be provided for making the mould stronger in some parts than others, for instance near the gate, where the cutting action is greatest. At these places the mould may be made of a stronger grade of sand, or if its shape allows, hard cores or firebricks cut to shape may be fitted in, to take the wear of the stream of metal. All square corners, both inside and outside, should be amply filleted, and wherever a rib or a projecting arm of the pattern protrudes, the sand in its immediate vicinity should be loosened up by ramming in cinders, sharp sand or sawdust; or the mould can be cut away to within two or three inches of the pattern, after it has been dried, and the space filled in with burnt sand.

Another point to be attended to with the idea of reducing the danger of hot cracks is the drying of the moulds. To produce the best results a mould should be rather over-dried than under-dried, that is to say it should be almost but not quite burned. A mould that is only just dry is in the most rigid possible condition; it can be baked a good deal more and yet preserve sufficient strength to stand the wear and tear of pouring, and it will then offer much less resistance to the shrinkage of the metal. The ideal mould, as has been said before, consists of a hard refractory skin and a collapsible backing, which will give way as soon as the cooling skin of the casting has become sufficiently rigid to support itself, and begins to shrink. It is to the production of these conditions as nearly as may be possible in practice that foundrymen have to bend their efforts.

Defective construction of cores is another fruitful source of cracked castings. Coremaking is a branch of the steel foundry trade that does not receive the attention it merits. It is equally as important, as the mould itself, calls for as much skill and contributes equally to the success or failure. And yet we often find the coremaking relegated to a very secondary place. Core sand mixtures should be as carefully studied as molding sand mixtures, and a great saving may be effected, not only in the matter of cracking, but in the cost of cleaning and the soundness of the castings by careful attention to this point. The same description applies to a core as to a mold—it should have a hard, smooth face, which will resist the cutting and fusing action of the metal, but it should crumble and fall out in the form of powder when burnt. Careful handling will permit the use of cores which seemingly are exceedingly delicate. As the writer has previously stated, cores can be made of almost anything, provided the wash is all right. When the core is rammed up it should have a good coat of a wash made of silica flour, ceylon graphite and molasses water, and then put in the oven and baked until after scratching the skin the inside is thoroughly "rotten." Then another coat of wash or two if necessary may be given, and the core is redried. It is surprising how strong this skin becomes, and it is no more than one thirty-second of an inch thick.

In a great many cases a core has to stand much greater pressure than the mold itself, as for instance in a pipe or cylinder, where the metal is shrinking on the core from every direction. If the core is not collapsible one of two things must happen—either it will crack the casting or the core will become so hard that its removal will be a very expensive and lengthy operation.

The second point, namely, the composition of the metal itself, is equally important with the foregoing. Any conditions which tend to hot shortness of the metal, which means brittleness above red heat, must be carefully avoided. The two principal elements found in common practice which have this tendency are sulphur and copper, and while their influence is not very great in the cold state of the steel, still, as the metal has to pass through the hot short period before cooling to the ordinary temperatures, it is important they should be kept as low as possible. Either of them by itself is dangerous, but the combination of the two is fatal. As a large proportion of Eastern iron is made from ores from the Cornwall district, a great deal of the scrap available, as well as the iron, has an appreciable content of copper, and it is therefore necessary to watch the sulphur most carefully, and care should be taken not to allow it to run over .045 percent. This is done by selecting melting stock as low as possible and running a high manganese, which will prevent increase of sulphur from the coke, etc., and tend to reduce it, if anything, by the formation of sulphide of manganese.

ASSOCIATIONS AND SOCIETIES.

Philadelphia Foundry Foremen.

W. P. Cunningham, Secretary, Pencoyd, Pa.

The Philadelphia Foundry Foremen at their June meeting had a report from the delegates that attended the National meeting in New York. It was also voted to omit the summer meetings, the next regular meeting being held in September.

Milwaukee Foundry Foremen.

Sol. Shaw, care Clinton Street Foundry of Allis-Chalmers Co., Secretary.

The regular meeting of the Milwaukee Foundry Foremen was held July 6. Officers for the ensuing year were elected as follows: Wm. Beck, of the Brand Stove Co., president; Chas. Thielges, of the Greenslade Foundry Co., vice president; Sol. Shaw, of the Allis-Chalmers Co., secretary; Peter Hott, of the Filer & Stowell Co., was re-elected treasurer.

After the election of officers there was some discussion in regard to changes in the constitution. The principal discussion was upon the subject of whether the meetings should be held once or twice a month, and it was finally decided to continue holding the meetings once a month, the first Monday of each month being selected as meeting night. Three new members were taken in.

Chicago Foundry Foremen.

Mr. Thompson, Link Belt Co., District Vice President.

The Chicago Foundry Foremen held their regular meeting on Friday evening, June 23. There was a general discussion on the "Use of Thermit in the Foundry" and there was also a paper presented on "By-Product Coke" by Mr. Schwerin, of Milwaukee. It was decided to change the meeting night from Friday to Saturday, so that hereafter the regular meetings will be held on the third Saturday evening of each month at 8 o'clock at the Grand Pacific hotel.

NEW ENGLAND FOUNDRYMEN'S ASSOCIATION.

Fred F. Stockwell, Secretary, care of the Barbour-Stockwell Co., Cambridgeport, Mass.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

F. H. Zimmers, Secretary, care Union Foundry and Machine Co.

PHILADELPHIA FOUNDRYMEN'S ASSOCIATION.

Howard Evans, Secretary, care J. W. Paxson Co.

ASSOCIATED FOUNDRY FOREMEN.

Frank C. Everitt, Secretary, 2113 Third Ave., New York, N. Y., care the J. L. Mott Iron Works.

Note: All communications for the society should be addressed to the secretary.

President, David Reid, Canadian Westinghouse Co., Hamilton, Canada; first vice president, W. H. Nicholls, Berkshire Mfg.

Co., Cleveland, O.; second vice president, Hugh McPhee, Eaton, Cole & Burnham Co., Bridgeport, Conn.

Vice presidents are as follows: For Erie Association, W. F. Grunau, Erie City Iron Works, Erie, Pa.; for Milwaukee Association, William Beck, of the Brand Stove Co., Milwaukee, Wis.; for Chicago Association, Mr. Thomson, Link Belt Co., Chicago, Ill.; for Indianapolis Association, W. S. Keller, of Hetherington & Berner Co., Indianapolis, Ind.; for New York Association, C. H. Thomas, New York City; for Cleveland Association, A. L. Hott, Interstate Foundry Co., Cleveland, O.; for Philadelphia Association, A. T. William, Enterprise Mfg. Co., Philadelphia, Pa.; for Hamilton, Canada, Association, Frank Reid, D. Moore & Co., Hamilton, Canada.

NEW YORK FOUNDRY FOREMEN'S ASSOCIATION.
C. H. Thomas.

ERIE FOUNDRY FOREMEN.
W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

HAMILTON, ONT., FOUNDRY FOREMEN'S ASSOCIATION.
A. Chase, care Sawyer & Massey Co, Secretary and Treasurer.

CLEVELAND FOUNDRY FOREMEN.
W. H. Nicholls, 608 Gordon Avenue, District Vice-President.

INDIANAPOLIS FOUNDRY FOREMEN.
W. S. Keller, of Hetherington & Berner Co., District Vice President.

CINCINNATI FOUNDRY FOREMEN.
E. W. Cadwell, Secretary.

PERSONALS.

Mr. E. E. Linthicum, manager of the United States Cast Iron Pipe & Foundry Co., Anniston, Ala., has tendered his resignation, to take effect as soon as his successor is appointed. Mr. Linthicum has been manager of this large plant for five years, and much of its success is due to his close personal attention. He has resigned in order to accept the management of a new company which is now being formed, and which is to establish a large plant of the same nature somewhere in the south.

Mr. C. E. Mills, of the C. E. Mills Oil Co., Syracuse, N. Y., has been seriously ill with appendicitis and peritonitis at his residence in Syracuse. At the last report Mr. Mills was getting along well and the doctors looked for his speedy recovery. Mr. Mills was at the convention of the American Foundrymen's Association in New York City, and had the pleasure of making many new acquaintances among the foremen and proprietors, and all of his friends will certainly wish him a speedy recovery.

Patrick McManus, who has been superintendent of the Sterling Steel Foundry Co.'s plant at Braddock, Pa., for the last two years, has resigned to accept a position as manager of the Sharon Steel Foundry Co., at Wheatland, Pa.

Louis Knapp has resigned his position as manager of The Stiles Foundry & Supply Co., of Parkersburg, W. Va., and has accepted a position with Tuttle & Baily, of Brooklyn, N. Y.

Richard Carrick has recently accepted the position as foundry foreman for Donkin & Co., Walker-Gate, New Castle-on-Tyne, England.

Mr. Chas. C. Woods, who has been secretary of the Wheeling Mold & Foundry Co., Wheeling, W. Va., for the past three years, has resigned his position with that company to become secretary of the West Virginia Bridge & Construction Co., of Glennova, W. Va.

Arthur Simonson, superintendent of the foundries of William Wharton Jr. & Co., of Philadelphia, will sail for Europe on August 12.

Mr. W. H. Nicholls, who has been connected with the Hill Clutch Co., of Cleveland, for several years, looking after its foundry work and the ordering of castings which were obtained from outside foundries, has resigned his position and accepted a position with the Berkshire Mfg. Co., of Cleveland, O., where he will act as salesman and demonstrator for its machines.

Mr. R. T. Crane, of the R. T. Crane Co., the main offices of which are in Chicago, entertained the managers of the various branches, together with the officers of the R. T. Crane Co., at his summer home at Lake Geneva, Wis. The celebration was in commemoration of the fiftieth anniversary of Mr. Crane's connection with the business. Everything that could be done to add to the comfort and pleasure of the guests was arranged for, including yacht rides on the lake and various forms of entertainment. At the same time arrangements were made for a grand excursion for the employes connected with the various works in Chicago.

Frederick T. Towne, general superintendent of the Yale & Towne Mfg. Co., Stamford, Conn., is seriously ill in that city. He was operated upon July 1, for appendicitis, this being the second operation. The physicians believe Mr. Towne will recover.

W. A. Jones, of the W. A. Jones Foundry & Machine Co., Chicago, will make a summer trip to Alaska.

Frederick W. Sivyer, president of the Northwestern Malleable Iron Co., Milwaukee, has returned from a three months' trip to Europe.

Horace W. Fernald, formerly with the Tonawanda Iron & Steel Co., and later with the Buffalo office of Rogers, Brown & Co., has been appointed resident manager at Boston of Rogers, Brown & Co. W. G. Moody retires as Boston manager on account of ill health.

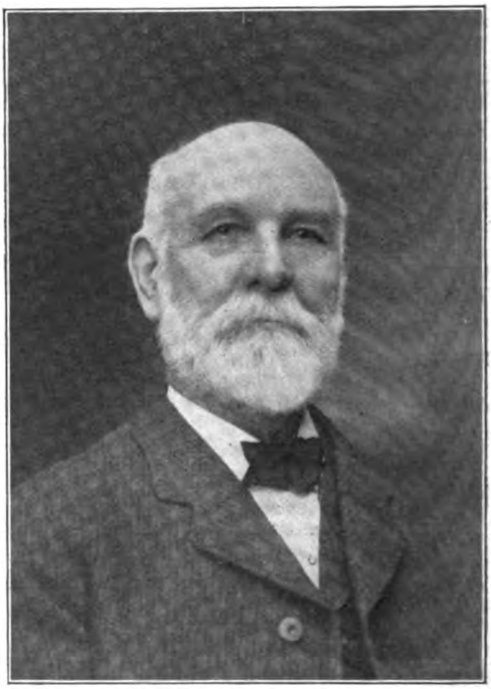
DEATHS.

Alva Carpenter, president of A. Carpenter & Sons Foundry Co., was born in Seekonk, Mass., March 2, 1829. He was the son of Capt. Jonathan and Lepha (Bourne) Carpenter and a lineal descendant of William Carpenter, who was the original proprietor of Rehoboth and the first town clerk, 1643-1649, of the township. The first American ancestor came from London, England, in 1638 in the ship Bevis.

Alva Carpenter attended the common schools of his town until fifteen years of age and then spent two years in a cotton mill. At the age of seventeen, he was apprenticed to learn the molder's trade with Thomas J. Hill (now the Providence Machine Co.) and was later many years with the Corliss Steam Engine Co. in the foundry. In 1865 he started into the business as proprietor in company with Amos D. Smith, under the firm name of Smith & Carpenter, on Dyer street between Peck and Orange streets.

After eight years of partnership, Mr. Carpenter became the sole proprietor of the Aborn street foundry which he continued until 1883 when he took in as partner Henry C. Bowen under the firm name of Carpenter & Bowen. This partnership was dissolved in 1889 and Mr. Carpenter then associated with him his sons, Wm. H. and Henry A. and started the more extensive works on West Exchange street, known as A. Carpenter & Sons Foundry Co., which was incorporated in 1896 with Alva Carpenter as president.

An honorable business career extending over a period of 40 years, beginning in a very small way, has continued to increase and stands as a fitting tribute to the quiet, unpretentious industry, energy and ability manifested by Mr. Carpenter and his sons. Mr. Carpenter's genial temperament, his unassuming, sincere and cordial manners have



ALVA CARPENTER.

won him hosts of friends and he has few, if any, enemies.

Never seeking political office or preferment, he was, somewhat against his own wishes, twice elected as representative from Providence in the Rhode Island Legislature, but declined positively further nomination. He was always interested in good government and was for years a member of the Municipal League of Providence.

He was in later years much interested in the Pomham Club, of which he was a member and on Friday, the day he was stricken, he had dined there very pleasantly with his wife and daughter. The West Side Club also had its attractions for him and he would quite regularly be seen there on Saturday evenings with a few genial friends.

He has for more than thirty years been active in Odd Fellowship and has occupied positions of trust and importance in that order. He was a charter member of Mount Pleasant Lodge.

He has been, since its organization, deeply interested in St. Andrews Episcopal Church, which he served many years as treasurer and as vestryman. Year by year, since its organization he has been a member of the Convocation of Providence elected by St. Andrews Church.

It was in his home life that his virtues shone brightest as husband, father and friend. In 1854 he married Mary Elizabeth Allen and the joyous celebration of their golden wedding a little more than a year ago was a fitting occasion crowning a half centurv of domestic happiness. Mrs. Carpenter, two married sons, Rev. Alva E. Carpenter and Henry A. Carpenter, the well known treasurer, vice president and general manager of the A. Carpenter & Sons Foundry Co., and their families, Mrs. Charlotte H. Carpenter, widow of William H. Carpenter and their daughter and Mrs. William A. O'Brien and Miss Mabel L. Carpenter survive him.

His children appreciate the fine traits of his noble, manly example. His kind affectionateness, his hospitality and love of home were well understood by all who were his favored guests and their name is legion.

Chas. Schenck, who was formerly manager of the Hertenstein foundry, at Columbus, O., died at his home in Columbus on June 22. He was 47 years of age and had had a very active career. For twelve years he conducted a foundry of his own in Columbus. He then retired from business for two years and later accepted a position as manager of the Hertenstein foundry, which he held at the time of his death.

Mr. J. H. Woody, who was for many years a leading business man of Asheville, N. C., and who was president of the Asheville Supply & Foundry Co., died on July 3. Mr. Woody was one of the best known men in the town and will be missed by many old friends and associates.

Mr. J. H. Gibson, secretary of the American Foundry & Machinery Co., of Chicago, Ill., was fatally injured in the wreck of the Twentieth Century Limited train on the Lake Shore road at Mentor, O., on June 21. He was taken to Cleveland, where he died at four o'clock on the morning of June 22.

FIRES.

The plant of the Austin Foundry Co., of Minneapolis, Minn., was damaged to the extent of $500 by fire, on July 10.

The foundry and two adjacent buildings of the Scranton Steam Pump Co., Scranton, Pa., burned on July 12, with a loss of $150,000, partially covered by insurance.

The foundry of Brown & Patterson, of Brooklyn, N. Y., was partially destroyed by fire on July 13.

The foundry of the East Jordan Foundry & Machine Co., of East Jordan, Mich., was damaged by fire on the night of July 5. Fortunately the fire was confined to the molding room, the pattern loft with its accumulation of patterns being saved.

The foundry and some other portions of the plant of the W. P. Brown Mfg. Co., of Racine, Wis., were destroyed by fire on June 16. The loss is estimated at $15,000, with $4,000 insurance. Mr. Brown states that while the loss is a very heavy one, he will rebuild at once.

The plant of the Dayton Malleable Iron Co., Dayton, O., was visited by fire on June 20. The fire originated in the core-making department and involved beside that part of the works their supply sheds and a small portion of the foundry, and part of the pattern department. The fire, however, was not so serious as to inconvenience them greatly for any length of time.

The new foundry and machine shop of Goins & Shank, Roanoke, Va., was completely demolished by the high wind which accompanied an electrical storm on June 20.

The foundry of the Dilts Machine Works, of Fulton, N. Y., was damaged by fire on the morning of June 20. The fire was of unknown origin. The night force did not leave the building until midnight and saw no signs of fire at the time they left. The property is said to be fully insured.

Owing to a misunderstanding of a telephone call, the fire department did not succeed in reaching the plant of the Elwood Iron Works, Kokomo, Ind., on June 27, and as a consequence, their buildings, valued at $3,000, were destroyed by fire. The loss is offset by $1,200 insurance.

The New Bedford Iron Foundry, of New Bedford, Mass., was damaged to the extent of $1,000 by fire on June 29.

NEW CONSTRUCTIONS.

The new foundry being built for the Brooks Locomotive Works, at Dunkirk, N. Y., is progressing rapidly.

The new building for the Newbury foundry, of Goshen, N. Y., is practically completed.

The car wheel foundry of the American Car & Foundry Co., of Berwick, Pa., is to be enlarged so as to give it a capacity of 540 freight car wheels per day.

The Ohio Cultivator Co., of Bellevue, O., is planning to build an addition to its plant 80 x 250 ft., which will give it one of the largest and most complete foundries of the kind in the country.

The Ensign Foundry Co., of Auburndale, near Toledo, O., is figuring on two new foundry additions. One will be 60 x 127 ft. and the other 40 x 87 ft.

R. H. Kiddle, of Kinsman, O., is improving his plant by adding a foundry for making iron and brass castings.

Plans and specifications have been prepared for the rebuilding of the plant of the Ohio Brass Works, of Mansfield, O., which was destroyed by fire some time ago. Four new buildings are to be constructed.

Architect J. T. Fortin has prepared plans for a foundry and pattern shop to be built at Canalport avenue and Johnson street, Chicago, Ill., for the Reder Foundry Co. The foundry will be one-story and 90 x 91½ ft. The pattern shop will be three stories and 76 x 103 ft. It is estimated that the two buildings will cost $40,000.

The Capitol Foundry, Springfield, Ill., owned by Joseph Farris, is to have an addition built. Plans are now in preparation for a building 120 x 120 ft., to be used as a machine shop. The shop will be equipped with a traveling crane and fullest switching facilities. The improvements will cost some $5,000.

Malpass Bros., of East Jordan, Mich., proprietors of the East Jordan Iron Works, whose foundry was destroyed by fire recently, have already gotten their new building well under way and propose to have the plant in operation some time during August. The new buildings are 26 x 70 and 26 x 57 ft. respectively.

A. M. Sweder, of the Lakeside Iron Works, Marquette, Mich., is planning a number of improvements in his foundry and machine shop. The foundry department has been idle for several months, on account of the fact that the building needed extensive repairs, including the rebuilding of a portion of it.

The Geo. A. Ohl Co. has started work on the construction of its new foundry at Newark, N. J., which is to be 56 x 235 ft.

Plans are being prepared for a plant consisting of machine shop, foundry, pattern and pattern storage shop, and boiler house, to be erected at Elkins, W. Va., for the Humphrey Mfg. Co., Towanda, Pa., which has lately been incorporated under the laws of West Virginia, with a capital stock of $25,000.

The United States Cast Iron Pipe Co. intends to move its Bridgeport plant to Chattanooga, Tenn., and have it running next spring.

The King Stove Works, successors to the Lizzie Lowman Stove Foundry Co., of Sheffield, Ala., has purchased ground adjoining its plant to enlarge the foundry and double its present capacity.

The Canadian Westinghouse Co. have prepared plans for doubling the size of their foundry building at Hamilton, Ont.

Ground has been broken for the additions to the foundry building of the Stanley Co.'s plant at Morningside, Pittsfield, Mass. The two additions, each 200 x 300 ft., will be of heavy mill construction.

Sargent & Co., hardware manufacturers, New Haven, Conn., have planned large extensions to their works, including a building, 50 x 600 ft., five stories high. The foundations for one section of the structure, 237 ft. long, are now being put in.

Messrs. Hartling & Moeckel, of Easthampton, Mass., have decided to build another addition to their plant, 50 x 80 ft., and several smaller additions to be used for offices, store room, pattern shop, etc. They conduct a general foundry business.

Innes-Demarest Stove & Heater Co., has closed a contract with the Carrington-Ford Co., Binghamton, N. Y., for the erection of the manufacturing section of its new plant. The foundry and machine shops will consist of three buildings connected and will be of brick and mill construction.

H. Delinsky will build a one-story brick foundry, 60 x 100 ft., at the corner of Monitor street and Norman avenue, Brooklyn, N. Y.

The Hays Mfg. Co., Erie, Pa., reports that its new buildings will consist of a machine shop, 50 x 160 ft., two stories high; and running parallel with it a foundry building, 60 x 198 ft. The company expects to have these buildings ready for occupancy by Nov. 1. This company is particularly interested in the best and improved equipments for brass foundries and power equipments, and would like to receive catalogues covering those lines.

The Wm. Cramp & Sons Ship & Engine Building Co., of Philadelphia, Pa., has obtained a permit for building a brass foundry 55 x 134 ft., and several other buildings.

The Landis Tool Co., of Waynesburg, Pa., is putting up a new foundry 28 x 60 ft.

F. E. Myers & Bro., Ashland, O., manufacturers of paving tools, pumps, etc., have recently acquired land adjoining their present three-story machine shop on which they contemplate building a new addition 60 x 300 ft. A 75 x 200 ft. foundry addition made necessary by the growth of their trade is also being built.

A new building for the Troy Foundry Co., of Troy, O., is under construction. It will be 100 x 120 ft.

C. & A. Patts & Co., of Indianapolis, Ind., have let a contract for rebuilding their foundry and replacing the machinery.

The Morden Frog & Crossing Works have secured fifteen acres of land at Chicago Heights, Ill., and will begin the construction of a large plant which will ultimately give employment to about 500 workmen. The buildings planned at present are a main factory building 250 x 700 ft., together with smaller buildings to be used for power house, pattern shop and offices.

The Economical Stove Co., Jacksonville, Ill., will make additions and improvements in its plant, and has purchased a brass and iron foundry. Just what machinery will be needed has not been determined as yet.

The Chicago Hardware Foundry Co., Chicago, Ill., will rebuild its North Chicago plant which was recently destroyed by fire.

Henry Orme's Sons, of St. Paul, Minn., have purchased a five-acre tract in Columbia Heights and will build a plant there for the manufacture of brass and iron castings. They hope to have the plant in operation by September 1.

The Detroit Iron Castings Co. has obtained a permit for the building of a two-story brick storage vault, at a cost of $7,500.

L. C. Bonning, of Hartford, Mich., has his new foundry nearly ready for operation.

Mr. Edro Richardson, proprietor of the brass foundry at 318 North Holliday street, Baltimore, Md., has had plans prepared for an addition 23 x 85 ft., and has submitted the plans for estimates.

Mr. D. T. Sutherland, of Bainbridge, Ga., has begun work on his new iron foundry in West Bainbridge.

Mr. C. W. Fouche, owner of the Anniston Stove Foundry, Anniston, Ala., has secured the services of Mr. W. B. Graham, of Ashland, Ky., to look after the work at his stove foundry. He also states that he has secured patterns for a new line of ranges.

The Wellsburg Mold & Foundry Co., of Wellsburg, W. Va., has just completed another addition to its plant, made necessary by the company's engaging in the manufacture of a new heater.

The Campbell Furnace Co., of Des Moines, Ia., has let a contract for its new foundry at Twelfth and Mulberry streets to the Miracle Pressed Brick Co., for $4,400.

The Stout-Parke Foundry & Machine Co., of Carthage, Mo., has erected a new foundry building 40 x 50 ft.

The addition to the Grand Forks Foundry, Grand Forks, N. D., is nearly completed.

The equipment for the foundry of the Fisher Machine Works, at Leavenworth, Kan., is being installed.

The C. R. Harper Mfg. Co., of Marshalltown, Ia., is building a new foundry 40 x 80 ft. which is to be devoted to the manufacture of soil pipe.

Montreal Steel Works, Ltd., Montreal, Can., is spending about $200,000 for enlarging and improving its plant, chiefly on extensions to the molding and finishing department of its steel casting plant. Considerable new labor saving machinery of the best type will be installed.

The Toronto Furnace & Crematory Co., of Toronto, Can., will erect a foundry and machine shop.

GENERAL INDUSTRIAL.

The Hedford Foundry Co., of Waterloo, Ia., is building an addition to its foundry.

The Abner Doble Co., of San Francisco, Cal., announce that arrangements have been made with the John McDougall Caledonian Iron Works Co., Ltd., of Montreal, Canada, whereby the latter becomes the sole licensee for the manufacture of the Doble system of water wheels in the Dominion of Canada.

The Marshalltown Aluminum & Brass Foundry Co., of Marshalltown, Ia., has been incorporated with a capital of $5,000. The incorporators are: Chas. Glick, I. T. Forbes, P. M. Bentley, E. L. Williams and P. Wishart. Mr. Forbes will be manager of the new concern.

The Safety Lock & Knob Co., Cazenovia, N. Y., has been incorporated with $100,000, capital stock to manufacture locks, door knobs and hardware. The incorporators are: Battese Revoir, Bartis M. Revoir, Eugene B. Goodrich all of Syracuse, N. Y.; Myrta E. Howell, Onondaga, N. Y.; Emmet H. House, Fulton, N. Y.

J. A. Fay & Egan Co., manufacturer of woodworking machinery, of Cincinnati, O., is increasing its capacity by erecting a 5-story building which will give the company 50,000 square feet of floor space. This will be used largely for a store house and exhibition room for their tools.

The Elyria Foundry Co., of Elyria, O., has been incorporated with a capital of $25,000.

The Standard Pattern Co., of Richmond, Ind., has lately been organized and now has its machinery installed and is doing considerable work for local manufacturing plants. They are prepared to make patterns of all kinds and also to make models or do other work in connection with the manufacture of new devices.

The stockholders of the Oregon Foundry & Machine Co., of Oregon, Ill., have voted to increase their capital stock $20,000 for the purpose of enlarging their plant.

The Kellogg Harvester Co., of Plano, Ill., took off the first heat in its foundry on June 9.

The Milwaukee Coke & Gas Co., has appointed Pickands, Brown & Co. exclusive selling agents for its Milwaukee Solvay foundry coke in Chicago and immediate vicinity.

The P. F. Wells Foundry at Milford, Mich., has been leased to Wilson & Hayes.

The Renfroe Replacer Co., of Birmingham, Ala., which was recently incorporated, expects in the near future to erect a foundry 80 x 300 ft. for making steel castings. The officers of the company are John Sweet, president; J. L. Renfroe, vice president; J. A. W. Smith, secretary and treasurer, and E. J. McCrossin, general manager.

John McKinney reports that he has completed his plant—the Woodburn Foundry & Machine Shop, at Woodburn, Ore., and has everything in working shape. The machine shop is 40 x 40 ft.; the pattern shop 40 x 40 ft. and the foundry 40 x 60 ft. with a cupola built on one side. There are also buildings for the cleaning department, core room, power plant, blacksmith shop, etc.

In the June number of The Foundry we had a notice stating that the Eaton, Cole & Burnham Co., of Bridgeport, Conn., had been absorbed by the Crane Bros. Co., of Chicago, Ill. Since then we have received a notice from the Eaton, Cole & Burnham Co. stating that the report was not true, and that the two companies were entirely separate, the only foundation for such a story being that one member of the Crane family was financially interested in both plants.

The Whitcomb Mfg. Co., P. Blaisdell & Co., and the Whitcomb Foundry Co., all of Worcester, Mass., have been merged into one corporation, and will hereafter be known as the Whitcomb-Blaisdell Machine Tool Co.; the capital stock being $200,000. The officers are Alonzo W. Whitcomb, president; Chas. E. Hildreth, vice president and treasurer; Samuel H. Clary, clerk.

The Stamford Foundry Co., Stamford, Conn., manufacturer of stoves, ranges and furnaces expects to add largely to its plant to meet the needs of its growing business resulting in its close affiliation with the Stamford Gas Stove Co. Some new machinery will be installed, orders for part of which have been placed.

The Lidgerwood Mfg. Co., Brooklyn, N. Y., making boilers, hoisting engines, etc., will remove to Newark, N. J., where a plant, estimated at a cost of $2,000,000, will be erected.

The W. P. Taylor Co., of Buffalo, N. Y., has been incorporated with a capital of $150,000 and will conduct a general iron foundry business. The directors are Wm. Perry Taylor, Frank J., Abel and Grace Taylor, all of Buffalo.

The Stoever Foundry & Mfg. Co., Myerstown, Pa., reports its plant crowded with work in both foundry and machine departments.

G. C. Blackmore has practically closed his negotiations for the land, buildings and stock of the Penn Radiator Co., of Corry, Pa., and hopes to have the plant in operation by September 1.

The Riverside Foundry & Machine Works, Pittson, Pa., J. A. Touhill, proprietor, is now purchasing machinery for equipping the shops which it has acquired at Scranton, Pa.

E. E. Hughes, receiver for the Franklin Roiling Mill & Foundry Co., of Franklin, Pa., has entered into contract with the Chicago Pneumatic Tool Co., whereby the former will manufacture all the gray iron castings used by the latter company, whose foundry has been closed on account of labor troubles.

The Bond Foundry & Machine Co., has been organized as successors to the business of Chas. Bond, manufacturer of power transmitting machinery and supplies, at present located at 518 Arch street, Philadelphia, Pa. A change of location is contemplated and the plant of the Grear-Clarkson machine shops has been purchased as a new site. The property acquired consists of a main shop, smith shop, boiler house and pattern shop, together with a number of smaller buildings. Some additional machinery equipment it is expected will be needed for new installation. The officers of the company are: Chas. Brown, president; Joseph Burr, vice president; Henry M. Beamsderfer, treasurer and H. H. Schenck, secretary. These officers and F. M. Shaw and Philip F. Ruhl constitute the board of directors.

The Dresden Machine Co., Dresden, O., has been incorporated with a capital stock of $10,000. The new company intends to conduct a general machine repair shop and also a modern foundry. The F. M. Walker machine shop conducted in Dresden, has been taken over by the new company It is located along the tracks of the Wheeling & Lake Erie railroad, and is considered a valuable piece of property. Immediate repairs will be made in the plant. The incorporators are: C. S. Littick, Emile A. Schenk, Henry A. Walker, E. J. Littick and R. Schenk. Emeil A. Schenk has been chosen president, and C. S. Littick, secretary and treasurer. Mr. E. A. Schenk was formerly master mechanic in the Dresden sheet mill. He is a practical and skilled machinist and will direct the mechanical developments. A number of new mechanics will be employed in addition to those who have been working for the *old* Walker Machine Co., and a much larger number of castings are expected to be produced from the foundry.

The Atlantic Foundry Co., of Akron, O., has been incorporated with a capital of $10,000. The incorporation is merely to reorganize the company and increase its capital. The incorporators are Chas. Reyman, Fred Spaulding. Philip Wittenbacher, Emil Krill and Ewald Erikson.

The Norwalk Iron & Brass Foundry Co., of Norwalk, O., has been incorporated with a capital of $10,000. The incorporators are John M. Book Jr., Aaron Townhill, Andrew B. Hamilton, Joe Herrimann and Chas. Books.

The Wm. G. Fischer Stove & Range Co., Cincinnati, O., has been incorporated with a capital of $20,000. The new company will take over the interests of Wm. G. Fischer and others.

The Mersfelder Pattern Co., of Cincinnati, O., has been incorporated with a capital of $10,000. The incorporators are M. L. Mersfelder, Daniel, Harry G., Clifford L., and Chas. H. Mersfelder.

The American Foundry & Machine Co., of Lindenwald, O., has been incorporated with a capital of $25,000. The incorporators are Abraham Ballinger, Adam Winchleman, Fred Dulli, Casper Schow, W. E. Schow, and John E. Foutz.

The City Brass Foundry Co., of Cleveland, O., has been incorporated with a capital of $10,000. The incorporators are Wm. D. Hirsch, Geo. Hammink, Frank J. Borsch, Gus Hirsch and Chas. Zucker.

Mr. F. W. Burger, a draughtsman in the employ of the Fort Wayne Foundry & Machine Co., Fort Wayne, Ind., has invented a new gas producer, one of which has been installed in the works of the Fort Wayne Foundry & Machine Co., to furnish gas for the 50 h. p. engine in this plant. The inventor claims that by the use of this gas producer he will be able to greatly reduce the cost of fuel necessary to furnish power.

Crane Co., of Chicago, Ill., announces that about June 24, the general offices and sales departments will move to the new office building at 519 S. Canal street, near the Judd street plant. The old location at 10 N. Jefferson street has been used by the company since 1864, and a branch of the city sales department will be continued at the old address.

The Chicago Pneumatic Tool Co., announces that the company has purchased the Canadian Pneumatic Co., of Montreal, and has secured that company's entire capital stock and will take possession within the next 30 days. This purchase gives the Chicago Pneumatic Tool Co. a Canadian plant which will enable it to transact business in

Canada at a large saving of cost in the way of tariff duties, etc.

The Independent Pneumatic Tool Co., of Chicago, Ill., has acquired the Aurora Automatic Machinery Co., of Aurora, Ill., builders of the Thor piston air drills, pneumatic riveting, chipping, calking and heading hammers and other pneumatic appliances.

The Moline Plow Co., of Moline, Ill., will put its foundry in operation at once. The plant has been idle for two years, during which period the castings have been secured from outside parties.

The work of remodeling the plant of the Summit Foundry Co., La Crosse, Wis., is progressing rapidly and the plant will be in operation before long.

The Roe-Stephens Mfg. Co., of Detroit, Mich., has purchased from C. W. Thomas the Michigan Brass & Iron Works, of Detroit, Mich. No change will be made in the management, as C. W. Thomas remains as president of the Roe-Stephens Mfg. Co.

The Union Steam Pump Co., of Battle Creek, Mich., is installing a brass foundry, equipped with the latest appliances, in connection with its iron foundry.

Dempsey & Sons, Shipbuilders, of Camden, N. J., are having several new buildings erected in connection with their plant, to be used as work shops and pattern department.

At the annual meeting of the United States Cast Iron Pipe Co., held at Burlington, N. J., June 28, the retiring board of directors was re-elected with the exception that L. R. Lemoyne was elected in place of F. Callahan.

The firm of Stewart & Bruckner, Nashville, Tenn., celebrated its thirtieth anniversary on June 22. It is a remarkable fact that both of the original members of the firm are still in active business along the same lines that they chose when they first started. For twenty-five years the plant has been located on its present site. Mr. Stewart has always looked after the shop and foundry, while Mr. Bruckner has had charge of the office and financial affairs.

The Central City Foundry & Machine Co., of Central City, Ky., has been in active operation for over two months and is building up a good trade.

The taking off of the first casting at the plant of the Coosa Pipe & Foundry Co., Gadsden, Ala., has been delayed on account of the fact that the elevators and some other machinery have been slow in arriving.

The works and main office of the Frictionless Metal Co., formerly of Richmond, Va., are now located in the company's own building at Chattanooga, Tenn. The new plant has a capacity of 4,000 lb. of frictionless metal per day.

The Chattanooga Roofing & Foundry Co., Chattanoogo, Tenn., of which J. E. Annis is president, has purchased the grate business from the Cahill Iron Works, and this business will be transferred to the Chattanooga plant. In order to accommodate the new business, which includes the patterns, foundry equipment, etc., of the Cahill works. Mr. Annis will erect a large addition to his present plant.

The Bruce Pattern & Mfg. Co. has been incorporated with a capital of $4,000. The company will commence business in Birmingham, Ala. The officers are: A. C. Bruce, president; W. T. Archer, secretary and treasurer, and J. W. Bruce, general manager.

J. R. Jones, manager of the Huntsville Foundry & Machine Works, Chattanooga, has completed arrangements for handsome improvements to be made at his local plant.

The South Pittsburg Foundry Co., of South Pittsburg, Tenn., has secured its charter from Virginia and filed a copy of it with the secretary of state.

The Southern Brass Works, of Atlanta, Ga., have started their new plant.

The technical schools connected with the Washington State University at Seattle, Wash., will have extensive additions made to their equipment, including woodworking, blacksmith shop, and foundry additions.

The Leggett Pump Co. has secured the plant of the old Parrot Stove Co., at Carthage, Mo., and will put it in operation at once.

The Ashdown Hardware Co., Little Rock, Ark., has been incorporated with $50,000, capital stock. The incorporators are: H. L. Toland, president; N. C. McCrory, vice president; C. L. Briant, secretary and treasurer.

The Fargo Iron & Foundry Co., Fargo, N. D., recently incorporated to take over the Parson Kellman Iron Works, Litchfield, Minn., and the T. L. Sykes Boiler Machine Works, Fargo, N. D., will erect a new plant in the latter place.

The new plant of the Mexican Car & Foundry Co., at Hutchison, Mexico, is completed, the machinery has been tested, and work started on the construction of cars.

Jack Marsden and John Schulz, both of Bessemer, Colo., have bought a foundry at Canon City, Colo., which they expect to put in operation at once.

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March 1905 to August 1905.

Index to Volume XXVI.—Continued.

Index to Volume XXVI.—Continued.

Authors' Index to Volume XXVI.

Vol. 26 AUGUST, 1905 No. 156

THE FOUNDRY

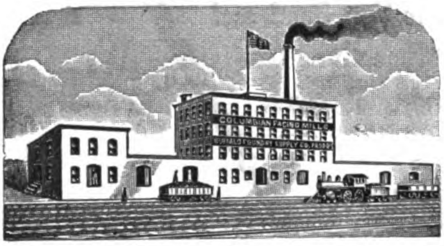
PUBLISHED MONTHLY BY

THE PENTON PUBLISHING CO.

CLEVELAND, OHIO.

Buffalo Foundry Supply Co.

BUFFALO, NEW YORK



Sole manufacturers of

Columbia Dry Sand and Loam Facing

Also manufacture many other kinds, such as

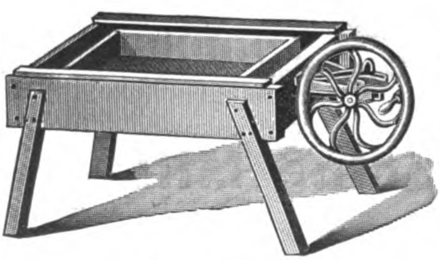
COLUMBIA CAR WHEEL FACING
COLUMBIA HEAVY STOVE PLATE FACING
COLUMBIA CORE WASH COLUMBIA RETURN FACING
COLUMBIA FIRE-PROOF FACING COLUMBIA INGOT MOLD FACING

As well as many others of our SPECIAL FACINGS, and of course we have

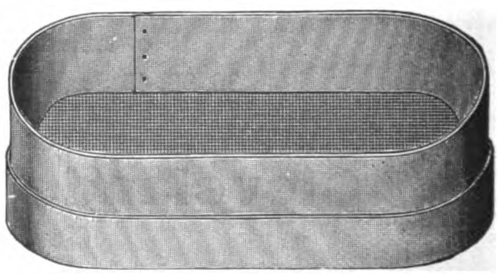
SEACOAL FACING
COLUMBIA CORE COMPOUND
FOUNDRY SUPPLIES
of all kinds

ALBANY MOLDING SAND

of all grades—
0-1-1½-2-2½-3-3½-4



Portable Foundry Sifting Machine

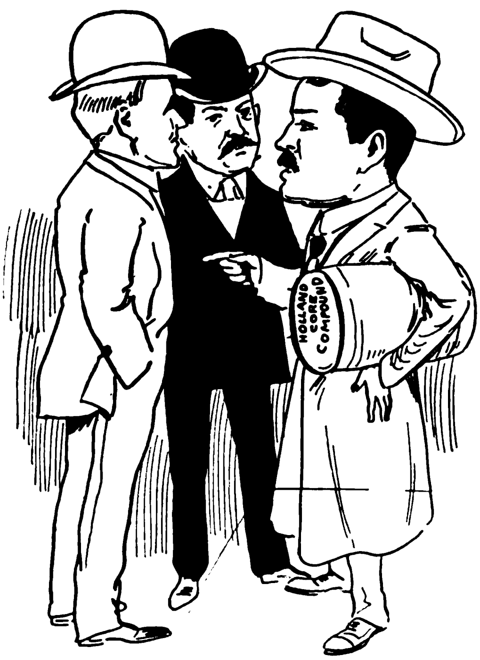


The Kingsland Oval Snap Flask Riddle

Having trouble with your Cores ?

NO, WE USE

HOLLAND LIQUID CORE COMPOUND



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It is the Best by Test.

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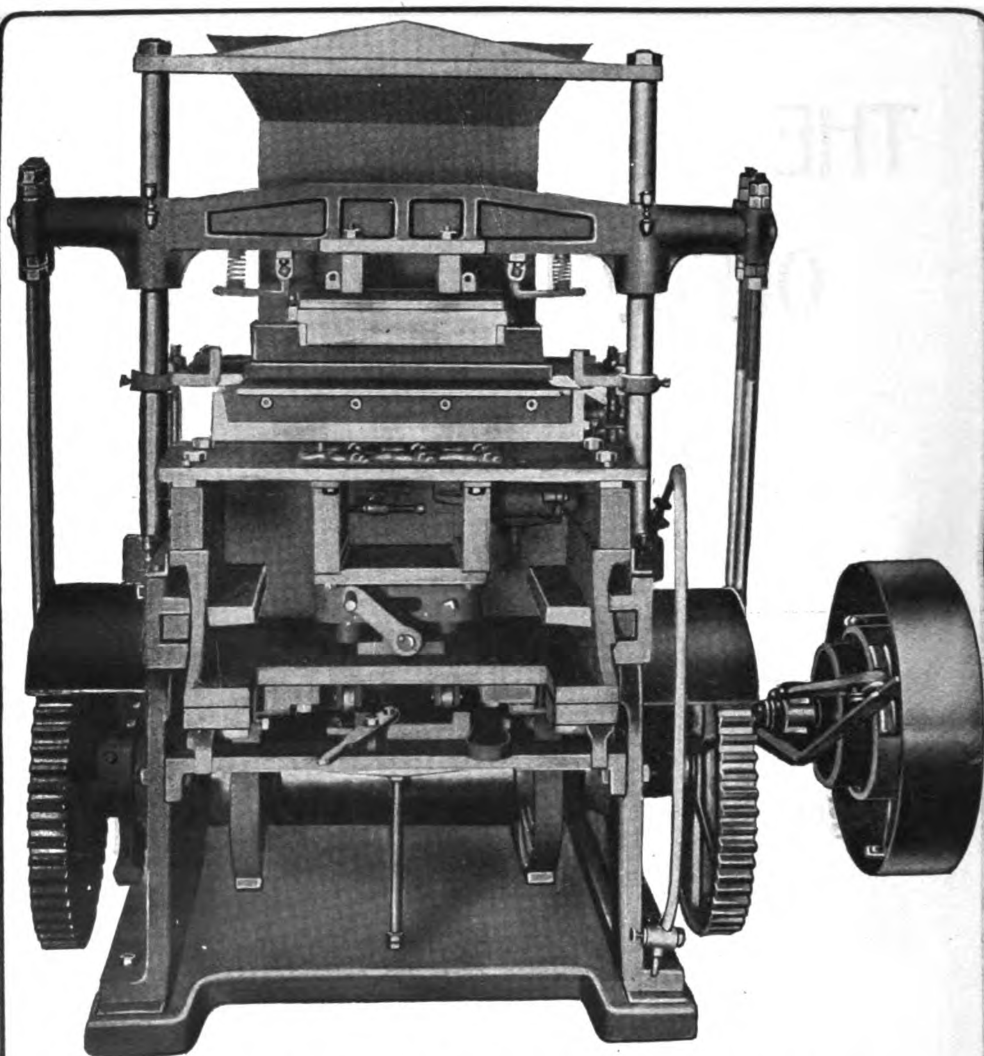
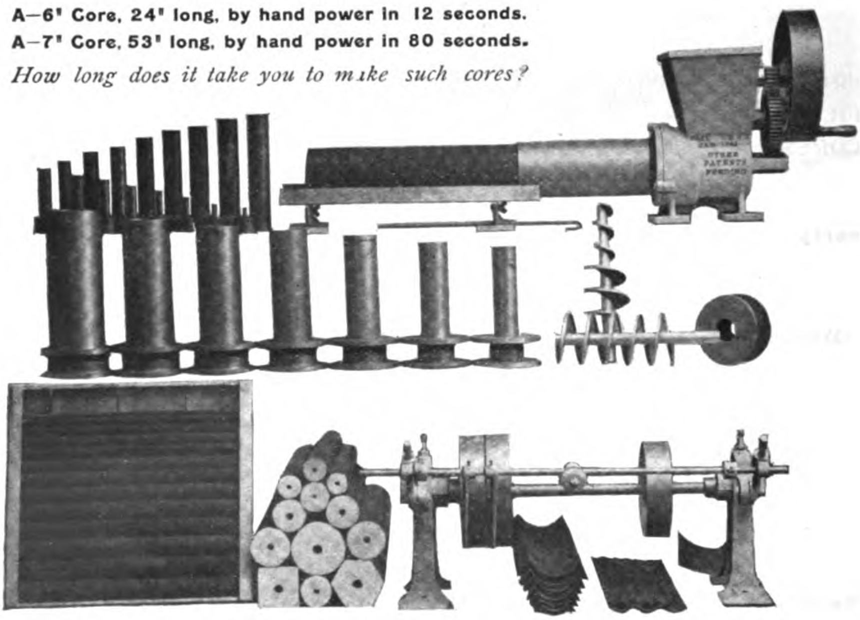
See pages 209 and 49 of July Foundry.



We are
Core Room Specialists
Core Machines for every need

Hand, Belt, Air, Steam or Electric Driven.
Round cores from 3/8" to 7"
Also irregular shapes.

A—6" Core, 24" long, by hand power in 12 seconds.
A—7" Core, 53" long, by hand power in 80 seconds.
How long does it take you to make such cores?



The wide range of shapes, the great strength and accuracy of cores made on our machines make them the best possible investment for your foundry.

Write for prices and descriptive catalogue.

The Falls Rivet & Machine Co.

Cuyahoga Falls, Ohio, U. S. A.

FOREIGN AGENTS:
J. W. Jackman, London, England. **Franz Kustner, Dresden, Germany.**
Hamilton Sand & Facing Co., Hamilton, Ont.

1827 —————— TO —————— 1905

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JOSEPH DIXON MADE THE FIRST
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JERSEY CITY, N. J.

MANUFACTURERS OF THE WORLD'S BEST CRUCIBLES
FOR EVERY REQUIREMENT OF FOUNDER
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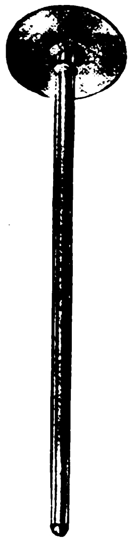
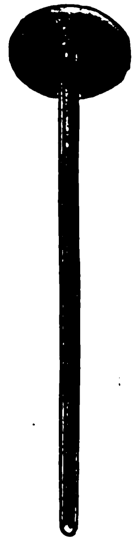



The cost of good chaplets—

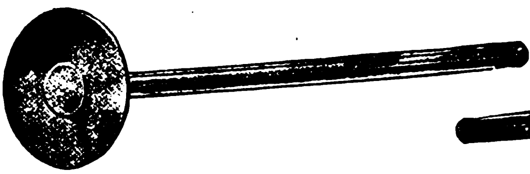
Lindsay Chaplets

cuts but little figure in your

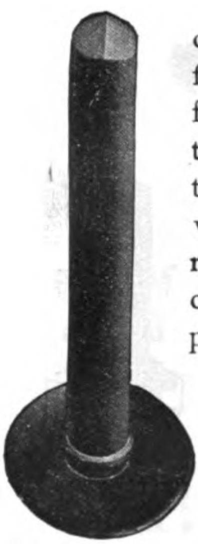
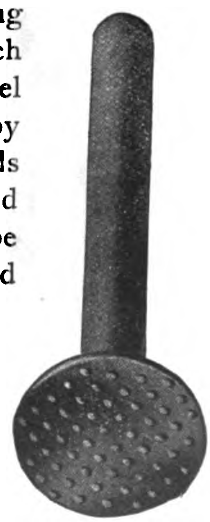
Foundry Expense

but the loss from defective castings resulting from the use of poor chaplets cuts a big slice from your

Foundry Profit.




Lindsay Chaplets

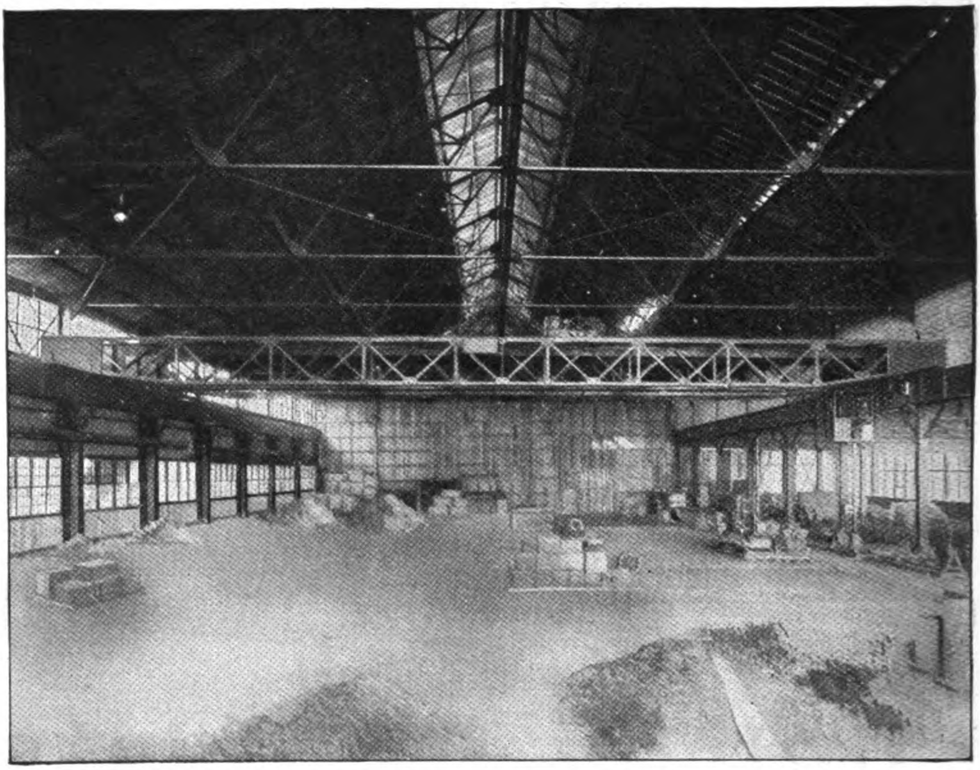



combine many time and money-saving features. Constructed of mild steel which fuses more readily with cast iron or steel than any other material. Easily shaped by the molder to any form required. Heads will not come off—cannot break—raised ring holds them in place should head be cut off in finishing. Lots of other good points.

Send for catalogue showing full line, or, better still, send a sample order and test these anti-blow-hole chaplets on your own work.


W. W. Lindsay & Co.

Harrison Building, Philadelphia, Pa.



Three-motor Electric Traveler, 10-tons capacity, 98-ft. span. Furnished McCormick Division, International Harvester Co., Chicago.

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ENGINEERS, DESIGNERS AND MANUFACTURERS

COMPLETE EQUIPMENT FOR

GRAY IRON, CAR WHEEL AND PIPE FOUNDRIES

MALLEABLE AND STEEL CASTING PLANTS

ALL TYPES

OVER 1500 IN USE

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Prices everlastingly lowest, goods everlastingly best. Plumbagos and Leads. BERG MINING CO., N. Y.

FOR SALE.—Three Tabor Molding Machines, air ram. Used one month. A. B., Box 461, THE FOUNDRY, Cleveland, O.

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FOR SALE.—One 3-Ton Ridgeway Steam Hydraulic Crane 24-ft. Swing, can be seen in position. Call or write to GEO. V. CRESSON CO., Philadelphia, Pa.

FLUOR SPAR.—Every grade. Quotations delivered anywhere. Cheapest suppliers. Address GEO. G. BLACKWELL SONS & CO., Ltd., Liverpool, Eng., or agents Penna. Salt Mfg. Co., Pittsburg, Pa.

FOR SALE.—Iron manufacturing plant with cupola, blower, boiler, engine and shafting. Indiana town 100 miles from Chicago. Will sell at bargain. Address Box 429, THE FOUNDRY, Cleveland, O.

Try Slade's Moulding Sand.

No. 0, $1.25 per net ton.
No. 1, 2, 3, $1.00 per net ton.
F. O. B. car at my Works.

George D. Slade,
Waterford, N. J.

FOUNDRY FOR SALE

All the property and assets of the Dayton Foundry Company, exclusive of the cash on hand and in bank, and including the office fixtures, foundry supplies, machinery and tools, one 75-horse-power Miller gas engine and appliances, wrought and cast scrap iron, bills and accounts receivable, are offered for sale.

Bids will be received for the sale of the same in whole or in part. For full information, schedule and list of property, call upon or address

HARRY FLUHART,
Trustee in Bankruptcy, Dayton, O.
VAN DEMAN, BURKHART & SHEA,
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FOR SALE.—New Foundry and Machine Shop, buildings all new. Foundry 30 x 80, all brick; will sell a part or the whole. G. F. CASE, Kalkaska, Mich.

BLOWER BARGAINS.
Roots Second-hand Blowers, bought, sold or exchanged for new ones. Address,
H. M. PAPWORTH,
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FLUOR SPAR.—We furnish best grades on the market. Ground lump or gravel. No order too small for our attention nor too large for our capacity. Prices on request. KENTUCKY FLUOR SPAR CO., MARION, KY.

FOR SALE.—Modern plant operating five ton grey iron foundry, machine and wood-working shops. Buildings and machinery in good condition. Plant on main line of three trunk railroads, 100 miles from Chicago. No labor troubles—open shop. Owners will entertain proposition to sell out entirely, rent or merge into another company. Address GEORGE H. GRIFFITHS, 1164 Monadnock Block, Chicago.

FOR SALE.—Well equipped foundry; new cupola, ten ton capacity, machine shop, fitting rooms and warehouse; buildings in good condition; two acres of ground. R. R. switch to buildings and river shipping facilities; location, 18 miles from Pittsburg; orders for castings given at once if desired; special inducements for prompt sale; owners; no commission. Call or write, 1221 Westinghouse Building, Pittsburg, Pa.

Help Wanted.

WANTED.—A man familiar with the molding of brass. Reference required. Box 459, THE FOUNDRY, Cleveland, O.

FITTERUP wanted on dry floor of steel foundry. Highest wages. None but capable men need apply. Box 458, THE FOUNDRY, Cleveland, O.

WANTED.—Melter capable of running a No. 6 Whiting Cupola to give hot iron. Address Stove Foundry, Box 464, THE FOUNDRY, Cleveland, O.

WANTED.—At once, 50 stove plate moulders for our new foundry. No strike. Steady employment the year around for good men. Also one stove pattern moulder. Address, ABENDROTH BROTHERS, Port Chester, N. Y.

WANTED.—A foreman in brass foundry. One familiar with mixtures and machine molding and competent to handle men properly; non-union. None others need apply. Address, with references, Box 463, THE FOUNDRY, Cleveland, O.

WANTED.—An A-1 up-to-date foundry foreman to make machinery castings. None need apply except those familiar with stripping plate molding machines. DELOACH MILL MFG. CO., Atlanta, Ga.

WANTED.—An assistant foreman and instructor for grey iron foundry in large Eastern agricultural implement concern. State age, experience, references and salary expected. Box 460, THE FOUNDRY, Cleveland, O.

WANTED.—A Foundry Foreman who understands handling men and getting out work at the least possible cost, and who can invest $2000.00 or more in a good business. Box 468, THE FOUNDRY, Cleveland, Ohio.

WANTED—Foreman for core department of a large malleable iron foundry. Must be thoroughly experienced, a good mechanic and competent to handle men. Must be strictly sober and have good references. Address WHITELEY MALLEABLE CASTINGS CO., MUNCIE, IND.

SALESMAN WANTED.—Commanding a good trade in Pennsylvania, New Jersey, and New York State, to sell iron and brass castings, on salary or commission. The Seelyville Iron Works, Seelyville, Pa.

WANTED.—First-class brass molder accustomed to jobbing work. Reply, Clum & Atkinson, Rochester, N. Y.

WANTED.—Foreman for Brass Foundry (7 Molders). One who understands mixing all kinds of metals, also understands handling help. Young men preferred, strictly temperate and good recommends. Box 469, THE FOUNDRY, Cleveland.

Situations Wanted.

WANTED.—Position by an experienced foundry foreman who can give the best of references. Has had extensive English experience. Box 467, THE FOUNDRY.

YOUNG man with twelve years' experience in coal mine and general job work would like position as foreman in small grey iron shop, can give reference. S. F. T., Box 466, THE FOUNDRY, Cleveland, O.

WANTED.—Position as foundry foreman; 15 years' experience. Heavy or light work. Capable of handling large force. Expert with cupola. Mix by analysis. Handle molding machines. References. Box 437, THE FOUNDRY, Cleveland, O.

POSITION WANTED: as foreman in a steel foundry by a first-class molder of 45; has 32 years experience in the business, up-to-date in piece work system, can handle a large force of men, held position as foreman 14 years. Box 470, THE FOUNDRY, Cleveland.

COMPETENT FOUNDRY SUPERINTENDENT of good executive ability is open for appointment, has large experience in all classes of work Loam, Drysand and Greensand castings and molding machines, also Foundry Chemist, competent. Box 471, THE FOUNDRY, Cleveland.

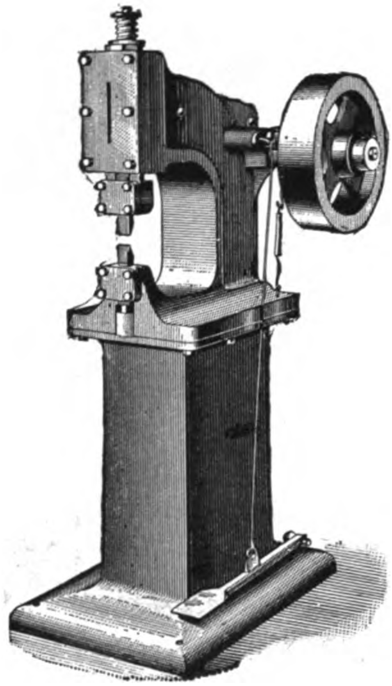
Miscellaneous.

SAMPLES FREE.—Compo Crayons for marking castings, etc.; better and cheaper than talc. Address D. M. STEWART MFG. CO., CHATTANOOGA, TENN.

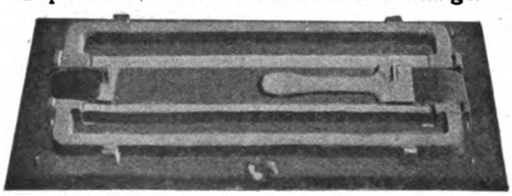
Wanted.

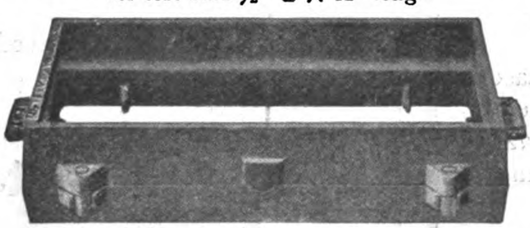
WANTED.—To purchase a foundry, either in operation or idle, suitable for manufacturing steam and hot water radiators and boilers. Address with description of plant, price and location. Box 462, THE FOUNDRY, Cleveland, O.

WANTED PARTNER.—Foundryman with large experience and some capital wishes to communicate with party in some smaller thriving city in one of the Western or Northwestern states with a view of partnership in foundry business on small scale. Box 465, THE FOUNDRY, Cleveland, O.



"KEEP'S TEST" OR MECHANICAL ANALYSIS





"KEEP'S TEST" OR MECHANICAL ANALYSIS
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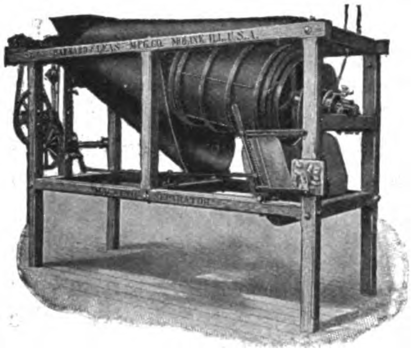
ECONOMY



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¶ It will separate the iron from your foundry refuse, cupola drop and slag.

¶ It is durable in construction, economical to operate and will pay for itself in a short time.

¶ Give it a trial. If not satisfactory it will cost you nothing.

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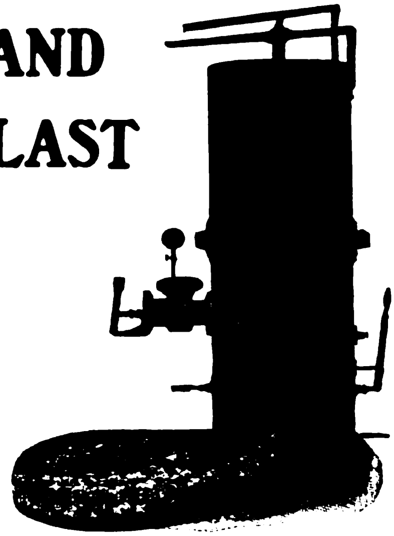
IMPROVED SAND BLAST



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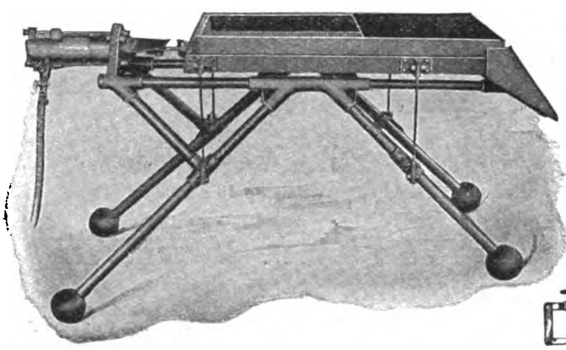

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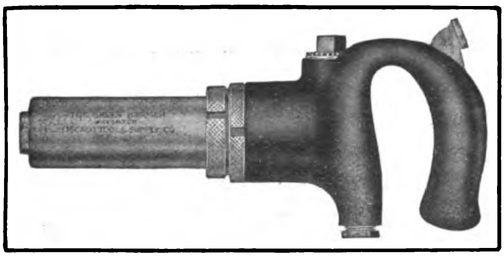

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NO SMALL AIR PORTS TO BECOME CLOGGED WITH DIRT.

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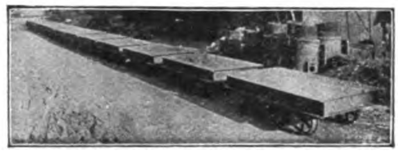

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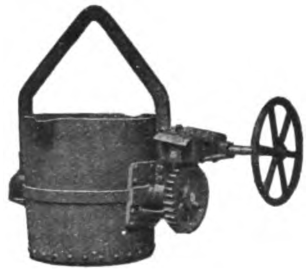

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UNEQUALED IN STRENGTH

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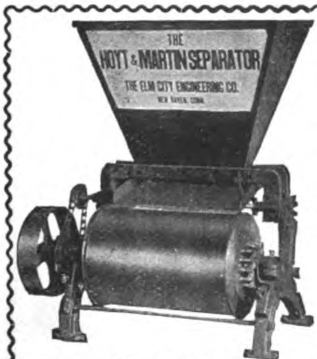

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