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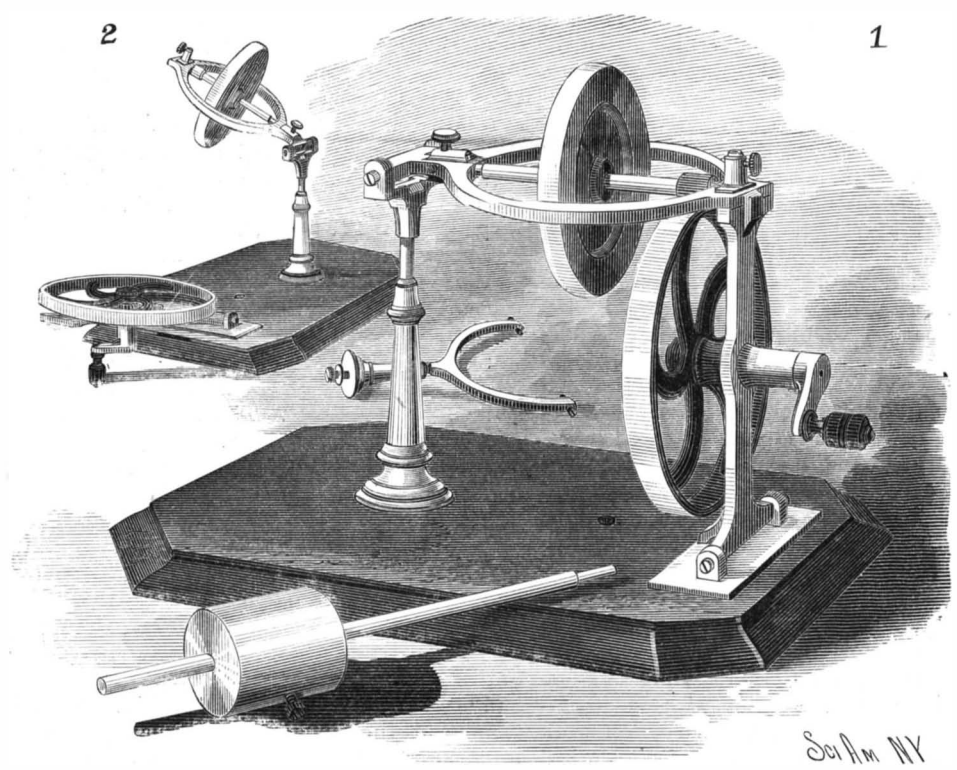
THE GYROSCOPE.

BY GEORGE M. HOPKINS.

No attempt will here be made to explain the action of the gyroscope, the object of the present article being merely to describe a few modifications of the instrument, and to mention peculiarities noticed in the performance of some of these modified forms.

Some years since, the writer described, in these columns, a gyroscope in which the rotation of the gyroscopic wheel was maintained by an electric motor, of which the wheel formed a part. In that instrument, the wheel maintained its elevated position for a longer time than the ordinary gyroscope; but it was found impossible to apply sufficient power to preserve a uniform velocity. The gyration of the wheel about the vertical axis acted effectively in retarding its rotation about its own axis, so that the wheel descended in a spiral course; and the electric gyroscope, so far as its normal actions were concerned, did not differ materially from the ordinary instrument. In one respect, however, the electrical gyroscope shows its superiority. When its gyratory motion around the vertical axis was maintained at a uniform rate, by the application of a very slight force, it would not descend, but would preserve its plane of gyration indefinitely. The amount of force so applied was insufficient to accelerate the gyratory motion. Probably it was not more than enough to compensate for the friction of the vertical pivot.

(*Continued on page* 340.)



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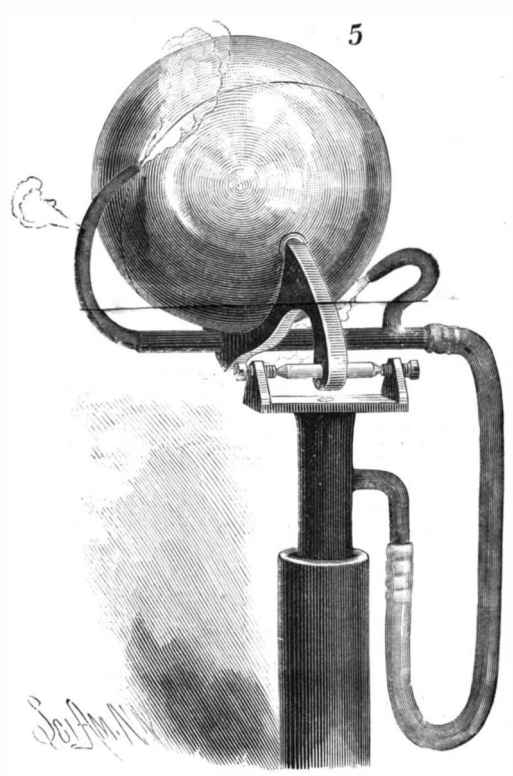

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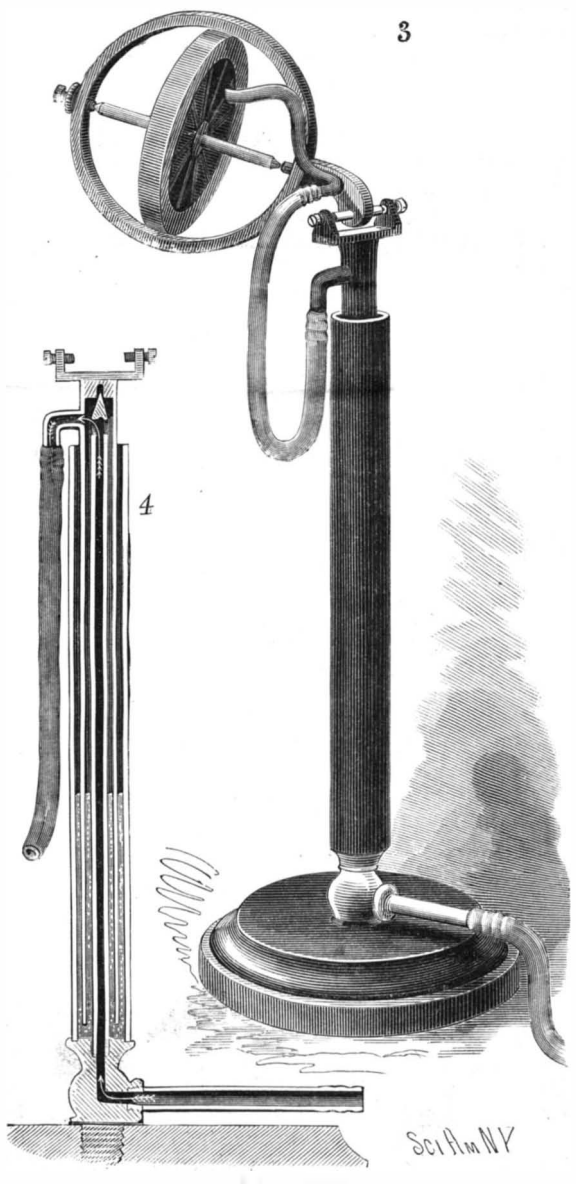

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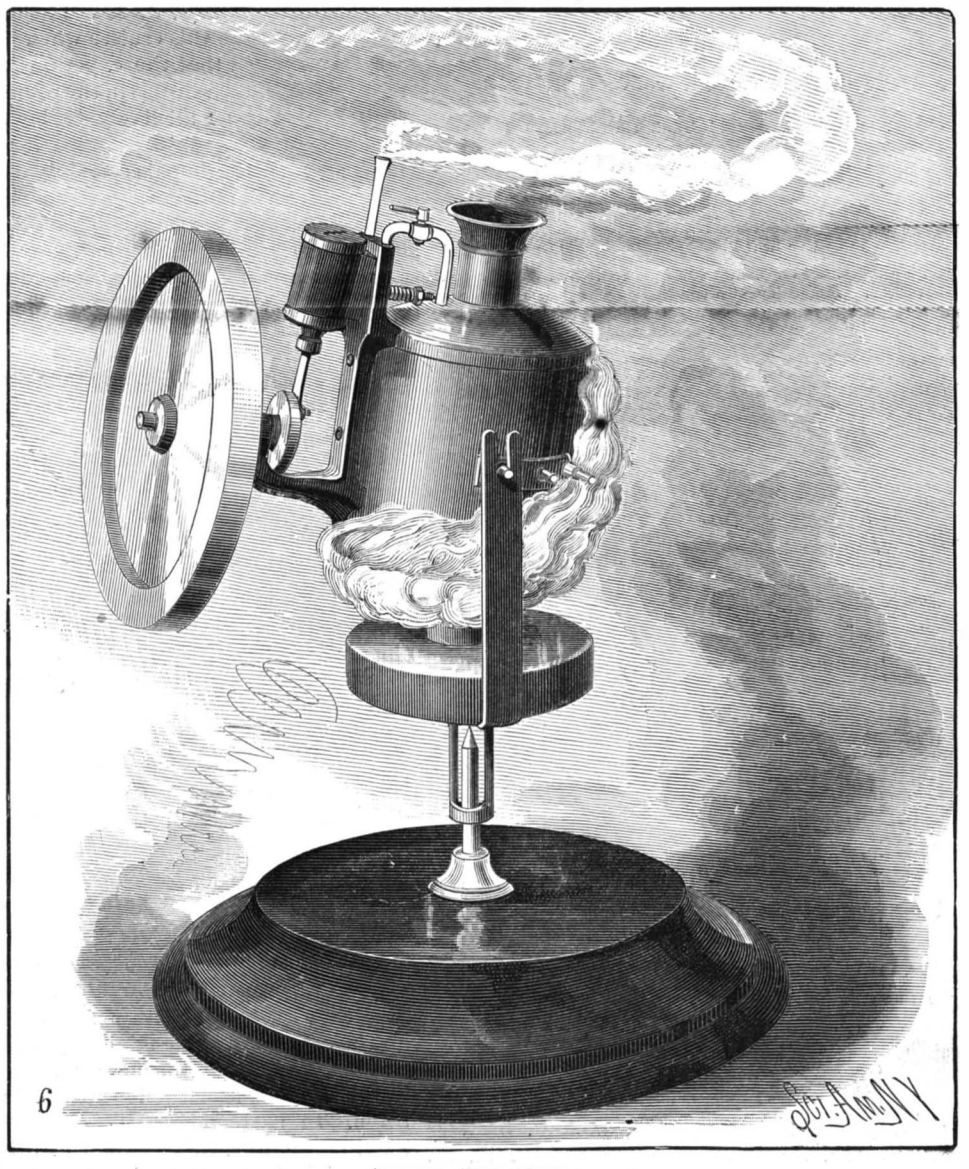

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NEW YORK, SATURDAY, NOVEMBER 27, 1886.

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THE DYNAMITE CRUISER.

The report that the contract had been let for building a cruiser specially designed and fitted for armament with Lieut. Zalinski's dynamite throwing gun has been contradicted as premature; but it is admitted that such a cruiser is to be built upon plans practically identical with those stated in the above mentioned report, namely, length 230 ft., beam 26 ft., draught 7½ ft., estimated horse power 3,200, highest speed 20 knots. Under the supposition that this speed of 20 knots was intended to be a sustained speed, several critics have privately expressed their belief that no such vessel could be constructed; for they say that, inasmuch as the great 8,000 ton steamers are barely able to make 18 to 19 knots in crossing the Atlantic, with a developed 12,500 horse power, a small steamer, such as is above outlined, cannot be given the machinery to make 20 knots.

There is a certain axiomatic character to these criticisms; but the critics probably make a serious mistake in assuming that the speed of 20 knots is to be the craft's capacity for any great length of time. If she had a normal speed of fifteen or sixteen knots, which could be driven up by forced draught for even an hour or less to 20 knots, she would fulfill all the conditions necessary to success. For, under the lower rate of speed, she could overhaul almost any cruising fleet, or even any single cruiser, when making an ordinary service passage from one port to another. Then, not until the two craft were so close to each other as to recognize each other as enemies would the 20 knot speed be called for. It is not likely that a combat between an ironclad and a light unarmored cruiser could last long. Either the latter would soon plant a dynamite shell or two in her heavy antagonist and finish her, or else she would be sunk by the ironclad's heavy fire.

As regards the battery to be given to the dynamite gun cruiser, it is natural that so untried an experiment should produce a good deal of divergence of opinion. In its favor it is said that the acknowledged success of the gun on shore can undoubtedly be repeated at sea. Its accuracy, lightness, and inexpensiveness, coupled with the terrific effect of its projectile charged with dynamite, are all cited as advantages which make such a gun especially desirable for a nation like ours, which does not wish to spend large sums on heavy ironclads and expensive guns. Assuming, therefore, that a cruiser can be built, having high normal speed and the capability of increase for short periods to a unique speed; that she can carry all the air compressing machinery, etc., for her dynamite guns, without depriving her of coal carrying capacity; that she can work her guns as effectively at sea as they have been worked on land; that the long tubes will not be so affected by the constant tremor and vibration of a screw steamer at sea as to be thrown out of line or "buckled"—assuming these things, there is good reason to expect good results from this cruiser when built.

But it is urged that the experiment is not beginning right; that the conditions in the proposed experimental cruiser are not at all likely to be the same as they would be in a war ship intended for service cruising. In the first place, there is certainly an awkward uncertainty as to the position the two guns will occupy. It is evident that as each gun cannot be less than 60 ft. in length (possibly even 80 ft. may be requisite), the guns cannot be mounted in broadside on a craft having only 26 ft. as her greatest beam. Thence it follows that only a certain fore and aft style of mounting can be used, and that the guns can be fixed only in a limited arc on each side of the bow and stern. Granting four points on each side of the keel forward and aft, each gun would cover eight points only, leaving sixteen points in which the vessel could not fire at an enemy at all. Clearly such a limitation of her fighting powers would detract seriously from her efficiency, and it ought not to be permitted if it can be avoided.

There is one experiment that has not yet apparently occurred to the constructor of the so-called dynamite gun, or at least nothing has been done about it practically. If a very high elevation were given to it—say even 60°—the projectiles, instead of striking at a low angle, would fall perhaps a little more nearly vertical than they went up, and would strike the enemy's decks instead of the broadside plating. Inasmuch as the decks are always more vulnerable than the broadside, the effect of the dynamite shell exploding thereon would be more damaging to the ship struck than it would be if the shell exploded against the broadside. Such an unusual elevation would permit the guns to be fired even from the broadside of a narrow craft like the proposed cruiser, while they could equally be fired at low elevations from the bow and stern. Of course such a use of the guns would be practicable only at such close quarters as to expose the craft to machine gun fire, and the game might not be worth the candle; but it would seem to be nearly the only way of utilizing these exceptionally long guns in ships of narrow beam. In narrow channels defended on each side, like the Narrows, this method of using the dynamite guns might be very effective. They could be sunk deep in the ground and protected by earthworks, so that the guns and crews working them would be absolutely safe against the fire of a hostile fleet, while at the same time they could rain down shells upon the channel. Extremely accurate shooting could be secured with the compressed air guns, the effect of the wind being the only element of uncertainty; and twenty-five or thirty of these inexpensive guns, properly placed, ought to be sufficient to close any narrow channel against a hostile fleet.

The government may have adopted plans which will make the experiments on board this proposed cruiser conclusive; and while it seems at present as though she would be far from determining satisfactorily the practicability of using the dynamite-throwing gun at sea, it is well, in view of the importance of the issues at stake, to have the trial made.

TORPEDOES VS. RAMS.

The United States ship Tennessee, the largest in the service, and at present the flagship of the North Atlantic squadron, met with a mishap at the Brooklyn Navy Yard on the 14th inst. A steam cutter of small dimensions bumped against her port bow and opened a hole nearly three feet long. It is thirty years since the Tennessee was launched. While she is one of the most comfortable vessels afloat, it is said she has long outgrown her usefulness for war.

The ease with which the hull of our best war ship may be penetrated presents a striking contrast to that of some of the old iron hulks of the British navy. For example, they lately tried at Portsmouth an experiment to see how big a hole they could knock in the hull of the ironclad Resolute by exploding a first-class torpedo under her bottom.

A 16 in. Whitehead, charged with 93 pounds of gun-cotton, was lashed to a boom and laid in contact with the port side, amidships. It was about 8 ft. under the surface, and close to the bilge keel. The conditions were entirely in favor of the torpedo, and it was expected that the destruction of the vessel would be both sudden and complete. The result, however, fell very far short of the anticipation. The ship was slightly inclined by the force of the explosion, and then listed a little in the opposite direction. Beyond this and the upheaval of the water, there was nothing to be seen by the spectators. Investigation showed that the bilge keel had been shaken off to the extent of 30 ft., and the plating below much indented. Between the bilge keel and the armor belt the skin plating was forced in between the frames, and three or four strakes had parted in the middle for a length of 8 ft.; some of the butts had been opened, so that gashes 2 in. or 3 in. wide appeared at the junction. Internally, skylights were broken and the coal blown about, but only one compartment was penetrated. The exact amount of damage cannot yet be determined, but it is evident that the ship was not disabled, and could fight her guns perfectly well.

WORK AND HABITS.

If the Knights of Labor can infuse in the mass of the organization the same ideas of personal habits as are voluntarily acted on by the managers, they will do much to improve the status of workingmen, whether laborers or mechanics. There already has been much improvement in this respect, the change being attributable to more intelligent estimates of the value of good habits than those which prevailed a generation ago. It was considered not unusual for a first-class workman to have his periodical sprees, and to be a free liver in the coarser meaning of the term; indeed, the union of loose habits and the reputation for competence to do a good job appeared to be natural and expected. "Blue Mondays" were common, the best workmen not putting in an appearance until Tuesday, requiring a day to get over the weekly debauch. Such men appeared to consider that their skill as mechanics entitled them to a license that was injurious to themselves and harmful to the employer's interests.

But the employers tire of these practices, and the dissipated workman cannot so readily assume on his skill as an excuse for his bad habits; the old notion of the union of drunkenness and duty, of immorality and ability, of high pay and low habits, is exploded. One of the most competent and efficient foundry foremen the writer ever knew lost his place in the establishment where he managed nearly fifty men, and his caste in the community, by his persistent practice of intemperate drinking. Said the manager, shortly after his dismissal: "I hardly know how to fill his place. There are not half a dozen men in the country who are his equals in the mixing of irons, the tempering of sand, and the carefulness of general management. I never lost a casting under him of the value of ten dollars. But I needed him six days in the week, and I paid for his coolness, his judgment, and his full capacity. I do not require my men to become total abstainers, although some might benefit by that method; but I do want their intelligent work."

It may be a necessity that employs unreliable skill and presumptive talent, but employers will apply a remedy as soon as they can. The workman may be

certain that personal good character and personal good habits are compatible with steadiness in work and skill in handling tools. There is no proper show of independence in working five days and loafing two days because the man is a first-class mechanic, and can assume on that fact and the forbearance of his employer. One of the best, as well as one of the largest, establishments for building machinery in this country has its own temperance organization in the shape of a mutual improvement society, and the proprietors justly boast that they have the best *personnel* of any shop of an equal number of hands. There are no "blue Mondays" in this establishment.

Ex-President Chester A. Arthur.

Chester Alan Arthur, the 21st President of the United States, died in New York city, Nov. 18, aged 56 years. Called to the Presidency by the assassination of Garfield, he bore himself through all the lingering days of Garfield's helplessness in a manner which had as much of wisdom as of dignity, and gave assurance to the country that allayed excitement and quieted apprehension at a time when men's minds were in a state of great tension. His subsequent career of three and a half years in the Presidential chair constitutes such recent history as to be familiar to all. People felt that the government under his administration was in safe hands, and its conduct in general was such as gave satisfaction to men of all parties.

Of Mr. Arthur personally it is to be said, first of all, that he was always the cultivated gentleman. He was graduated from Union College at an early age, having to teach school winters during the latter part of his college life, and while commencing the study of law, to assist in paying his own expenses. He was always a diligent student, and came of a family of marked intellectual capacity, but he was courteous, affable, and winning in manner, almost by nature; and in all that he did his gentle breeding was as evident as were the breadth of his culture and the thoroughness of his equipment when he was suddenly called upon, by a strange decree of fate, to fill the highest office possible for an American citizen.

The Welsbach System of Gas Lighting by Incandescence.

This system, which is the invention of Dr. Carl Auer von Welsbach, of Vienna, consists in impregnating fabrics of cotton or other substances, made into the form of a cylindrical hood or mantle, with a compound liquid composed of solutions of zirconia and oxides of lanthenum (or with solutions of zirconia with oxides of lanthenum and yttrium), which mantle, under the influence of a gas flame, is converted into a highly refractory material capable of withstanding for long periods without change the highest temperatures which can be obtained from the most efficient form of atmospheric burners, and which, under the influence of such temperatures, glows with a brilliant incandescence, very white, and perfectly steady, and which, moreover, retains its woven or reticulated character; the organic volatile and carbonaceous matters being entirely burnt out, and replaced by an incombustible and highly refractory residual skeleton, which becomes by its brilliant incandescence the source of light in the burner. The light emitted is, at a distance, hardly distinguishable from a twenty candle incandescence electric lamp, and by a modification of the composition of the impregnating liquid, a yellower light is obtained, resembling that of the best gas lights, but much more brilliant, and with a saving of gas of from 50 to 75 per cent, and, being perfectly smokeless, it is incapable of blackening ceilings and internal decorations. The illuminating power of the lights is about ten candles per cubic foot of gas consumed, and the mantles last from 800 to 1,500 hours.

Tercentenary of the Introduction of the Potato into England.

It is proposed, says *Nature*, to hold a tercentenary potato exhibition at the St. Stephen's Hall, Westminster, from Wednesday, December 1, to Saturday, December 4, and to appoint one of those days for a conference, when some of the unsettled questions relative to the history, etc., of the potato may be discussed. The exhibition will consist of four sections: 1. A historic and scientific collection, to include early works on botany in which the potato is figured; maps showing the European knowledge of the New World three hundred years ago, and the proximity of potato-growing districts to the ports most frequented; early books on travels and voyages in which reference to the potato occurs; works and papers in which attempts to define the different species are made; illustrations of the species and varieties; contemporary references to the voyages of Hawkins, Drake, Grenville, and Raleigh. 2. Illustrations of potato disease, and works on the subject. (Sections 1 and 2 will be arranged under the advice of a committee of scientific gentlemen who have consented to give their co-operation.) 3. Methods for storing, preserving, and using partly diseased potatoes, etc. 4. A display of tubers of all the various varieties grown. (In this section, gold, silver, and bronze medals will be awarded. Each exhibit must be accompanied by a statement of date of planting, locality, nature of soil, etc.)—*The Garden.*

Progress of Naval Torpedo Boats.

The competition for the supply of new torpedo boats to Turkey, which has been carried on for some time past, has terminated in favor of a German firm. A contract has been signed for three torpedo cruisers and nine torpedo boats. The cruisers are to be 70 meters, 60 meters, and 45 meters long respectively, with a speed of 25 knots, 23 knots, and 20 knots. The torpedo boats are to be 37 meters long, with a speed of 22 knots. All will be armed with Hotchkiss guns, in addition to Swartzkopf torpedoes. The whole will be delivered within eighteen months.

The French Admiralty has ordered of the Society des Forges et Chantiers twenty-six first-class torpedo boats, of which sixteen are to be constructed, at a cost of 175,000f. (7,000*l.*) each, at the company's yards at Marseilles and La Seyne, and ten, at a cost of 173,000f. (6,520*l.*) each, at Havre. The former boats are to be delivered at Toulon, the latter at Cherbourg. The dimensions of the new torpedo boats are as follows: Length over all, 35 meters (115 ft.); breadth, extreme, 3·35 meters (11 ft.); depth of hold, 2·5 meters (8¼ ft.); draught aft, 2 meters (6½ ft.); displacement, fully equipped, 53¾ tons; minimum speed, 18 knots. Each boat is to have two torpedo launching tubes and to carry four torpedoes. The boats are to be constructed in seven watertight compartments. The coal bunkers, placed each side of the boilers, form for the latter a sufficient protection against light projectiles. All the material used in the construction of the boats must be of French manufacture. The trials include a forced and a continuous run. In case the maximum speed is less than 20 knots, 500 francs are to be deducted from the contract price for each tenth or each fraction of a tenth of a knot below that speed. Should the maximum speed, however, of any boat be under 18 knots, the boat in question will be rejected. During a continuous run of eight hours, the average speed must not fall below 12 miles an hour. The keels of two twin screw cruisers, the Surcouf and Torbin, have been laid down at Cherbourg and Rochefort respectively. The vessels will have the following dimensions: Length over all, 95 meters (312 ft.); breadth, extreme, 9 3 meters (30½ ft.); depth of hold, 7·05 meters (26 ft.); draught amidships, 4·24 meters (14 ft.); displacement, 1,844 tons. The speed of the cruisers is to be 19½ knots, and their engines are to develop 6,000 horse power. Their armament is to consist of two 14 centimeter (5½ in.) guns on the forecastle, three 47 millimeter (1·83 in.) quick firing guns, and four mitrailleuses, besides five torpedo launching tubes—two forward, one aft, and one at each side.

Smoking and Heart Disease.

In a report by Dr. Frantzel, of Berlin, on immoderate smoking and its effects upon the heart, it is stated that the latter show themselves chiefly by rapid, irregular palpitation of the heart, disturbances in the region of the heart, short breath, languor, sleeplessness, etc. Dr. Frantzel says that, if the causes of these complaints are inquired into, it is generally found that the patients are great smokers. They may not smoke cigars rich in nicotine, but full flavored cigars imported from the Havanas. Smoking, as a rule, agrees with persons for many years, perhaps for twenty years and longer, although by degrees cigars of a finer flavor are chosen. But all at once, without any assignable cause, troubles are experienced with the heart, which rapidly increase, and compel the sufferer to call in the help of the medical man. It is strange that persons consuming cigars of ordinary quality, even if they smoke them very largely, rarely are attacked in that way. The excessive use of cigarettes has not been known to give rise to similar troubles, although it is the cause of complaints of a different nature. The age at which disturbances of the heart become pronounced varies very much. It is but rare that patients are under thirty years of age; they are mostly between forty and sixty years old. Persons who are able to smoke full flavored Havanas continue to do so up to their death. If we look round among the better classes of society, who, it is well known, are the principal consumers of such cigars, it is astonishing to find how many persons with advancing years discontinue smoking. As a rule, affection of the heart has caused them to abjure the weed. In such cases the patient has found the best cure without consulting the medical man. If he makes up his mind to discontinue smoking at once, the complaint frequently ceases at once; in other instances it takes some time before the action of the heart is restored to its normal state. In such cases, besides discontinuing smoking, relief must be sought also by regulating the diet, taking only easily digestible food, light beer and wine in moderate quantities, abjuring coffee, as well as by short walks, residence among mountains of moderate elevation, and suitable interior treatment. By taking this course, all symptoms disappear in the course of a year, and do not reappear if the patient does not recommence smoking. In a third category of cases, the more acute disturbances leave the patient; he feels well and hearty, but an irregularity of the heart, more or less pronounced, is left behind. It has not yet been determined what it is that makes smoking injurious; but this much appears certain, that it does not depend upon the amount of nicotine which cigars may contain.

Old Spanish Mineral Specimens.

According to *Die Natur*, a remarkable collection of minerals exists in the cellars of the Academia San Fernando, at Madrid. It is contained in a number of boxes, which have filled the cellars for about 200 years, and which may remain there as long again unless some better fortune befalls them than that which has attended them in the past. They come down from the golden age of Spanish domination in South America and in Mexico, when the mines of these regions made them the El Dorado of the globe. No one knows exactly the contents of the boxes, but they are believed to contain the rarest objects, although the scientific importance of collections was but little appreciated in the days when this one was made. It appears also that collections made by Humboldt during his travels in America, and handed over by him as a kind of scientific tribute to the Spanish Government, are in the same academy, "locked up since 1804, in a press, untouched." With respect to the famous skeleton of the *Megatherium americanum*, Cuv., found by the Marquis de Loreto on the banks of the Rio Luxon, near Buenos Ayres, in 1778, which is in the Museum of the Academy, its present state is described by the Brothers Fraas, of Stuttgart, in their letters from the south of France and Spain, just published under the title of "Aus dem Suden," as being one of the utmost confusion. The bones are bored for mounting, but they are "completed and restored" to the verge of the impossible. The bones are placed in absurd positions, and parts which were inconvenient to the mounter are put aside altogether. The writers ask what the state of instruction in natural history must be in an academy where such things are possible.

The Australian Frozen Meat Trade.

In a letter written last month, the Melbourne correspondent of a Scotch paper gives some interesting data regarding the frozen meat trade of that city. He says that though the frozen meat companies have not been very successful, the Melbourne one having been wound up some months ago, yet since the works passed into other hands there is promise of success. Instead of purchasing sheep, as did the original company, the present owners of the works only kill, freeze, and ship the sheep for private owners at specific rates, the owners themselves taking all risks of sales in London. This new system, which has for some time been in vogue in New Zealand, came into operation in Melbourne last April, and up till the dispatch of the correspondent's letter, as many as 50,000 sheep had been frozen at the works at Williamstown.

The graziers who consigned on their own account to London agents were pleased with the returns, as they found, after paying all expenses of freezing, freight, and commission, they had got more per head for their sheep than the prices realized for similar animals sold alive in the Melbourne market. Such shippers actually realized from 15s. to 17s. 6d. per frozen sheep, when the market rates in Melbourne for live sheep were only 12s. a head. But even had they realized only 12s. for the frozen carcass, they would continue to take all the trouble and risk of sending the meat to London, because one of the main objects of doing so is to reduce the surplus stock in Australia, which without an outside market to resort to, sheep become a glut in the colony, and probably without such outlet would have to be sold for 5s. or less per head, or be got quit of by being boiled down for tallow.

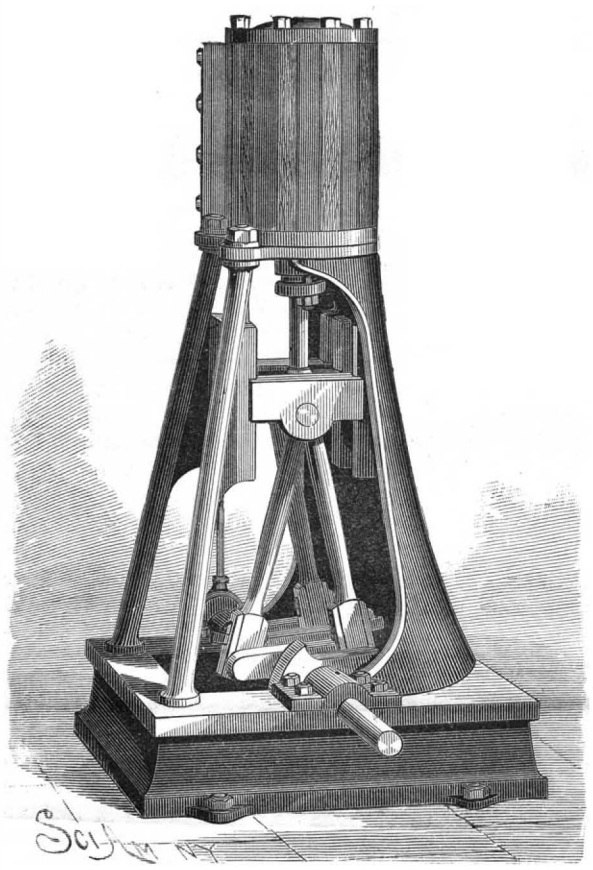
Steel Pipe.

It is reported by the Berlin *Eisenzeitung* that the new process for making steel pipes employed at Burbach is very successful. A syndicate has been formed to build works at Burbach, the capital being 1,200,000 marks, of which 500,000 marks are issued to the patentee, A. Mannesmann, of Remscheid. It is stated that Funke & Ebers, of Hagen, Germany, have also purchased patent rights, and a large firm in Paris propose to apply the method to the manufacture of copper tubing. As to the process: As soon as the steel is cast into the round mould, a core is thrust into the steel, so that a tube is formed between it and the walls of the mould. In order to prevent cracking of this annular casting during cooling, the core is so made that it follows up the shrinkage of the steel. The steel cup thus obtained may then be rolled in an ordinary train.

A BIG gopher snake was killed recently at Dayton, Fla., in whose stomach was found a three foot rattlesnake, still alive. The gopher was over six feet in length.

IMPROVED BALANCED STEAM ENGINE.

Of the moving parts of a steam engine, the piston, piston rod, and crosshead have only a reciprocating motion, while the connecting rod has both a reciprocating and rotary motion, the rotary motion being almost *nil* at the connection with the crosshead,



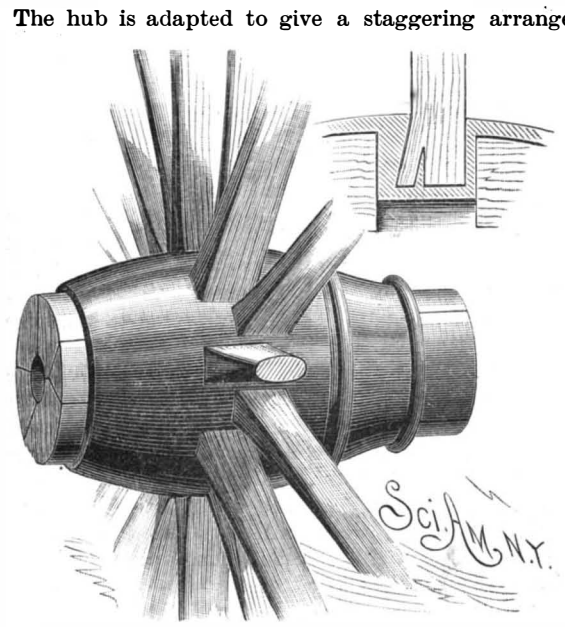
LOUQUE'S BALANCED RECIPROCATING COUNTERWEIGHT ENGINE.

and being almost perfectly rotary at its connection with the crank, which has, of course, only a rotary movement. To perfectly balance these motions, it is necessary to counteract the effects of the one by the other. In the engine represented in the accompanying engraving, this end is reached by a simple and admirable arrangement of counterbalancing parts. The engine has a three-crank shaft. The connecting rod being weighed, its weight is divided in two equal parts, and a rod is connected to each of the crank pins opposite the main crank. These rods always move in opposition to the connecting rod. The piston, piston rod, and crosshead are also weighed and the weight divided in two equal parts, are placed at the end of the balanced rods, and are made to move in slides running parallel with the crosshead. The engine is thus perfectly balanced. The inventor did not deem it necessary or useful to counterbalance the slide valves. The effect of such counterbalancing has been so extraordinary in its practical results that these engines have been run without bolting to the floor and without flywheel, at either slow or high speed. The counterweights can be applied to any engine.

Further particulars can be obtained from the patentee, Mr. Charles Louque, 31 Carondelet Street, New Orleans, La., and from our Business and Personal column.

IMPROVED WHEEL HUB.

The hub is adapted to give a staggering arrange-



GRASBERGER'S IMPROVED WHEEL HUB.

ment to the spokes, while it secures the greatest possible strength without destroying the symmetry and beauty of the plain wooden hub. The body of the hub is composed of two wooden end sections, which are bored to receive the axle, and are fitted within a metal shell, which is constructed with recesses forming pockets for the spokes. In the construction here illustrated, the spokes are held in place by being made to spread out laterally by a locking wedge, as shown in the sectional view. The outer and inner wooden end blocks, which form the core of the hub, are turned to shape, then cut in five pieces, one of which is wedge shaped, to form a key for the whole; or they can be steamed and forced into the hub.

This hub receives the full size of the spokes the whole length of the tenon, and repairs are easily made, as the spokes are independent of each other. It is impossible for the grease to get in around the spokes, in case of a loose box.

This invention has been patented by Mr. Boniface A. Grasberger, of 1448 East Franklin Street, Richmond, Va.

How Plaster Casts are Made—Col. Pat. Gilmore's Plaster Cast.

The St. Louis *Globe* gives the following amusing account of Col. Pat. Gilmore's experience in the hands of a couple of youthful modelers: "I went to the studio at the hour fixed, and was to be met there by a well known sculptor, who had courteously undertaken to do the modeling himself. By some unfortunate mischance, he failed to put in an appearance. Two apprentices were vigorously stirring the liquid plaster of Paris or whatever villainous compound is used for the purpose. After about half an hour's waiting, it was decided to proceed in the great man's absence, and I was invited to disrobe. A much-beplastered white sheet was wrapped around my neck and shoulders tightly, and my face and hair were liberally greased to prevent the plaster sticking to the flesh. Pieces of paper were stuffed into my mouth, nose, and ears, and I was told to shut my eyes. No sooner had I done so than my persecutors commenced pouring the liquid on my head. One poured while the other pressed the rapidly hardening compound so as to fill every recess and get a cast of every feature. They poured a great deal too much on, and soon my head was incased in a mask as hard as iron. The heat was insufferable. I could not move my head, for the awful weight threatened to dislocate my neck if I did; my eyes seemed being pressed into my brain, and the paper circlets not proving adequate for their purpose, I began to feel the first symptoms of suffocation. I could not call out, and believed myself to be dying. But my troubles had barely commenced. The apprentices had not fixed the centerboard, or slit, properly, and when they mercifully decided to release me, they found the cast would not come in half as it usually does. In a successful operation the two halves are joined together after removal, and a perfect reproduction of the face and head easily produced; but in my case both dividing board and grease had been overlooked, and the only course left was to smash the mask off. Mallet and chisel were used, producing an effect like concussion of the brain. Finally my face was freed, and I was able to breathe, and make a few remarks to the boys on their carelessness. Then it transpired that they had omitted to grease behind my ears, and the plaster adhered to the skin like glue. To remove the former, the latter had to be torn away, and when at last I got away I was a mass of blood and sores. After two weeks' medical attention I got about right, but the memory is still fresh."

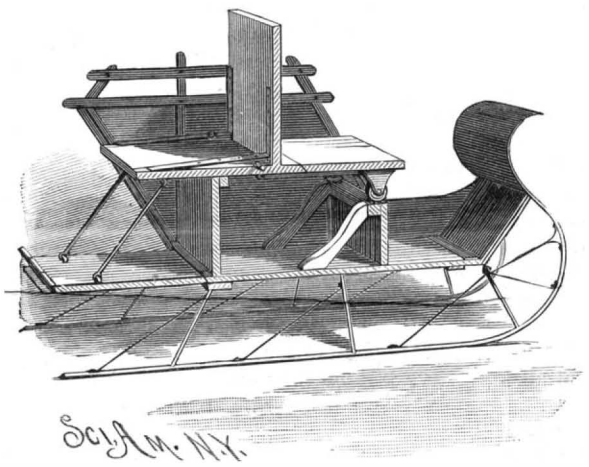
How to Collect Mosses.

At the meeting of the Royal Society of Tasmania on July 13, Mr. R. A. Bastow, F.L.S., read a paper on the collection, observation, and identification of mosses, from which we take some practical hints. The collector should provide himself with a good pocket lens, a table knife, a piece of carpet 12 by 8 to kneel upon, very capacious pockets, two or three old newspapers, a small billy, and refreshment. The latter is an absolute requisite, for it is wonderful how voracious one becomes by the time that the furthest point of the collecting ground is reached.

Mr. Bastow makes it a rule never to collect anything on the journey outward, no matter how tempting a tuft of capsules may be. It is better just to mentally note them and pass them by in going; they may just as easily be secured on the return. Every tuft of moss that is gathered should be carefully folded in paper, so that the species may be kept separate. However beautiful a medley tuft of moss may be, it is better left behind; tufts of one species only should be looked for. Mosses thus gathered will keep a long time, but it is better to wash them and lay them tastefully between blotting paper under pressur for a few days. They are then both dry and rigid, and may be packeted and labeled at once, or placed in an album, or mounted on glass slips as slides for the microscope. The author has prepared a key to the study of Tasmanian mosses, which is a new feature in the introductory portion of bryology. The Tasmanian mosses are the first in the botanical world to be diagrammatically arranged, so that the student may have all the genera before him on one sheet, so bracketed and arranged that he can speedily find out the genus of the specimen in hand. One species of each genus is represented, in its natural size and as it appears under the microscope with a 1½ inch objective. The key also contains short generic descriptions; these, in conjunction with the list of Tasmanian genera, their authors, the English meanings of the generic names, and the habit of each genus, in the body of the paper, will afford great assistance.

IMPROVED VEHICLE SEAT.

The object of this invention, which has been patented by Mr. James Steele, of Guelph, Ontario, Canada, is to so construct a vehicle seat and body that it may be arranged as a single or double seated vehicle. The body of the vehicle is provided with a hinged back, to which is connected a tilting seat, by rods jointed to the seat and back of the body. An auxiliary seat is hinged to an extension of the back of the main seat, and provided with rollers running upon guides placed in the body below the main seat. When only a single seat is required, the back is raised to a vertical position, thereby bringing the main seat into a horizontal position, where it is supported by the frame of the vehicle. At

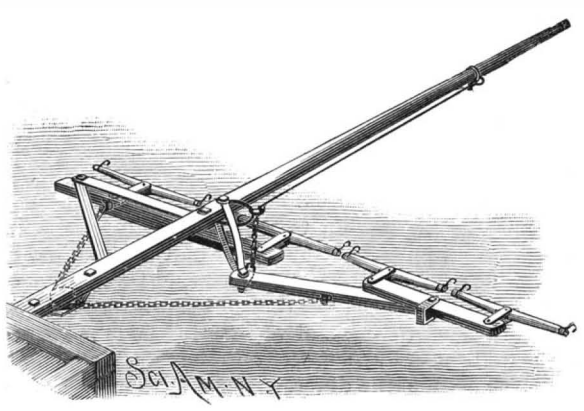


STEELE'S IMPROVED VEHICLE SEAT.

the same time the auxiliary seat is folded under the main seat, its rollers riding along the guides, and the end board is brought against the rear ends of the side pieces of the body. When two seats are desired, the back is lowered to a horizontal position, to form the rear seat, while the main seat is brought into a vertical position, so as to serve as a back to both seats. The auxiliary seat is carried upward, and forms the front seat. The end board is lowered, and becomes the foot board for the rear seat. The engraving represents the seat arranged in this manner.

DRAUGHT EQUALIZER.

The simple and efficient draught equalizer here illustrated is designed to be used with four horses abreast. To the tongue are secured two bars united at their outer ends, and one of which is at right angles to the tongue. Upon the bolt connecting the ends is pivoted one end of an equalizing bar extending beneath the tongue, and to the under surface of which, at the free end, is pivoted an equal armed evener, having single trees at each end. To the tongue, a short distance in front of the bar, placed at right angles, are pivotally connected two bars, between whose rear ends is pivoted one end of a second equalizing bar. The centers of the two equalizing bars are connected by a chain passing around a sheave in a frame secured to the under side of the tongue, near its rear end. To the outer end of the second equalizing bar is pivoted an evener, provided with two single trees. Upon each of the bolts holding the bars connected with the inner end of the second equalizer is placed a clevis. These are connected with a rod secured to a ring encircling the forward end of the tongue. This arrangement limits the rearward swing of the two bars, and fixes the inner end of the



HOLCK'S DRAUGHT EQUALIZER.

second equalizing bar. By means of this arrangement of equalizing bars and chains, a thorough equalization of the pull of the four horses is obtained, and, to a great extent, side draught is avoided.

This invention has been patented by Mr. Charles F. Holck, of Laporte City, Iowa.

Seth Wilmarth.

Seth Wilmarth, one of the greatest of American machinists, died at his home in Malden, Mass., Nov. 5, aged 76, of heart disease. In navy yard circles, for the past quarter of a century, Mr. Wilmarth occupied a distinguished place, and made many and important mechanical improvements. His advice was sought by the most prominent machinists of the world. Over twenty patents were taken out by him, among them the hydraulic lift for revolving turrets, for which alone the United States Government paid him $50,000. He invented a planer and the great lathe at the Charlestown Navy Yard, at the time of their construction the largest machines of their kind in the world. He was a farmer's son, and was born in Brattleborough, Vt., in 1810. Evincing a predilection for mechanical work, he was apprenticed at a machine shop in Pawtucket, R. I. He rose rapidly until he was recognized as a master of every branch of mechanical knowledge, and in 1855 he was appointed Master Mechanic and Superintendent of the Charlestown Navy Yard by Rear-Admiral Joseph Smith. Every building of importance in the yard was erected under his supervision, and he was the guiding mind in every mechanical improvement projected.

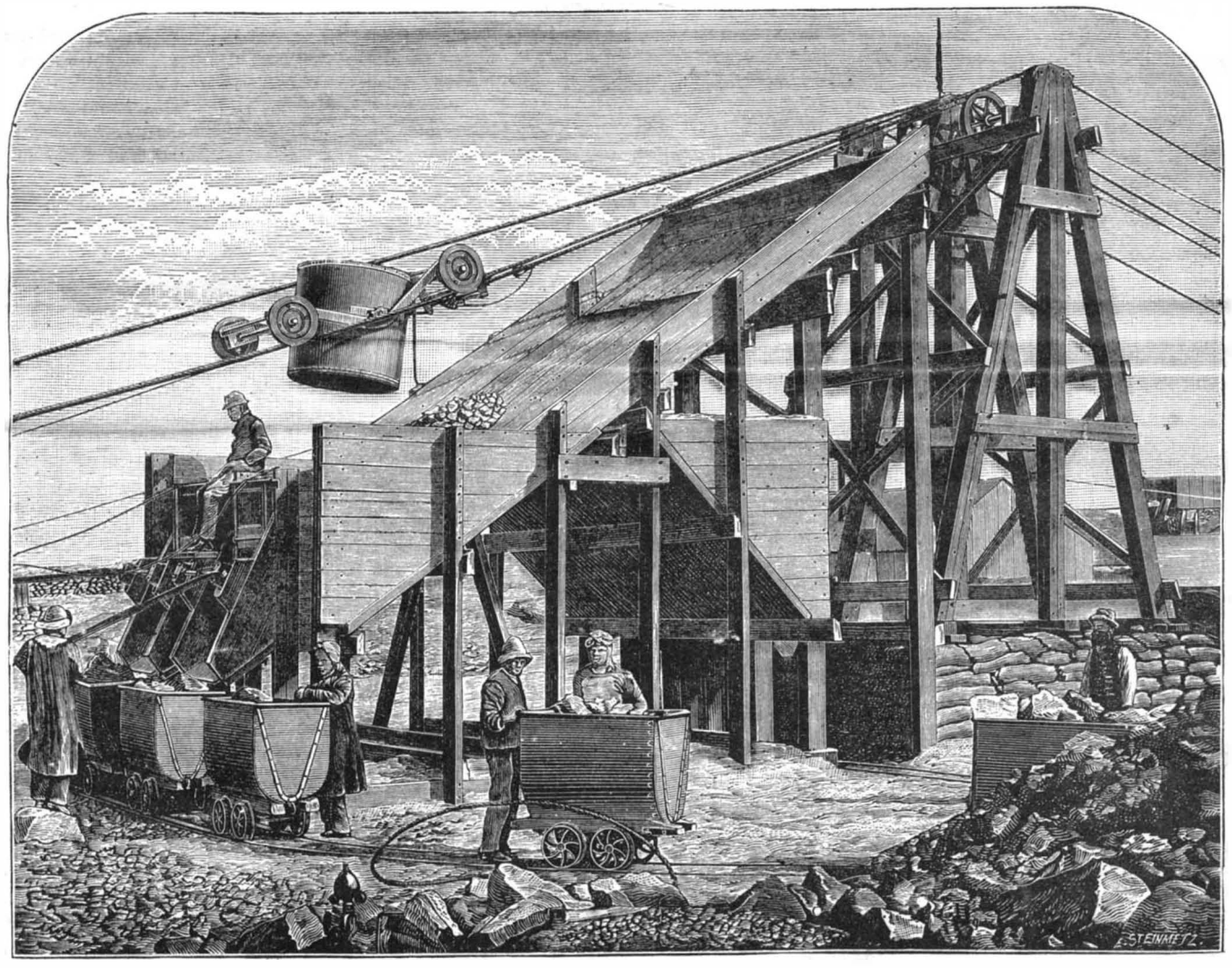
Dangers of Sewer Gas.

The amount of sickness caused by sewer gas, the world over, is little known. Defective plumbing is one form of murder. Death is almost sure to result unless the victim has a strong constitution to withstand the shock he receives from this source. It was defective plumbing, the *American Builder* claims, which caused the late severe illness of Secretary Manning. Workmen engaged in tearing the plumbing out of Secretary Manning's private office found in a little closet in the corner a pipe four inches in diameter, besides several smaller pipes, leading directly to the sewer without any trap or contrivance to prevent sewer gas from coming into the room. These pipes strike the sewer just at its head, where the greatest amount of gas is formed. In the winter, when the doors and windows were shut, the air was most oppressive, and sometimes in the coldest weather Mr. Manning was forced to open the windows. His physicians pronounce his disease blood poison from sewer gas, and say that it was brought on, beyond doubt, by his sitting in that little room.

THE AFRICAN DIAMOND INDUSTRY.

At the diamond mines, South Africa, an immense amount of machinery is now employed in the work of elevating the earth containing the diamonds, crushing and separating the same. The earth is raised from the mine pits by means of tubs that run on wire cables, the loads being carried and dumped on inclined boxes, thence distributed into small cars, to be distributed upon the depositing floors.

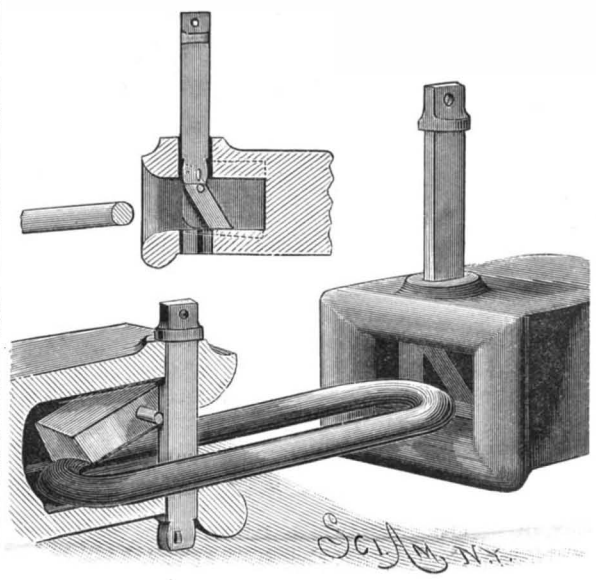
Our illustration, which is from *Engineering*, shows one of the Compagnie Generale's depositing boxes, with blue ground in the box and trucks loaded therefrom ready to be drawn away to the depositing floor. An empty tipping tub is shown on the standing wires over the box ready to be lowered down again into the claims. The Kafir sitting on the box has to hook an anchored wire on to the hanging bar of the tub as it passes over him, by which means the tipping of the tub is effected, the tub itself being so balanced that it quickly rights itself again after tipping. The bottom of the depositing box is formed of iron grating, whereby the coarse lumps of blue ground are sifted from the finer ground, which passes into the lower receptacle of the depositing box and is trucked away separately, thus facilitating the process of pulverization.



THE AFRICAN DIAMOND INDUSTRY.—A DEPOSITING STAND.

IMPROVED CAR COUPLING.

This coupling may be used on any form of car, but is especially applicable for use on freight cars. It may be used in connection with the ordinary pin and link coupling. The drawhead is formed with the usual opening, and in the upper portion are two recesses, within which are pivotally mounted tumblers, whose forward faces are recessed. The tumblers are connected



REQUA'S IMPROVED CAR COUPLING.

by a cross rod so located that, when in the position shown in the upper sectional view, the rod will be beneath the coupling-pin hole, the pin being provided at its lower end with a cotter which prevents it from being entirely withdrawn. The tumblers serve to hold the extended end of the coupling link elevated when arranged as shown in the left of the lower figure, the lower wall of the main opening being inclined so that the link will be raised to a position to couple automatically with the adjacent car. In the drawhead into which the link enters, the pin is supported by the cross rod uniting the tumblers, which are swung down. The entering link strikes and throws the tumblers back, so as to permit the pin to drop into the link.

This invention has been patented by Mr. Mark M. Requa; particulars can be obtained from Mr. B. A. Mann, of Lanesborough, Minn.

Electrical Resistance of Carbon.

The principle of the carbon telephonic transmitters is briefly this: A button of carbon is placed between two metal conductors, one of which, being in contact with the vibrating membrane, is made, when the telephone is used, to bear with varying pressure on the button of carbon, thus changing the resistance of the circuit, and so varying the current flowing therein. Previously, the diminution of resistance corresponding to the increased pressure has been held to be due to the better contact of the carbon and the metal caused by thus squeezing them together. This view has been opposed by Mendenhall (*American Journal of Science and Arts*), and his later experiments make good his position. He finds, using soft carbon or compressed lampblack, that the resistance of this material varies greatly with pressure, and that the greater part of this change is due to a real change in the resistance of the carbon itself, and only a small portion of the variation is due to the surface contact. He found that a comparatively great pressure would sometimes result in a permanent reduction of the resistance of the carbon; and that this resistance is so uncertain and fluctuating, that it is extremely doubtful whether this phenomenon could be applied so as to give a measure of the pressure exerted.

Chinese Straw Shoes.

We understand that Dr. Macgowan has sent to the Agricultural Bureau, through Consul-General Kennedy, of Shanghai, a collection of shoes made of rice straw, and worn by laboring people in the south of China. Dr. Macgowan sends them, suggesting the introduction of rice-straw shoe making into the rice-producing regions of the South. They are made by women and others who are too feeble for more active employment, which circumstance, and the abundance of the material, render them very cheap—from one to twelve cents per pair!

Dr. Macgowan suggests also the introduction into nurseries for children's wear of these straw shoes, that more freedom be allowed to the feet of our children.

The highest priced shoes—12 cents—are made of mat grass (*Arundo mites*), which Dr. Macgowan says should be acclimated in the South, and that mat making would prove a profitable industry.

The Electrical Railway in Minneapolis.

The *Electrical Review* contains an interesting account of the successful operation of the electrical railway in Minneapolis, in which it says: "The trains consist of three or four passenger cars, each weighing 11 tons empty. The number of passengers carried is often as high as 600 at one time, so that the weight of the train is as follows: Four cars, each 11 tons, 44 tons; 600 passengers, at 130 pounds, 39 tons; motor car, 8 tons; total, 91 tons. The steam dummy now brings the train to as far as the steam is allowed, and then the electric motor relieves it and takes the train down town with its passengers. The distance over which the electric motor travels is at present somewhat near a mile, the speed being about seven miles an hour, this being the regulation speed within the city limits. Considering the constant stopping and starting at each block, the grades in the road, and the heavy trains, the electric motor must be given the credit of doing at least as good work as could be expected or obtained from any steam engine. During the seventeen or eighteen hours of service, not a single minute of stoppage is made except to let off and take on passengers. This electric road has been in operation for several weeks without a hitch or a breakage. The motor, which is about 40 horse-power, works as perfectly under a heavy as under a light load. From the permanency and the character of the work done by this electric railway, it will be seen that electric railways on elevated as well as on ordinary roads must become facts in the immediate future. They are indeed now with us, and there is no more trouble to build 200 or 300 horse-power generators than to build machines of fifty horse-power. The public is losing its skepticism, and what was proclaimed as an impossibility yesterday has become a fact to-day."

THE GYROSCOPE.

(*Continued from first page.*)

While this phenomenon can be perfectly shown only by means of an instrument in which the power is practically constant and the velocity uniform, the tendency of the gyroscope to act in this way may be exhibited by means of an ordinary one revolving at a high velocity. The difficulty of securing a high speed in a large gyroscope has led to the application of a friction driving device, as shown in Figs. 1 and 2, by means of which an initial velocity of from 4,500 to 5,000 revolutions per minute may readily be attained.

The instrument, after being set in motion, behaves like other gyroscopes not provided with means for maintaining the rotary motion of the wheel, but the size of the instrument and the facility with which it may be operated render it very satisfactory.

The gyroscope wheel is 6 inches in diameter, ⅝ inch thick, and, together with its shaft, weighs 3½ pounds. The annular frame weighs 1¾ pounds. So that 5¼ pounds must be sustained by gyroscopic action when the counterbalance is not applied.

The driving wheel is 7¾ inches in diameter. Its face is ¾ inch wide. Its shaft is journaled in an arm pivoted to the base, with its free end adapted to enter a recess in the edge of the annular frame, for supporting the gyroscopic wheel while motion is being imparted to it. Upon the shaft of the gyroscope wheel is secured a soft rubber tube having an external diameter of nine-sixteenths inch. This shaft makes 13·84 revolutions to one turn of the drive wheel, so that when the drive wheel is turned six times per second the gyroscope wheel will make very nearly 5,000 turns per minute (4,982).

This gyroscope may be arranged as a Bohnenberger apparatus by removing the tall standard and attaching the shorter one to the center of the base by means of a bolt. The annular frame of the instrument is suspended on pivotal screws in the extremities of the semicircular support, which is capable of turning on the upper end of the short standard. In the engraving the short standard, together with the semicircular support, is shown lying on the table. The usual counterbalance is also shown lying on the table. Fig. 1 shows the drive wheel in position for imparting motion to the gyroscopic wheel, and Fig. 2 shows the driving wheel withdrawn and the gyroscope in action.

As this instrument does not differ from the ordinary one, except in the application of the driving mechanism, it will be unnecessary to go into particulars regarding its performance.

In Figs. 3, 4, and 5 are shown pneumatic gyroscopes, and Fig. 6 represents a steam gyroscope.

The pneumatic gyroscope shown in Fig. 3 consists of a heavy wheel provided with flat arms arranged diagonally, like the vanes of a windmill. The wheel is pivoted on delicate points in an annular frame having an arm pivoted in a fork at the top of the vertical support. The arm of the annular frame carries a tube, which terminates near the vanes of the wheel in an air nozzle which is directed toward the vanes at the proper angle for securing the highest velocity. The opposite end of the tube is prolonged beyond the pivot of the frame.

The support of the annular frame, shown in vertical section in Fig. 4, consists of an inner and outer tube, the inner tube having a closed upper end terminating in a pivotal point. The lower end of this tube communicates with the horizontal tube, through which air is supplied to the machine.

A sleeve, closed at its upper end and carrying the fork in which the arm of the annular frame is pivoted, is inserted in the space between the inner and outer tubes, and turns on the pointed end of the inner tube. The inner tube is perforated near its pointed end, to permit of the escape of air to the interior of the sleeve, and the lower end of the sleeve is sealed by a quantity of mercury contained by the space between the inner and outer tubes. The air pipe carried by the annular frame communicates with the upper end of the sleeve by a flexible tube. When air under pressure passes through the inner pointed tube, through the sleeve, and through the air nozzle, and is projected against the vanes of the wheel, the wheel rotates with great rapidity, and the gyroscope behaves in all respects like the electrical gyroscope above referred to.

The gyroscope shown in Fig. 5 is adapted to the standard just described, but the heavy wheel is replaced by a very light paper ball, whose rotation is maintained by two tangential air jets, which play upon it on diametrically opposite sides, and nearly oppose each other, so far as their action on the surrounding air is concerned. The rotary motion is produced solely by the friction of the air on the surface of the ball. The upwardly turned nozzle is arranged to deliver an air blast which is a little stronger than that of the lower nozzle, so that a slight reactionary force is secured, which assists the gyroscope in its movement around the vertical pivot sufficiently to cause the ball to maintain its horizontal plane of rotation continuously. In fact, this gyroscope will start from the position of rest, raise itself in a spiral course into a horizontal plane, and afterward continue to rotate in the same plane so long as air under pressure is supplied.

It may be questioned whether this machine is a true gyroscope. However this may be, it is certain that the reactionary power of the stronger air jet is of itself insufficient to produce the motion about the vertical pivot; neither is there a sufficient vacuum at the top of the ball to produce any appreciable lifting effect.

The steam gyroscope shown in Fig. 6 hardly needs explanation. It differs from all of the others in generating its own power within its moving parts. The boiler is supported by trunnions resting in a fork arranged to turn on a fine vertical pivot. The engine is attached to the boiler, so that both engine and boiler swing on the trunnions in a vertical plane. The wheel of the engine is made disproportionately large and heavy, to secure the best gyroscopic action.

The performance of the steam gyroscope, is like that of the other power-propelled gyroscopes, and needs only a reactionary jet of steam or some other slight force to keep up the rotation around the vertical pivot, and thus render the action of the instrument continuous.

It has been suggested that, as the engine makes from 1,000 to 2,000 revolutions per minute, the exhaust steam might be turned to account in producing the reactionary effect necessary to maintain the action continuously.

A NOVEL FLOWER POT.

The flower pot shown in the accompanying engraving is the invention of Mrs. S. L. Hunter, of Little Rock, Ark. The pot is made with two walls forming a space between them that serves as a water reservoir. In the inner wall near the bottom are holes through which the water flows to moisten the earth. Fixed to the side of the outer wall, and communicating with the reservoir by a hole, is a spout through which the reservoir may be filled or emptied as required. By thus admitting the supply of water at the bottom, the plants are made to send down deep roots in the earth to seek the moisture, and they will not be so liable to send out roots near the surface, as in the case of pots supplied by pouring water on top of the packed and hardened earth. Plants set in these pots may be transported a long distance, as the reservoir holds water sufficient for many days.

A Mighty Petroleum Fountain.

Mr. Charles Marvin, writing to the *Pall Mall Gazette*, says:

The Russian newspapers just received contain a telegram from Baku announcing the greatest outburst of oil ever known. It runs thus: "Baku, October 5.—At Tagieff's wells a fountain has commenced playing at the rate of 30,000 poods of petroleum an hour. Its height is 224 ft. In spite of its being five versts from the town, the petroleum sand is pouring upon the buildings and streets." It is astonishing that the St. Petersburg correspondents of the London papers should not have telegraphed this remarkable phenomenon, and I can only account for their remissness on the grounds that they have either been too preoccupied with Bulgarian matters or have grown so accustomed to fresh oil fountains at Baku lately as to be blunted to the significance of the present one. Yet Tagieff's "gusher" beats out and out every previous record in the oil regions of the two hemispheres. The champion petroleum fountain up to now has been the "Droojba," which in 1883 spouted to the height of 200 ft. or 300 ft., at the rate of nearly 3,300 tons of oil a day. "This single well," I wrote from the spot in that year, "is spouting more oil than all the 25,000 wells in America yield together."

Such an outflow was looked upon as almost incredible, and had there not been other Englishmen at Baku at the time, I should have probably fared as badly as Bruce and other travelers. But the Droojba is now nowhere. Tagieff's well is spouting nearly 500 tons an hour, or more than 11,000 tons of oil a day. If it were in London, it would top the Monument by 20 ft., and the mansions of far off Belgravia would be covered with its greasy dust. During the birth throes of a Baku oil fountain, stones are hurled a terrific distance, and a high wind will carry the fine sand spouting up with the oil miles away. The roar of the gas preceding the oil flow is terrific, and the atmosphere for a time is rendered almost unbearable. Compared with such fountains as the Droojba and Tagieff, the Great Geyser of Iceland is a pygmy. Luckily the gas soon clears off, the stones cease to rattle about the surrounding buildings, and then the fountain becomes as orderly as those in Trafalgar Square, pouring upward sky high with a prodigious roar, and forming round about the 13 in. or 14 in. orifice vast shoals of sand, beyond which the petroleum gathers in lakes large enough sometimes to sail a yacht in.

How long Tagieff's "spouter" will last, and what its ultimate yield will be, will depend upon circumstances. The Droojba lasted 115 days, flowing for 43 days at the average rate of nearly 3,400 tons a day, 31 days at 1,600 tons, 30 days at about 900 tons, and 11 days at 600 tons. The owners then managed to fix a "cap" over the orifice, and placed the well under control. The total amount of oil spouted, at the very lowest estimate, was 220,000 tons, or 55,000,000 gallons; the highest estimate put it at 500,000 tons. At a rough estimate, had the oil spouted in America, it would have realized about a million sterling, and made its owner a millionaire, instead of which the fate of the fountain at Baku was to render its master a bankrupt; for the shoals of sand engulfing neighboring buildings led to claims of damage surpassing what he got for the small quantity of oil he was able to catch and store, while the rest, flowing beyond on to other people's property, was in most cases "annexed" and not paid for. It is to be hoped that Tagieff & Co. will not be so unlucky; but in any case most of it is sure to be wasted.

Lechesne.

"Lechesne" is an alloy of nickel, copper, and aluminum for the production of a superior kind of *maillechort*, or German silver. It is recommended as combining absolute malleability with an exceptional degree of homogeneity, tenacity, and ductility. The inventor, M. Thirion, claims also for the new metal less liability to oxidize and to act as a heat conductor than other alloys heretofore in use. These latter advantages, he holds, are conspicuous on a comparison of the new alloy with those of nickel and copper for coinage, and with the old fashioned descriptions of German silver (nickel, copper, and zinc), or, again, with the best kind of latten. Like gold, silver, and platina, the "lechesne" alloy satisfies the conditions of the most difficult processes that could be applied, such as hammering, drawing, and deep chasing or punching, especially in ornamental work. The distinctive feature of this metal consists in the addition to the binary alloy (nickel and copper) of a quantity of aluminum, calculated according to the proportion of the nickel. The aluminum is introduced a few moments before the casting process, care being taken to send it to the bottom of the fusion, and to insure thorough distribution throughout the mass by vigorous mixing. Its combination is facilitated by its natural affinity to both copper and nickel. The proportion of the aluminum entering into the alloy is as follows: One gramme 65 centigrammes per kilo of alloy containing 10 per cent of nickel. Any attempt to deoxidize an alloy of nickel and copper in which the aluminum was not carefully introduced toward the close of the fusion would lead to carbureting. If it were sought, for instance, to expel the surplus carbon by superheating, the inadequate quantity of free oxygen present would prevent the combustion of the carbon, so that the metal would in reality become even more deteriorated by the process by an increased oxidization. The aluminum both deoxidizes and decarburets the metal, but the following precautions should be observed: The nickel is first placed in the crucible, and as soon as it melts, the copper is gradually introduced, the vessel, of course, being closed. When the two metals are in a state of fusion, they are puddled together. Then the alloy is reheated and the aluminum thrown in, the temperature being rapidly raised almost to boiling point. In the next place the alloy is cast very hot, this operation being effected promptly and with the utmost regularity. The chief malleableness of the article is derived from the copper, which imparts a property and a tone in that respect found lacking in the nickel. The aluminum suddenly, but surely, oxidizes the alloy, burning away every trace of the carbon introduced into the crucible by the raw material; it considerably augments the tenacity of the alloy, and, above all, insures its compaction. The new metal is regarded in industrial circles as likely to effect considerable changes in many branches of trade, and has already been experimentally tested, with the most gratifying results.

Piston Valves for Locomotives.

According to M. Ricour, piston valves in locomotives wear at the rate of one twenty-fifth inch for 125,000 miles, while with the slide valve the same extent of wear takes place with one-sixtieth of the mileage. The wear of the valve gear is reduced in the same proportion. The effect in the consumption of fuel is shown by the returns made at Saintes Station for the year 1882, where on all engines worked with slide valves the coal consumed per 1,000 tons conveyed one mile was 226 lb., against 234 lb. in the year 1884, when 30 out of 40 locomotives had been fitted with cylindrical valves.

Correspondence.

Large Railway Maps.

To the Editor of the Scientific American:

I notice that a correspondent, in your issue of Nov. 13, calls attention to the use of railway maps on the walls of railway stations, and observes that they are only used by foreign railways. At least one American road adopted the practice some years ago; and if your correspondent has ever entered the Broad Street station of the Pennsylvania Railroad in Philadelphia, he could not fail to have noticed the excellent map of that road's lines and connections painted over the entire surface of the western wall of the main saloon.

Such maps are very effective as educators of the traveler, and well deserve a more general adoption.

F. N. BARKSDALE.

A Reminiscence of Audubon.

To the Editor of the Scientific American:

When John James Audubon, the great American naturalist, had finished his remarkable double elephant folio work on the "Birds of America," he turned his attention to our quadrupeds. In 1841, while living at 86 White St., New York, he asked permission of the Mayor to shoot rats on the Bowery to get specimens for study and illustration, and received permission to do so. The following is a copy of the order handed to him in person by the Mayor:

MAYOR'S OFFICE, NEW YORK, Aug. 20, 1841.

Permission is hereby given to Mr. [John James] Audubon or his son to shoot rats at the Bowery early in the morning, so as not to expose the inhabitants to danger. ROBERT H. MORRIS, *Mayor.*

This was two years before Audubon undertook his remarkable expedition to the Upper Mississippi and Yellowstone River, to obtain material for his great work on quadrupeds. JOS. M. WADE.

The Hygiene of Cycling.

According to Dr. Kunze, of Halle, cycling is a health stimulating exercise, which ought to be commended by medical men. It is a powerful means of strengthening the human body, and may even be considered an exercise acting as a preventive and curative, of no mean order, of certain bodily ailments. Looked upon in the latter light, cycling is a kind of gymnastic exercise, possessing specific effects which are absent in ordinary gymnastics. The velocipedist (especially the bicyclist) learns, first of all, the art of balancing himself, by practicing it on an instrument as sensitive as it is easily overturned. To acquire it, it is necessary to call into precise action certain muscles, every individual muscle being trained to do its particular work. Those who are thrown from a bicycle, as a rule—certain eventualities, against which even the most skilled velocipedist cannot guard, excepted—do not yet possess the required ability to balance themselves. This latter aquirement is of great use also in practical life. Those who possess it will be able to jump ditches with greater precision and safety, pass along narrow paths, mount more difficult staircases, climb up and descend precipitous mountains, and will also carry themselves more erect, than those who do not possess this power of preserving an equilibrium. A further effect of velocipede riding is to strengthen the muscles, not only of the lower extremities, but also those of the abdomen, the chest, and the arms, which are constantly being excited to contract. The muscles of the lower extremities contract and relax in the action of propelling the velocipede, and there is no other movement which requires such rapid and energetic contractions. We frequently find that the muscles of the thigh and lower leg of cyclists increase in size, and, consequently, cyclists are able to bear without fatigue long walking tours. As, however, every organ which becomes stronger is less liable to disease, strengthened muscles predispose velocipedists less to ailments than the relaxed muscles of non-velocipedists. It would be highly interesting if reliable statistics could be obtained from the various cycling clubs, showing whether and how frequently muscular rheumatism of the thigh, for instance, is met with among velocipedists. The effect of cycling exercise upon the abdomen is of very special importance. With the contractions and relaxations of the muscles of the thigh those of the abdomen stand in close relation, and it is evident that the latter must be equally benefited. Upon the chest, cycling exercise acts in two ways. In the first place, by the contraction of the muscles of the abdomen, the stagnant air in the lungs is more thoroughly expelled, and, in the second place, the apparatus of breathing is more powerfully acted upon by the greater difficulty of respiration and aspiration experienced in quickly propelling the velocipede. The more effectual expulsion of the stagnant air from the lungs must be of favorable influence upon the change of matter in the human body, in so far as the entry of oxygenated air into the lungs is thereby increased, oxygen forming one of our most important means of nourishment. Those who wish to expand their chests, Dr. Kunze says, should mount a velocipede.

The Navies of Britain and France.

Under this heading the *Engineer*, in a lengthy article, discusses the pros and cons of a possible war between England and France. We make a few extracts:

A portion of the French press has latterly adopted a threatening tone toward England. Our occupation of Egypt has lasted too long, and has excited the jealousy of our neighbors. Hence we are told a war with England would be popular, seeing that "no general mobilization would be necessary"—we quote from the *Standard*—"as an invasion of France was not to be apprehended, and any landing of a French army in England need not be contemplated. The object of the war would be to vindicate the rights and position of France as a Mediterranean power, and to effect this only the navy, and perhaps a *corps d'armee,* certainly not more, would be needed. The landing of twenty or thirty thousand men in Egypt would not be a work of insuperable difficulty, and this would entail the capitulation of the small British force engaged there. That once effected, England would probably be glad to sue for peace, especially as her navy was not now in a posion to cope with that of France." Taking this as a sample, it is interesting to examine the data on which the soundness of this statement can be tested; that is to say, to look briefly at the relative strength of the French and British navies, and at our general position in the Mediterranean.

We submit lists of British armor-clad ships, which may, we think, be as fairly representative of their strength at the present moment as any we have seen. From this the British coast defenders of the Glatton class are omitted. The French are included as being available for European war generally.

Assuming, then, that the British fleet of regular fighting ships is about 20 per cent stronger than that of France, we may pass on to torpedo boats, and lastly transport and troop ships. In the former we fear the French are considerably in advance of us, though we know of no recent statistics published on the subject, and progress is rapid in this branch of building. In transports, on the other hand, France is very weak.

To place troops in Egypt, the French navy would have to force its way past our Mediterranean fleet, and make good a landing, which would constitute a serious operation of war. In seems to be thought in France that because their troops muster in hundreds of thousands, where our thousands are reckoned in tens and twenties, they would compare with us equally well in sending an expedition consisting of thirty thousand men across the seas. This is a great error. We believe that our blows would be found far reaching and quick, if not very heavy; and that no power could carry out this class of undertaking with the ease and speed of England. Abyssinia, Ashanti, Egypt, and the Zula war have all called into play the necessary machinery for this class of operation, while such machinery is habitually working in India. At the present moment we have about thirty thousand men in Burmah. The state of the country, no doubt, has been the object of a considerable measure of public attention; but who has heard of any trouble or effort in sending the troops there, or supplying them? The French, who come next to ourselves, make more fuss about the transport of ten thousand men from Marseilles to Algiers than we do if we send double the number to the remotest habitable quarter of the globe.

To land thirty thousand men in Egypt, then, France would have to muster her fleet unperceived in the Mediterranean, to make war without a week's notice, and then, without any delay, to destroy the British Mediterranean fleet entirely.

If our power of supplying Egypt from India, without disturbance or trouble, be compared with the project of the French crushing our fleet and landing and supplying an expedition from the Mediterranean, it would be concluded that France could hardly devise an operation more calculated to fail than this attempt to drive us out of Egypt.

We must, however, look at war with France in a general aspect. It does not at all follow because Egypt is the provoking cause, that the fighting need take place in Egypt. What if France declares war, and at once strikes us, where she of all powers can hit hardest, in our soft place, our commerce? This, we confess, is a much more serious matter. This is the danger to which we and many in this country have long called attention. It is to meet this that we have latterly been so much more in earnest in building swift cruisers Undoubtedly this is the question of the day as to England's defense, and in the case of France as the enemy, raised in its most serious shape. Suffering and loss would be entailed on England.

Then, again, other nations would suffer as well as ourselves. When we find that seven-eighths of the carrying trade of the world is in British vessels, it exposes a very vulnerable object to attack undoubtedly, but at the same time an object that concerns the world generally, and not England only.

France herself would feel the stoppage of her trade sufficiently to prevent such a war being popular for long, in spite of the light hearted way in which some French writers speak of it.

We have little doubt that there is too much good feeling and good sense in France to provoke such a catastrophe; but the bare possibility ought to spur us on to the construction of the classes of vessels specially suited to protect our commerce.

BRITISH ARMOR-CLADS AVAILABLE IN THE IMMEDIATE FUTURE.

Name.	Date of launch.	Displacement.	Speed.	Maximum armor.	Armament. Primary guns.
		Tons.	Knots.	In.	
Hercules	1868	8,680	14 0	9	8—18-ton M.L.
Monarch	1868	8,320	14·9	10	2—24 "
Audacious	1869	6,010	12·8	8	10—12 "
Invincible	1869	6,010	14·1	8	10—12 "
Sultan	1870	9,200	14·1	9	8-18 "
Iron Duke	1870	6,010	13·6	8	10—12 "
Hotspur	1870	4,010	12·7	11	2—25 "
Swiftsure	1870	6,910	13 8	8	10—12 "
Triumph	1870	6,640	12·0	8	10—12 "
Devastation	1871	9,330	13·8	14	4—35 "
Thunderer	1872	9,330	13·4	14	2—38 " / 2—35 "
Rupert	1872	5,440	13·6	14	2—18 "
Alexandra	1875	9,490	15·0	12	2—25 "
Dreadnought	1875	10,820	14·2	14	4—38 "
Shannon	1875	5,390	12 4	9	2—18 "
Inflexible	1876	11,880	13·8	24	4—80 "
Temeraire	1876	8,540	14·5	11	4—25 "
Belleisle	1876	4,870	12·2	12	4—25 "
Nelson	1876	7,630	14 4	9	4—18 "
Northampton	1876	7,630	13·2	9	4—18 "
Neptune	1878	9,310	14·2	13	4—38 "
Superb	1878	9,170	13·8	12	16—18 "
Agamemnon	1879	8,510	13 3	18	4—38 "
Orion	1879	4,810	13·0	12	4—25 "
Ajax	1880	8,510	13 3	18	4—38 "
Conqueror	1881	6,200	15·5	12	2—43-ton B. L.
Collingwood	1882	9,150	16 4	18	4—43 "
Colossus	1882	9,150	15·5	18	4—43 "
Edinburgh	1882	9,150	15 5	18	4—43 "
Imperieuse	1883	7,390	17·0	10	4—18 "
Rodney	1884	9,700	17·0	18	4—68 "
Warspite	1884	7,390	17·0	10	4—18 "
	—	250,640	—	—	—

FRENCH ARMOR-CLADS AVAILABLE IN THE IMMEDIATE FUTURE.

Name.	Date of launch.	Displacement.	Speed.	Maximum armor.	Armament. Primary guns.
		Tons.	Knots.	In.	
Ocean	1868	7,500	13·7	8¾	4—23-ton.
Marengo	1869	7,187	12·0	8¾	4—23 "
Suffren	1870	7,600	14·3	8¾	4—23 "
Richelieu	1873	9,100	14·0	8¾	6—23 "
Friedland	1873	8,540	13·4	8¾	8—23 "
Colbert	1875	8,457	14·4	8¾	8—23 "
Tonnerre	1875	5,574	12·3	13	2—28 "
Redoutable	1876	9,200	14·7	14	4—28 "
Trident	1876	8,800	14·3	8¾	8—23 "
Fulminant	1877	5,574	12·0	13	2—28 "
Amiral Duperre	1879	11,100	14·5	12½	4—48 "
Devastation	1879	10,100	15·2	15	4—48 "
Turenne	1879	6,400	14·1	10	4—15½ "
Bayard	1880	5,881	14·5	10	4—15½ "
Terrible	1881	7,200	14·5	19¾	2—75 "
Courbet	1882	9,700	15·0	15	4—49 "
Vauban	1882	5,900	14 0	10	4—18½ "
Amiral Baudin	1883	11,380	15·0	21½	3—75 "
Furieux	1883	5,560	12·0	17¾	2—47 "
Indomptable	1883	7,168	14·5	19¾	2—75 "
Dugueselin	1883	5,869	14·0	10	4—18½ "
	—	163,790	—	—	—

NOTE.—French ships are generally better furnished with secondary armaments of guns than the British.

Slipping of Leather Belts.

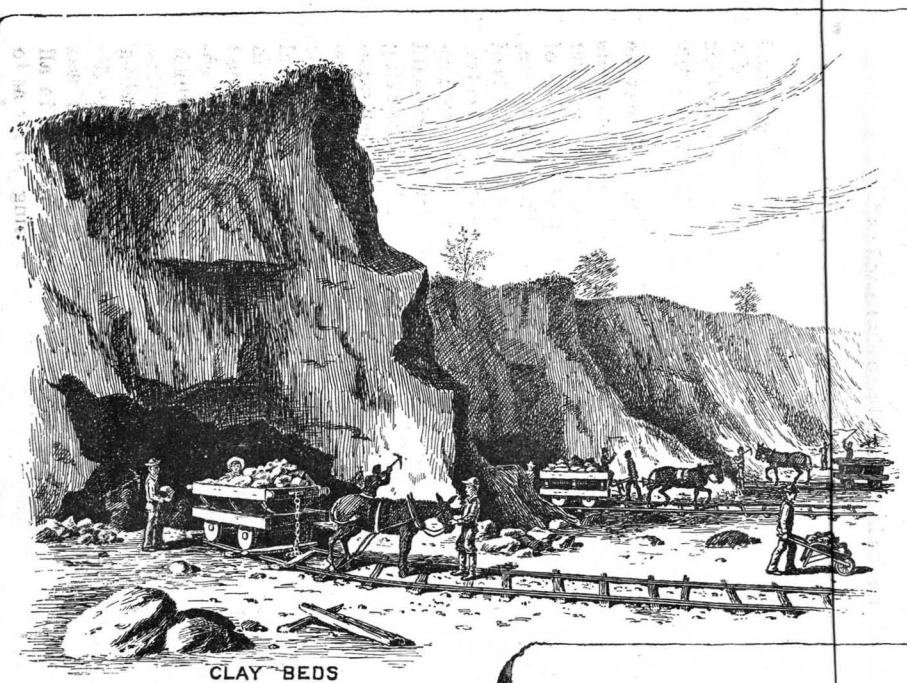
The slipping of belts is a great annoyance, not always remedied by tightening. The writer has known a slipping belt to be so shortened as to spring the shaft without preventing the slipping. The radical remedy is to keep the belt pliable, so as to hug the faces of the pulleys; but this is not always feasible. The belt may be softened by neat's foot oil or by castor oil. A siccative oil, like linseed oil, is unfit for a leather belt, as it has an affinity for the oxygen of the atmosphere and reverts to its acid base, which is injurious to the leather.

When a ready remedy is demanded for a slipping belt, the powder known as whiting, sprinkled sparingly on the inside of the belt, is least harmful of any similar application. Powdered resin is bad, as it soon dries the leather and cracks the belt, while it is difficult to get it out of the leather; whereas whiting may be wiped off or washed out with water. The use of water on belts, preliminary to oiling, is good. The belt should be washed on shutting down at night—or Saturday, after the close of work, is better—and then the oil applied when the belt is partially dry. Never oil or wash a belt while stretched on the pulleys. If iron-faced pulleys were always lagged with leather, there would be little complaint of the slipping of belts. But often this slipping is due to too much strain on the belt; there is economy in running wide belts—wider than is the usual practice. Many a three inch belt has to do duty for a four inch belt, to the annoyance of the operator and the ruin of the belt.

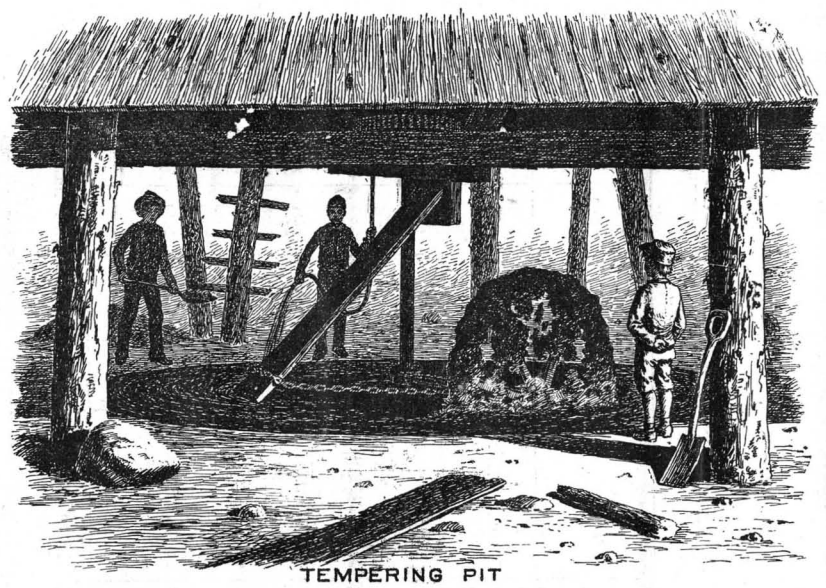
Neuralgic Ointment.

Menthol	45 grains.
Cocaine	15 "
Chloral	10 "
Vaseline	5 drachms.

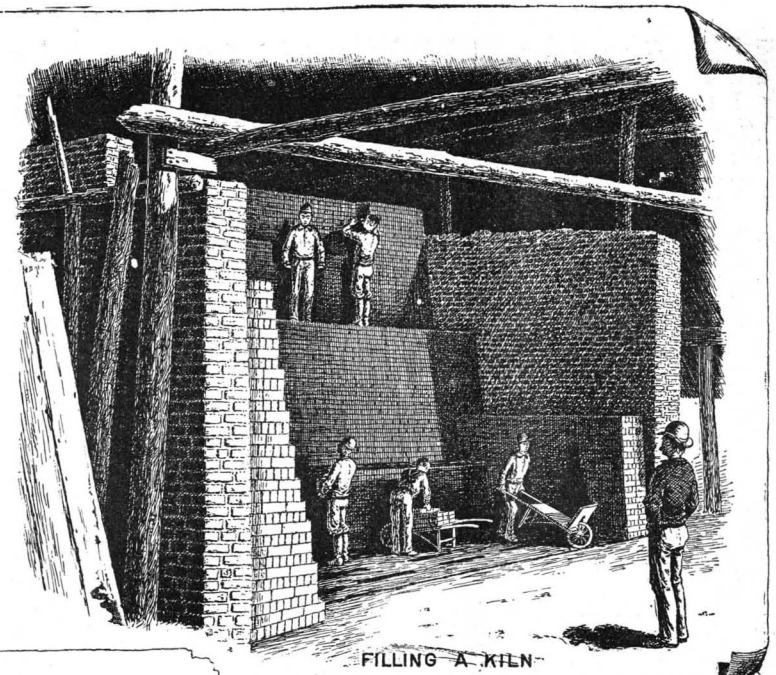
To be applied to the painful part (Galezowski).—*Jnl. Pharm. et Chim.*



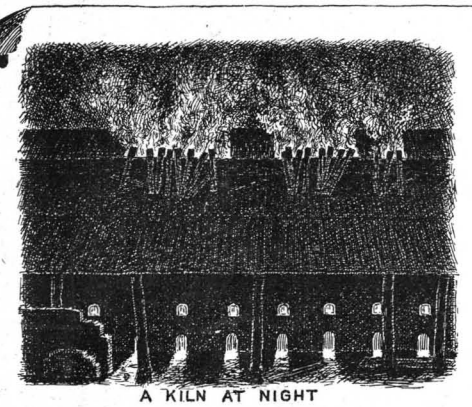
CLAY BEDS



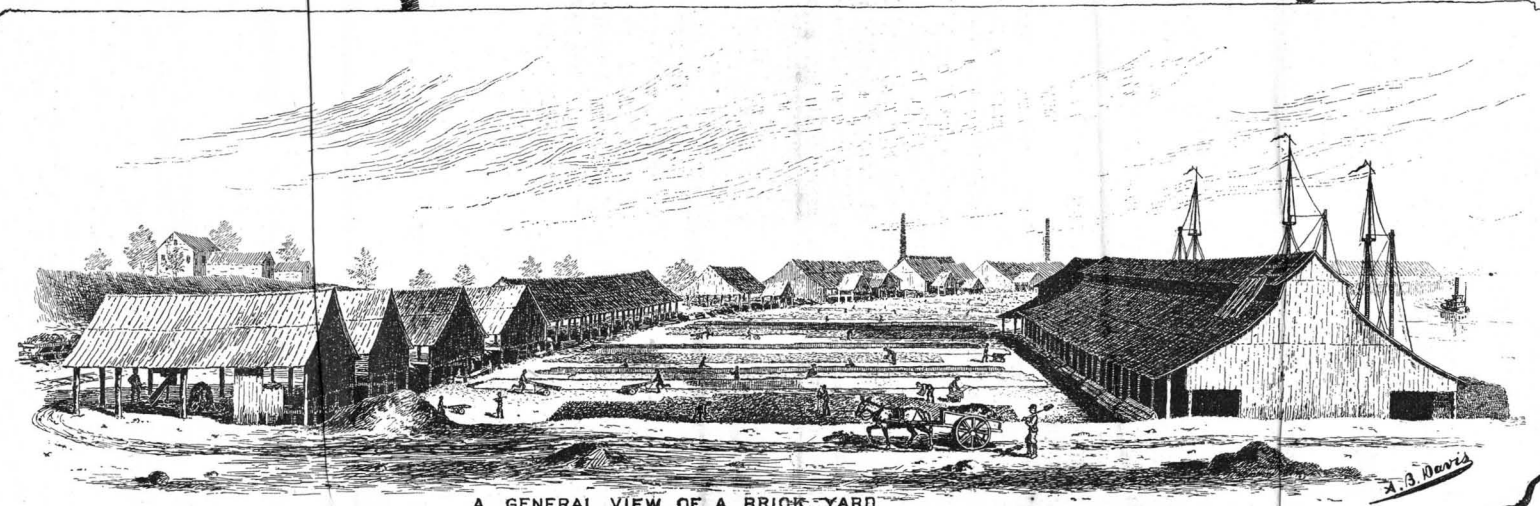
TEMPERING PIT



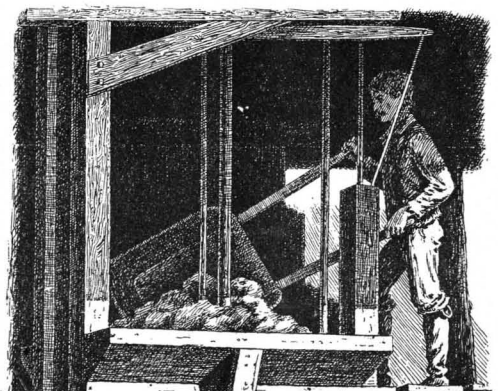
FILLING A KILN

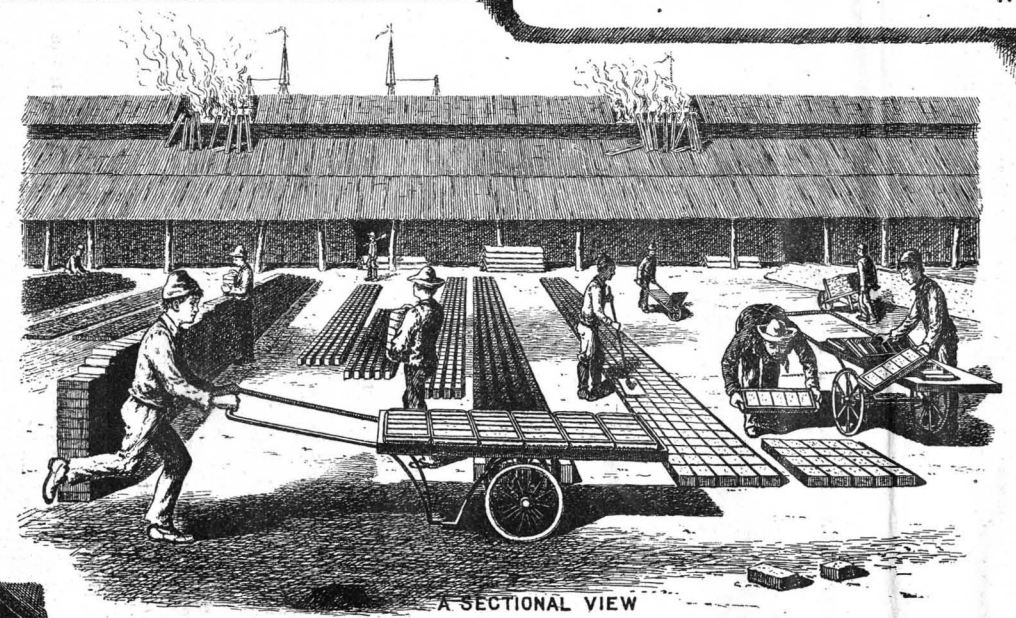


A KILN AT NIGHT



A GENERAL VIEW OF A BRICK YARD





A SECTIONAL VIEW

EDGERS AT WORK

MOULDING BRICKS

BRICK MAKING.

BRICK MAKING.

Perhaps there is no process so easy to describe and yet so hard to execute as the making of brick. The clay is dug, kneaded, moulded, and burned, and each detail appears so simple that it would seem any one ought to be able to transform a little clay into a good brick; but between the pit and kiln stand two characteristics which must be present in order to insure good results—these are experience and skill. No rule can be laid down for the handling of the clay; the routine which in one yard produces first quality would, if transferred without change to another, only cause miserable failure. The method of burning and the degree of heat which in one locality will turn the clay there found into good, hard brick would, in the next yard perhaps, yield only a kiln of spoiled and useless clay. So that it is safe to say that a brickmaker who had only worked one clay in one yard would be compelled to begin anew his apprenticeship if he were thrown in contact with different features.

The quality of a brick can only be ascertained after we know the exact conditions under which it is to be used, for the simple reason that a brick may do well in one place and yet be useless in another. Of course, a first-class hard-burned brick—in this neighborhood, those of a dull, dark red are preferred—will do in any locality; but in some circumstances the work is not harmed, and the cost is reduced, by the judicious use of other kinds. A hard brick which may be saturated with water, then frozen, and finally thawed, without showing any signs of being injured may be used almost anywhere. But a softer brick may stand exposure to the weather and yet be disintegrated if exposed to constant moisture underground. Another brick may not be able to endure either moisture or exposure to the weather, and yet may be well suited for inside work, where it will be kept dry. The adaptability of a brick of a certain quality for a certain location can best be determined by the maker, provided he thoroughly understands his business.

A brick yard, as usually laid out, consists of a large and perfectly level piece of ground called the yard, along one side of which are the rough sheds covering the kilns, and along the opposite side of which are the moulding machines, back of and near which are the tempering pits and clay banks.

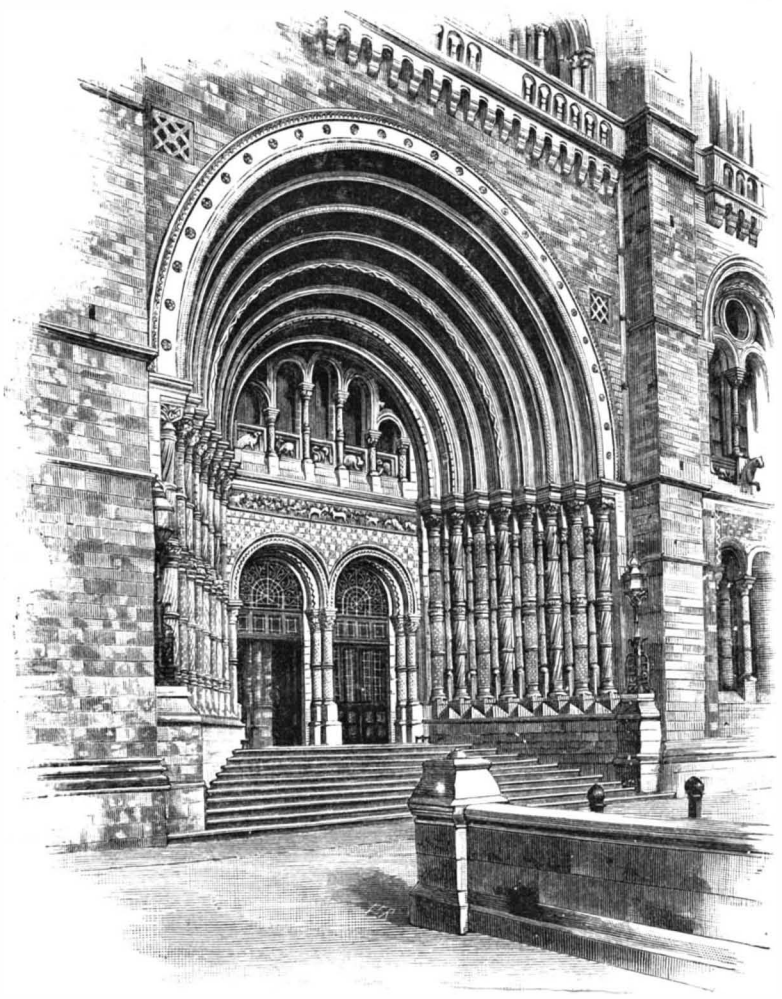
The clay is first brought to the tempering pit, which is a circular hole sunk three or four feet below the surface of the ground, and from twenty-five to thirty feet in diameter. In the center is a column, pivoted upon the top of which is a long horizontal arm carrying the wheel. This arm is revolved either by horses traveling around the edge of the pit or by steam. The wheel is large enough to rest upon the bottom, and as it rolls around it is gradually moved from the hub to the outside and then back again, so that in its passage the contents of the pit are surely and thoroughly commingled. The clay brought to the pit is mixed with sand, and sometimes with a different clay, this being governed by the quality of the principal clay. In each quantity of clay sufficient to make a thousand bricks is mixed from one to a little over one bushel of coal dust or screenings. Until recent years, wood alone was used in the burning of brick, which was a slow and, as wood became scarce, an expensive operation. The mixing of fine coal with the clay reduces the time of burning to from three to four days, lessens the cost, and insures a more equal and thorough burning of the entire kiln.

From the tempering pit the clay passes to the grinder, placed just at the edge of the yard. There is a vertically placed box, in which revolves a shaft carrying blades which force the wet clay down and through an opening in the bottom of one of the sides. The mould, which is a frame having spaces the size of the brick, is first sanded and then placed on a platform beneath the opening, when the clay is forced into each space by a descending plunger operated by a short crank on a shaft driven by the main shaft of the grinder. A forward movement of a lever by the moulder draws the filled mould forward, when it is placed on a platform barrow. When full, the barrow is rapidly run to the yard and the moulds emptied, the brick lying flat upon the ground. When partially dried by the sun, they are turned on edge by an edging machine, which resembles the mould in shape, but is not quite so deep. As the bricks leave the mould, their edges are apt to be rough and slightly drawn out or feathered. This is removed by spatting with a light board, of such size as to cover a mould of bricks, attached to the center of one surface of which is a long handle. Where there is plenty of room, the bricks are left in the yard until ready for the kiln. In smaller yards they are put in hack, that is, they are piled up in a long row six or eight bricks high. When there are indications of rain, two boards nailed together along their edges to form a right-angled trough are placed on top, while other boards are rested against the sides of the bricks, which are thus protected from the water.

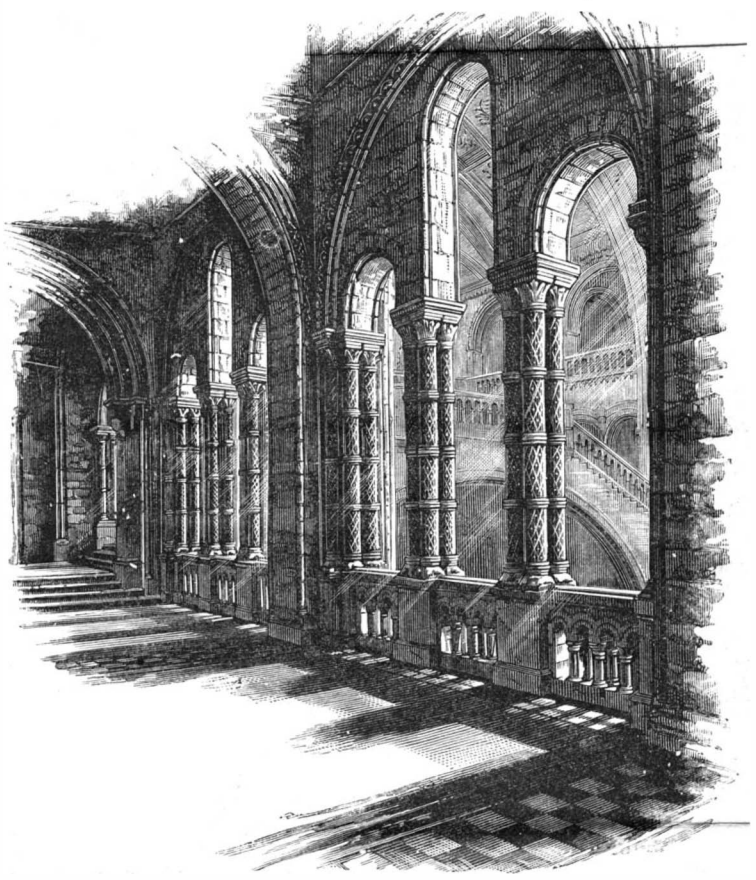
From here the bricks pass to the kiln, in which they are placed on edge, with the longest dimensions of every alternate row running in the same direction. Between every two bricks there is a small space left for the passage of the heat, which, owing to the alternating arrangement of the rows, is obliged to take a most roundabout road from the arch to the top. The arches extend through the kiln, and in them at each end the wood for the fire is fed. After the bricks have all been set, the outside is covered with a plaster of clay that prevents the escape of heat. The fire in the arches is started gradually and increased in intensity, and continued as long as the experience of the burner dictates. The small particles of coal distributed through the clay assist most materially in producing heat, and render more sure the even burning of the whole kiln.

For convenience, the bricks from a kiln may be placed in three divisions: those subjected to the greatest heat, near the arch, those subjected to the least heat, near the sides and top, and those in between. In the upper bricks—sometimes known as salmon—small particles of unburned coal may be detected; in the middle bricks, only the small cell formed by the coal remains; while the bricks which have been unduly heated are shrunken and glazed sufficiently to close these cells. The bricks from the center are the most valuable, and are most sought after by builders, although the others, especially the salmon, have their uses, as was explained in the beginning.

Before the clay can become a brick, it passes, in the most common method of brick making, through the following steps: Digging the clay, shoveling in carts, dumping in the pit, and tempering; shoveling on barrows and wheeling to the grinder; moulding, putting on trucks, carrying to yard and dumping; spatting, turning up, and hacking in the yard; putting on trucks, tossing up in the kiln, setting, tossing out of the kiln, and dumping from the wagon at the place of building. It seems strange that each of a thousand articles can be handled separately so many times and then delivered at a cost of only from six to eight dollars. As one of the oldest and most experienced brickmakers in the country said to the writer: "It is doubtful if any other manufactured article, weighing from four to five pounds, can be handled seventeen different times, moved considerable distances, be subjected to a high temperature for a long time, and be finally delivered, sometimes many miles from the clay bank, at a cost of only a little more than half a penny."



PRINCIPAL ENTRANCE, NATURAL HISTORY MUSEUM, SOUTH KENSINGTON, ENGLAND.



GALLERY AROUND HALLS, SOUTH KENSINGTON MUSEUM.

THE SOUTH KENSINGTON MUSEUM.

The great and beautiful building, completed in 1881, for the reception of the overflowing treasures which the British Museum could not conveniently accommodate, has received high commendation for its architectural merits and for its special fitness for the purposes for which it was designed, and is now one of the places which most strangers visiting London make it a point to visit. It contains the departments of zoology, geology, mineralogy, and botany of the British Museum, under the style of a Museum of Natural History, and is open to the public free on three days of the week, there being a charge of sixpence on other days.

Some idea of the character of the building may be obtained from the accompanying illustrations, one showing the main entrance and the other a portion of one of the galleries. The principal materials of the building are red brick, buff and gray terra cotta, with greenish gray Cumberland slates and bands of Welsh slate repeating the banding of the terra cotta. The interior, as may be inferred from the portion represented, consists of courts and corridors of graceful proportions, the numerous columns and arches being richly ornamented, a distinctive feature of such ornamentation in panels and arches consisting of representations of many of the varied forms of the organic kingdom. There are many boldly designed animal forms in silhouette along the lines of crestings, while in panels under the windows are reptiles and other allied forms in high relief. One of the panels in the entrance hall represents a pair of herons, one of which has just captured a lizard; and a panel on the balustrade has a pair of grouse, with young ones resting in the herbage. The idea of representing, in the decorations, the object for which the structure was erected has been carried out so far as possible in all the details, one enthusiastic critic going so far as to say of the building that "the facade is an open book, whereon are recorded, in a language which all can read and understand, the inexhaustible beauty and

wonder of this world in which we live." Architecturally, the building is not predominantly either classical, Romanesque, or Gothic, but rather a combination of elements of all three styles, with special features and adaptations that do not belong to either. It is a noble structure, and well sustains throughout the high impression always made upon the educated observer entering its magnificent central portal.

East African Drugs.

Of curative drugs, the East African manifests but little knowledge. Near Lake Ugombo, a small, wild aloe, when the green skin has been peeled off, forms an ice cold and healing application to burns; and in the neighborhood of Dar-es-Salaam, a highly aromatic plant, with hairy purple stalks, called *arcazamudi*, is reputed a good native cure for pains in the stomach. The Somalis occasionally eat the local variety of dragon's blood, a resin of acidulous flavor obtained from the *moli* tree (*Dracœna schizantha*). Between Zanzibar and Dar-es-Salaam occurs a creeper with bean like, hairy, S-shaped pods having severe stinging powers; it is about four inches long, of yellowish brown color, and is called *upupu*. The pain yields to cowdung and wood ashes. In the same region, a broad bladed grass, called *mwanga mwitu* enjoys some fame as a styptic.

Arrow poisons come much more prominently within the range of native study, and most tribes use some description of vegetable poison for anointing their spears and arrows. The most important is a species of *Strophanthus*, either *S. hispidus* or *S. kombe*, which will probably prove to be the sole source of this class of poison used on the eastern coast, from Zanzibar to Somali-land, and even far into the interior. The plant is a runner, bearing large, rough ribbed leaves, arranged in clusters of three or four together. Each shoot consists of three branches, of which one bears the seed and the other two the leaves. The flower is yellow, with curiously tailed petals. The seed has the form of a huge military frog button, with lobes nine inches long, and is the direct source of the poison. This, according to St. Vincent Erskine, is called *umtsuli* in Gaza or Southern Mozambique, and is so energetic that men wounded by arrows in the fleshy part of the leg have been known to die within three hours, and with small bucks the poison takes effect before they can run out of sight. He likens the active principle to strychnine.

These facts quite accord with the description given by R. W. Felkin and A. W. Gerrard (*Pharmaceutical Journal*, April 9, 1881, p. 833) of the poison used by the Wanika and Wakamba tribes, west of Mombasa, except that several roots are supposed to contribute to the deadly effect. These authors mention an antidote composed of sundry roots reduced to charcoal, which, however, proved a failure on trial. Careful investigation of the *umtsuli* reveals the fact that it is a powerful cardiac poison, as powerful as digitalin, and more powerful than veratria, when injected under the skin. But it causes only nausea, vomiting, and some weakness when taken by the mouth.

The flesh of animals killed by this poison is eaten by the blacks without ill effects. Probably identical with this is the "poison tree," from the roots of which the natives of Somali-land extract a black and pitchy substance for poisoning their arrows. Perhaps, also, the pitch-like poison obtained from the boiled-down bark of a tree used on the Rufiji River for application to arrows, lances, and even bullets, and the *muavi*, or poisonous decoction of the bark of a tree, employed in the trial by ordeal of the natives of the Nyassa and Zambesi valley, is the same article under another guise.

Indulgence in narcotics appears to be confined to tobacco, which is very commonly grown under cultivation. It is a special product of the Handei district, whence considerable quantities of the sun-dried leaf, beaten into little round flat cakes about two inches in diameter, are sent down to Pangani for export.

The tobacco is coarse and strong, but of fairly good flavor. The Kiswahili use water pipes (*kiko*), made of gourds of various shapes. They swallow the fumes in smoking, and seem to enjoy the paroxysm of coughing which results.—*Jour. Soc. of Arts.*

ACCORDING to a report of the Church Temperance Society, there are in New York, the metropolis of the New World, 10,197 liquor saloons, 447 churches, and 121 public schools.

THE REPAIRING OF TANKS AND RESERVOIRS.

We illustrate in the cuts accompanying this article an excellent method of repairing reservoirs in general and tanks, such as are used for the reception of gas holders. It involves the application of a coffer dam, which may be made of any appropriate shape. One is shown as applied to the treatment of a crack in one of

BOTTOM SECTION OF COFFER DAM AGAINST TANK WALL.

the gas holder tanks of the Consolidated Gas Company of this city. The apparatus was constructed and used at the suggestion and under the superintendence of the engineer of the company, Mr. William T. Lees. To the gas engineer this process offers the complete solution of one of his most vexatious problems.

When such a tank wall breaks, the rupture, as a rule, is vertical, and runs down nearly to the bottom, a distance of 20 to 35 feet. It is usually of sufficient extent only to cause a loss of water, not enough to exhaust the tank in spite of all efforts. The general way of mending such is to pump out the water, cut the brick away for a foot or two in width, and rebuild the space. Then the tank is filled again. In many cases, after all this has been done, the crack reopens in about the same place. When the water is pumped out, the walls tend to contract under the external pressure, thus partially closing the break. Then, after repairing, when water is readmitted, the hydraulic pressure, re-establishing the balance, makes the walls assume their old position, and the crack opens as before. It was with a view of avoiding the shrinkage under compression and subsequent expansion of the walls that the coffer dam was applied. The course of reasoning was this. The water, while present in quantity to fill the tank, was assumed to keep the crack open to its widest extent. This seemed to offer the proper conditions for repairing it. If well stopped under these circumstances, there seemed little or no possibility of its opening again.

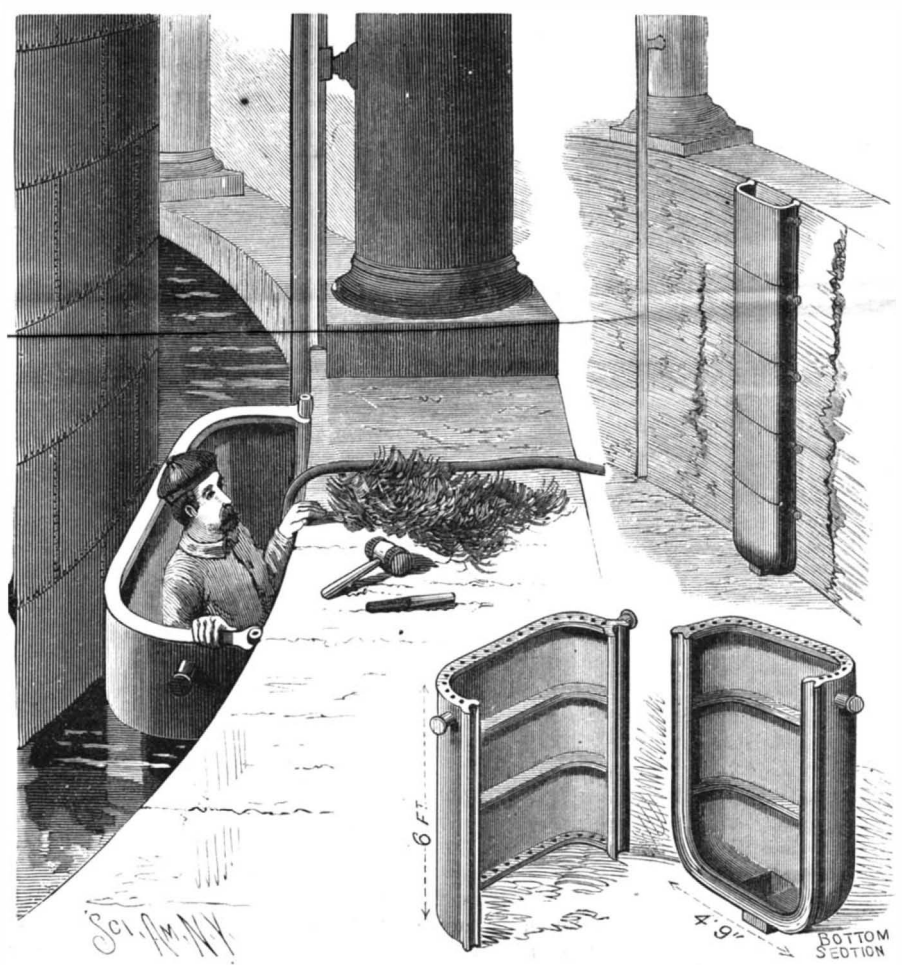
The tank in question was about 170 feet in diameter and 70 feet deep. A cast iron coffer dam, of U-shaped section, was constructed in sections, 6 ft. long and 4 ft. 9 in. in width. Flanges, faced off and perforated for bolts, were provided at the top of the lower section and at the top and bottom of the others, for attaching them together. The bottom section was closed at the base, and had a small downward extension or well to facilitate pumping. Studs or lugs were provided by which to lift the whole. A semi-circular groove was carried around the edge designed to come against the sides of the tank. A 2 in. India rubber hose, with ¾ in. aperture, was provided to act as packing. The dam was applied as described below.

The sections were all screwed together, while lying on the ground, with bolts and nuts, so as to secure watertight joints between them. The hose was placed in the groove, and by blocks and falls the united sections were raised to a vertical position and lowered into the tank. Several of the lugs were used for attachment of the slings, so as to provide against accident. When the dam was in place, having the crack within its opening, the water was pumped out by a large pump. As soon as adhesion to the tank wall was thus secured, a small steam siphon sufficed to keep it dry. Thus a space was obtained nearly 5 ft. long and 15 in. wide, extending some 30 ft. down. A man was sent into the dam, who, with hammer and chisel, calked the crack, driving oakum into it until it seemed perfectly filled. The adhesion between the tank and dam under the influence of the pressure was so great that the weight of the structure (several tons) could be sustained perfectly without tackle.

It was applied in a somewhat contracted space, between the outer section of a gas holder and the tank. Where the corresponding space in other gas holder tanks is insufficient, more room can be procured by hoisting up the outer section.

The mending worked excellently. The anticipated results followed, and the tank is in use to-day.

An incidental advantage of the method is that there is no necessity of stopping the operations of the gas holder, at least as regards its inner section. The flange on the bottom of the outer section, it may be assumed, would in most cases interfere with the use of that section. The face of the dam was flat. The radius of curvature of the tank was so large that no corresponding shape of the face of the dam was necessary, the elastic hose accommodating itself perfectly to the slight bend requisite. The application of this method to reservoirs in general is so obvious as to need no mention.



COFFER DAM AND SECTIONS.—DAM APPLIED TO TANK.

Gas.

There are, says President A. C. Wood, Amer. G. L. A., about 1,080 gas light companies in the United States and Canada, and of this number 153 are set down, in a recently published list, as water gas plants. The total number includes small and isolated plants erected for lighting factories, mills, summer residences, and hotels, as well as those erected as auxiliaries to established coal gas works, and exclusive plants for lighting towns, cities, and districts.

During the past twenty or more years, the projectors of various water gas schemes have been indefatigable in their exertions to induce the established companies to adopt their processes; and, either by force or through threats of competition, demands for large sums of money, or by purchase, they have only succeeded in establishing this small number of plants.

When a man or company of men projects and establishes an enterprise that is for the accommodation and benefit of the public, they are to be commended and encouraged in such an undertaking. But I will defy the projectors of any water gas scheme to prove that, in a single instance, their operations have been for the public good or for the benefit of the gas consumer. Therefore it is not surprising that so few of the gas companies of the country have been induced to take

hold of these schemes; and, in fact, the only wonder is that the numbers mentioned above have allowed themselves to be inveigled or forced into it.

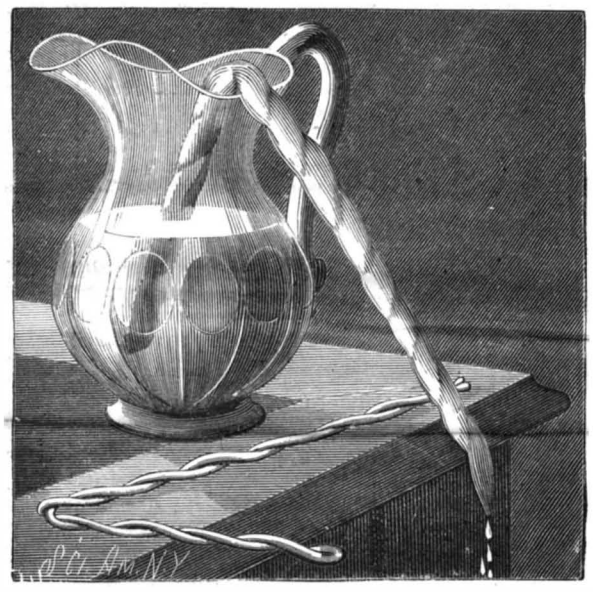
THE CAPILLARY SIPHON.

T. O'CONOR SLOANE, PH.D.

The experiment illustrative of the mechanics of a drop of water given in a recent issue of this paper exemplifies very well the action of films, or capillary force. It is a magnified illustration of a force that usually is only seen exercised on the smallest objects. In the pores of blotting paper or of a lamp wick, where the liquid columns are of almost infinitesimal area, it becomes visible. In larger tubes its action is almost null. If a dry and tubular substance, one that water can wet, has one end immersed in a vessel of water, the fluid will rise to a considerable height. If the object is bent into the shape of a siphon, and its free end is carried below the level of the water, hanging down outside of the vessel in question, it becomes a true siphon. By capillary force its pores are filled with water. Drops begin to form at its free end, and capillary action ceases as far as the porous substance is concerned. The action was dependent on the existence of surfaces of water concave toward their direction of motion. As soon as these disappear, capillary action with reference to the tubes is impossible. The porous substance now represents a mass of narrow tubes, and the water in the longer arm by true siphon action pulls over the fluid from the vessel, and delivers it drop by drop from its end.

A simple method of constructing a capillary siphon is shown in the cut. A piece of wire is doubled and bent into the proper shape. This serves as a framework, and around it strips of muslin are wrapped. Placed in a pitcher as shown, it soon becomes charged with water, and if time is given, it will empty the vessel. A towel placed in a pail of water and hanging over its side will empty it if the end falls below the bottom of the vessel. Otherwise it will draw the fluid down to the level of its own outside dependent end.

The reason for illustrating this very simple experiment is its practical value. In the treatment of inflammation of glands, notably of the mammillary glands, irrigation is often prescribed. At home this is usually effected by hand, wet cloths being applied to the place and continually renewed. This involves incessant attention. If, however, a cloth is spread over the seat of inflammation and a slow dripping of water upon it is maintained, the same result is reached, only in a more perfect manner. To this end the arrangement just described lends itself admirably. The wire frame can be made as long as necessary, so as to lead the drop



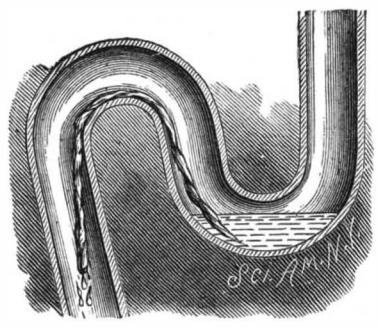
CAPILLARY SIPHON.

wherever desired, and a slow drip can be maintained by the hour on any place. An early use of this application for a period varying from several hours to one or two days may prevent many weeks of sickness. For personal attendance, always more or less uncertain, it substitutes definite mechanical action.

The same siphon may work to the detriment of health. A plumber's trap depends for its efficacy on its filling of water. If some threads get into it and are carried over the bend, as shown in the next cut, they may form a capillary siphon, and in time empty the trap and admit sewer gas.

The pressure producible by this form of siphon depends, as in any siphon, on its effective height. The measure of its force may be determined by experiment. A test tube, six or eight inches long, has a doubly perforated cork fitted to it. A little colored water is placed in the bottom of the test tube. A few drops of ink will answer as the coloring agent. A glass tube of small bore is arranged to pass through one of the holes in the cork tightly. A lamp wick is rolled up longitudinally and is passed through the other. It must also fit tightly, and should reach down nearly to the bottom of the test tube when the cork is in place. It is well, before putting the cork finally in place, to thoroughly wet the wick.

The cork, with the tube and wick passing through it, is placed in the neck of the tube. The wet wick, if of proper size, will fill so perfectly the aperture in the cork, through which it extends that air will not be able to pass. The outer end of the wick is placed in a vessel of water supported well above the test tube, and the whole allowed to stand. In a few minutes the



CAPILLARY SIPHON EMPTYING TRAP.

siphon will begin to work, and water will be carried by it into the tube. As the cork is supposed to fit tightly, and must do so for the success of the experiment, and as the small tube and wick both pass tightly through it, air cannot escape. Hence as water is siphoned into it, the pressure of the air increases, and the water rises in the small tube. This is the indicator or gauge of pressure. The smaller the bore of the gauge tube, the quicker the water will rise in it. If all is rightly proportioned, the pressure will show in five minutes, and in an hour the water in the gauge tube will rise up four or five inches.

It is well, before showing this experiment, to cause the lamp wick to act as a siphon for a few minutes, delivering water into some other receptacle. This acts as a trial of its efficiency, and if it operates well, then the success of the definite experiment may be safely relied on. The preliminary trial should be made with the wick passing through the cork. It is essential that it should tightly fit the aperture in the cork, but, at the same time, it must not be so squeezed that the passage of water will be interfered with.

As it delivers water very slowly, the water entering the test tube forms a layer on the surface of the water already present. If the outside vessel for supplying water is filled with clear water, the appearance of the layer of transparent fluid on the colored layer below is of interest. The pressure tube should dip well into the colored fluid, as the object in coloring the water is principally to cause the slender column to show well. If only slightly immersed, the uncolored water delivered by the siphon may enter it, making its column hard to discern.

The New York Elevated Railroad Structure.

The patrons of the elevated railways are, no doubt, deeply interested to know that the structure on which they ride daily is sufficiently strong to endure the strain to which it is subjected, and to that end I beg you to insert this communication, embodying a few facts, in reply to your editorial of October 14, headed "The Elevated Railways."

The "L" lines consist of thirty-two miles of structure, all of which is double track. They are divided into spans about forty feet long, each span being independent, and the ends of the girders resting upon transverse girders supported by wrought iron columns in one type of construction, the girders resting upon the columns.

The material is the best refined iron for bridge purposes, and has a tensile strength of not less than 50,000 pounds per square inch, the rapid transit act requiring that the strains on the compression and tension members be limited to 9,000 pounds per square inch, the shearing strain on the rivets to be not more than 7,000 pounds per square inch, a maximum deflection of the girders to be not greater than 1-1,500 of its length, the columns so proportioned as to have a factor of safety of five, and the foundations not to have a greater weight come upon them than 2,000 pounds to the square foot.

With the increased weight of the engines now in use, necessary to draw five loaded cars, in no case is any portion of the structure strained anywhere near the limit above referred to.

In a series of experiments made by the eminent English engineer Fairbairn, he concluded that a light plate girder of 20 feet span, if subjected to 100 daily deflections equal to one-quarter of its breaking load, would last 300 years. Now, our structure having a factor of safety from six to ten, the latter on Second Avenue, what may we expect as to the life of the "L" roads? Surely, not so serious a condition of things as set forth in your editorial.

We have during the past four years re-enforced the Sixth Avenue pin-connected structure so as to keep up the high factor of safety required by our charter, and fit it for the type of engines now in use. The Third Avenue line is undergoing the same additions, three-fourths of the work being completed. The Second Avenue line is designed for engines much heavier than those we are now using.

The elevated structures cannot consistently be compared with iron bridges of surface roads:

1. The spans of our structure are small in comparison.
2. The trains are much lighter.
3. The engines less than one-half as heavy.
4. The speed is from one-half to one-third less than on surface bridges.
5. A long train causes no greater strain than a short one, because one car only, or an engine and part of a car, can be upon a pair of girders or bridge at a time, no matter how long the train.

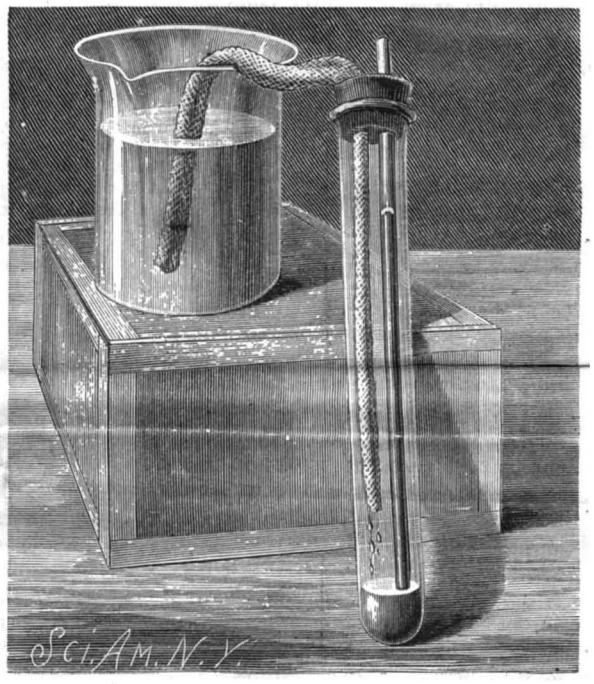
Pieces of iron taken out of the structure recently and carefully tested show that no deterioration has taken place.

A board of eminent engineering experts and builders of iron bridges made a thorough investigation, March, 1885, and reported that the structure was in better condition at the time than when first opened for business. Associated with these gentlemen was Professor Thurston, of the Stevens Institute of Technology, now connected with the scientific department of Cornell University, who made tests of the iron, and reported that there were no signs of crystallization, and was surprised at the uniform good quality of the iron submitted to him for testing.

A large and efficient force of men is employed by the company night and day to inspect the track and structure. Constant improvements are being made to relieve the structure from undue shocks, such as replacing fifty and fifty-six pound rail with steel rail weighing seventy pounds per yard, and the best devices for rail joints are being tested.—*F. K. Hain in New York Sun.*

A Gigantic Gas Holder.

Messrs. Ashmore, Benson, Pease & Co., Limited, of Stockton, have had for eighteen months in course of construction the largest gas holder in the world. It is designed by Messrs. George & Frank Livesey, engineers to the South Metropolitan Gas Company, and is being erected at their new works at East Greenwich, London. This gas holder, when completed, will considerably exceed in cubical capacity any other gas holder



PRESSURE PRODUCED BY CAPILLARY SIPHON.

in existence. The height of it, when inflated, will be 174 ft., and the diameter of it 250 ft., and it is calculated to contain 8,250,000 cubic feet of gas. It is constructed in four tiers, which telescope into one another, so that when not in use they lie flush with the ground in the concrete tank, which is excavated to receive them. The area covered by the holder is rather more than one acre in extent; its roof is without internal support, except when lowered, when it is supported by a wooden framing fixed in the tank, and on which it rests. To keep the holder in its proper position, there are 28 wrought iron standards, at equal distances round it, rising to the height of 178 ft., up which the guide rollers work. The total weight is approximately 1,700 tons, included in which is a considerable amount of steel. This holder will be the only one in the world exceeding in size either of the Birmingham corporation gas holders, illustrated in the SCIENTIFIC AMERICAN, vol. lv., No. 10.

FLOWERS.—It is estimated that about 100,000 species of flowering plants are now known to botanists.

ENGINEERING INVENTIONS.

A feed water heater has been patented by Mr. George Green, of Corpus Christi, Tex. It is composed of a series of pipes attached to half cylindrical heads, placed diagonally in the fire box of the boiler, and connected with its water space, being designed also to serve as a spark arrester and increase the fire surface.

A method of heating water in steam generators has been patented by Mr. Frederick G. Wheeler, of New York city. This invention covers an improvement on a former patented invention of the same inventor, and consists in first charging the generator with water at ordinary temperature, and then obtaining the initial heating by injecting superheated steam.

A spark arrester has been patented by Mr. Orlando T. Owings, of Le Mars, Iowa. The smoke stack projects into a cap, a deflector being supported from the upper end of the smoke stack, and having a central aperture, with a lid or cover, and other novel features, the device being simple in construction, and calculated to prevent sparks from passing out of the smoke stack.

A reversing gear for engines has been patented by Messrs. Robert Rutherford, of Reutchler, and Thomas Moore, of O'Fallon, Ill. An eccentric with a forked pin is adjustable on a disk attached to the crank shaft, a cam plate sliding in the disk, with diagonal grooves which engage with the forked pin, and other novel features, whereby a positive motion is given to the slide valve at all times, and the link commonly used for reversing is dispensed with.

An automatic danger signal has been patented by Mr. Errett E. Phillips, of New Castle, Pa. Combined with a signal operated by a slide is a chain mounted on sheaves and carrying a bar, a spring, and lever, with stem, and means for operating the slide from the chain, with other novel features, so that an approaching train will trip the parts and cause the signal to be displayed, the invention being more particularly applicable to points upon the track not visible from each other.

AGRICULTURAL INVENTIONS.

A harrow has been patented by Mr. Mathias C. Theisen, of Diana, Dakota Ter. This invention covers a novel construction of a harrow designed to be readily adjusted for use as a rigid or a flexible harrow, or as a smoothing harrow, or a straight toothed harrow, and at the same time simple, strong, and durable.

A combined drill and planter has been patented by Mr. William H. Halfaker, of Acton, Ind. This invention covers a novel construction and combination of parts for a machine that can be readily adjusted to drill or plant the seed, and to drill the seed at a greater or less distance apart, and which can be readily controlled and will be reliable in operation, however adjusted.

A corn and cotton planter combined has been patented by Mr. Joseph G. Davis, of Huntsville, Texas. This invention covers a novel construction, in which the various parts are so arranged that the number of grains planted in a hill may be regulated as desired, while the depth of the furrow may likewise be regulated as desired, the planter being calculated for planting cotton or other small seeds.

MISCELLANEOUS INVENTIONS.

A rein holder has been patented by Mr. Frank J. Gibbs, of Philipsburg, Pa. It consists of a novel construction of buckle adapted to be clamped on the rein, and having a loop for receiving the hand of the driver, making a simple, easily attached, and efficient hand hold or rein holder.

A fabric turfing or rug making implement has been patented by Mr. Damas M. Chamberland, of Duluth, Minn. It is a simple device for making a succession of loops in a fabric which forms the body of a rug, the device being one which can be conveniently held in the hands in making the rug.

A barrel vent has been patented by Mr. Frederick Hopkins, of Chicago, Ill. It is especially for use on beer barrels and similar vessels, and is so made as to admit air, to permit the withdrawal of the contents at the top, and yet prevent the passage of gases from the barrel.

A laundering machine has been patented by Mr. Robert H. Cornett, of Livingston, Kan. It is for washing and wringing clothes, and has a washer so fixed in a tub that by turning a crank the clothes are passed between a main roller and bed rollers, some with corrugated and some with plain faces, while a wringer is held in convenient attachment to the tub by brackets.

A process of extracting tannin from wood has been patented by Mr. Edouard Tavernier, of Paris, France. The process involves the use of a specially devised centrifugal machine, by the use of which the heavier impurities of a tannin extract are eliminated from the lighter and purer portion, the latter liquid being drawn off from a point near the center of rotation.

Wall paper forms the subject of a patent issued to Mr. William Campbell, of New York city. It has a design or figure, with a continuous surface of flock of a single color, through which the design appears, the design being first printed, the paper then entirely coated with glue, and the flock applied to the entire glue coated surface.

A method of blasting earth has been patented by Mr. Henry H. Bourne, of Manhattan, Kan. It consists in boring a hole of proper depth, inserting a tube, and exploding a small cartridge at the bottom of the tube, then filling the chamber caused by this explosion with the desired explosive, withdrawing the tube, and firing the larger charge.

A vehicle has been patented by Mr. Charles Dinsmoor, of Warren, Pa. It is made with a series of wheels journaled in connecting links, with a track consisting of hinged links, to make endless tracks, whereby springs can be dispensed with, and the vehicle is designed to have a smooth and easy motion, without jolt, strain, or friction.

A half sole for boots has been patented by Mr. Darius Banks, of Morrisville, Pa. It is formed with a V-shaped recess at its rear, into which a metallic fastening plate is inserted, with apertures for nails or other fastening devices, for securing the half sole to the instep sole, the main body of the half sole being secured to the boot or shoe by nails in the ordinary way.

A sewing machine improvement has been patented by Mr. Otto L. Schastey, of New York city. It is for machines that sew with a single thread, used for making a cross or binding stitch, and has its throat plate made movable with the other parts, the invention being an improvement on a former patented invention of the same inventor.

A conveyer has been patented by Messrs. Job C. Conger and George W. Henderson, of Columbia, Mo. It is designed to convey grain, flour, sand, etc., in such way that the material will not be injured in handling, and has a reversible flight, with a stop, whereby the flight is held in a positive vertical position or allowed to slant as desired.

A chin rest for violins has been patented by Mr. William V. Arthur, of Oakland, Cal It is made of hard wood or other suitable material, and has its top surface hollowed out to adapt it to receive that part of the jaw usually rested on the top, the rest when in place being above the belly of the violin, and not in contact with any of the vibrating parts.

A picture hanger has been patented by Dora Mitchell, of Ottumwa, Iowa. It consists of a pole made in sections hinged together and provided with a fastening at the joint, with a double forked head piece fixed to one end and a spring clamp fixed to the other end, making a light, strong, and efficient tool for hanging and taking down pictures.

A spark arrester has been patented by Mr. John H. Optenberg, of Oshkosh, Wis. This invention covers an improvement on a former patented invention of the same inventor, in a novel arrangement whereby the main deflector may be raised from its normal position to one that will allow a free draught through the smoke stack, with other novel features.

A hand mirror and brush has been patented by Mr. William Booth, of Leominster, Mass. This invention covers an improved frame, with a back plate, a handle front plate on the handle extension of the back plate, and a grooved band frame surrounding the whole, in such way that these articles can be made at less expense and with greater facility than when made in the ordinary manner.

A stock car has been patented by Mr. Benjamin F. Williams, of Springville, N. Y. The car is divided by four partitions, which are pivoted so their lower ends may be swung up against the roof of the car, there being movable feed troughs, a slide rod for securing the heads of the stock between bars, and other novel features, whereby the stock may be kept, fed, and watered.

A hydrocarbon burner has been patented by Mr. William Barraclough, of Balmain, near Sydney, New South Wales. It consists of a reservoir and burner connected by intermediate pipes, one being filled with glass, and there being heaters and mixing tubes, whereby heated air can be mixed with kerosene vapor, with other novel features, for burning the vapor without the aid of a wick.

An opera chair has been patented by Julia A. Callahan, of Brooklyn, N. Y. It has a garment knob or button on the top of the chair back, a hook or support pivoted to the side of the chair back, and a hook or support pivoted to the chair near its lower end, a drip cup being fastened to one of the rear legs for receiving the lower end of an umbrella stick or cane, the chair itself being of the usual construction.

A combined blackboard and map support has been patented by Mr. Henry E. Hayes, of Brooklyn, N. Y. It consists of rods, three in a set, of which two sets are used, the upper ends of each three rods being inserted in the angles of a triangular case, with other novel features, making a readily adjustable support for maps, charts, etc., and one which will allow of their being easily reversed.

An apparatus for cutting circular wooden plates has been patented by Mr. Isaac M. Rhodes, of Hancock, Mich. In the base plate is a screw, to secure the plate to the wood to be operated upon, and there is an upwardly extending hub, which forms a central bearing for an operating handle that carries adjustable cutters, which can be readily arranged to cut in a circle, as desired.

A tricycle has been patented by Mr. William N. Smith, of Bad Axe, Mich. The invention consists of an interchangeable train of gear wheels rotating the driving wheels, and operated by treadles, with a steering device and an adjustable seat, making a machine especially adapted for regulating the speed as required for racing, traveling on rough roads, or in hilly country.

A wheeled vehicle has been patented by Mr. William B. Kelly, of St. Louis, Mo. It has a series of independent wheels arranged between opposite sides of the platform, springs sustaining the load on the wheels, and wheel guards so arranged as to strike any obstruction and lift the wheels successively over it, the springs afterward forcing the wheels back to the ground.

A gate has been patented by Messrs. Henry P. Bullock and Henry P. Cayce, of Jonesborough, Texas. Its construction is such that it may be opened automatically by the depression of a platform in the gateway or by the pulling of cords pendent from a support at or near the gateway, being designed especially for a farm gate which shall be simple, inexpensive, and self-closing.

A shutter for photographic cameras has been patented by Mr. Cyrus Prosch, of New York city. A pair of apertured shutters are pivoted in a case intersecting the camera tube, and arranged to swing past each other, to open and close the camera tube, a spring-actuated lever operating both shutters simultaneously, the device being adaptable for either instantaneous or time exposures.

A vegetable and root cutter has been patented by Mr. Ira P. Cribb, of Canandaigua, N. Y. The frame has two hoppers divided by a partition, a screen, troughs, a reciprocating cutter frame provided with horizontal and vertical knives, and other novel features, the whole so arranged as to work efficiently and rapidly without danger of the machine becoming clogged.

A lock-up for printers' forms has been patented by Mr. Walter Lloyd, of Chicago, Ill. It consists of two bars slotted lengthwise, and two cross bars fitted thereto, all fitting into a tongue on the inner edge of the chase, the bars having ratchet teeth on their outer faces, and there being corner blocks to engage these teeth on the bars, and hold them in position as they may be closed up on the type forms.

A former for sheet metal vessels has been patented by Mr. Charles A. Wilbraham, of Poquonock, Conn. It has a bed plate to which a former block is held, one or more gauge bands fitting over the block and over each other, and a clamp adapted to hold the blank to the band or bands prior to bending the blank, with other novel features, whereby the bodies of sheet metal vessels can be bent or shaped truly with economy of time and labor.

A valve attachment for hydrants has been patented by Mr. Lyman G. Keyes, of Armstrong, Kansas. The chamber or case of the valve is connected to the lower water chamber by means of a bushing, the exterior thread of which is a left hand thread, and the valve and its chamber are so inserted that they may be disconnected from and lifted out of the hydrant case, saving the digging down around the hydrants for repairs from freezing, etc.

A middlings purifier has been patented by Mr. Ora L. Anderson, of Pleasantville, Ind. It has a vertical series of shaker frames, two vertical series of sieves mounted therein, intermediate conveyor troughs, a feed spout for one series, and an elevator landing from the conveyors below this series to the upper sieve of the opposite series, the machine being designed to thoroughly purify and grade middlings passed through it.

A stem winding device for watches forms the subject of two patents issued to Mr. Olof Johanson, of New York city. The invention consists in a key constructed with a ring and a U-shaped loop bent three times at right angles laterally, to adapt it to receive and engage with the crown of a stem winding watch, the construction also being such that the guard ring is attached to the rotary crown of the stem, to facilitate the easy and quick winding of stem winding watches

A take-up and let-off mechanism for looms for weaving broad silk has been patented by Mr. James Nightingale, Jr., of New York city. Its construction is such that the tension on the fabrics and warps is obtained from weighted levers, and not directly from the cloth beam, as in other looms, the adjustment of the fabric to the reed being entirely independent of the cloth beam, the only function of which is to carry the completed fabric, but not to give the same any tension.

An incased pile has been patented by Mr. John W. Crary, of Bluff Springs, Fla. The pile is driven in the usual way, and around it is built a platform suspended from cross bars on the top of the pile. Upon the platform and around the pile is built a brick casing, leaving a small space next the pile to be filled in with cement, the platform and its casing being sunk, as the casing is built, to or below the general level of the bottom, the space next the pile being finally filled with cement.

NEW BOOKS AND PUBLICATIONS.

MICROSCOPIC FUNGI. By M. C. Cooke, LL.D. Illustrated with 269 colored figures by J. E. Sowerby. London: W. H. Allen & Co. 1886. Pp. 262.

This work is of much interest at the present day, when the need for specializing microscopic studies is so apparent. The first impulse of the possessor of a microscope is to apply it to all objects, using it really as a scientific toy. In Mr. Cooke's manual there is presented a special field for its use; and it is by following precisely such lines of work as here suggested that the best discipline is secured and most real work is to be done with the instrument. The subjects of rust, smut, mildew, and mould are treated of, and, as is evident even from the title page, are most liberally illustrated. The cuts are beautifully colored, and are selected so that one quite ignorant of the subject would be guided along the road to a full knowledge of it as far as it has been developed. The recent origin of the study is animadverted on by the author, and the great relative importance of the cryptogams is insisted on. The main part of the work is in popular language, but an appendix of some fifty pages gives the botanical classification and descriptions of the fungi treated of in the book. An index closes the work.

THE GAS ENGINE. By Dugald Clerk. New York: John Wiley & Sons.

The author has in this work endeavored to represent the different steps by which the gas engine has, from a comparatively insignificant use in 1860, obtained the large employment it now has wherever small powers are required. The book also explains the science and practice of the gas engine, treating of the different types and the chemical and physical phenomena of combustion and explosion exhibited in the leading examples of these machines. The author, although himself the builder of a very successful gas engine, generously adds, while "many inventors have contributed to its progress, its present position is in the main due to the patience, energy, and commanding ability of one man, Mr. Otto." The conclusion is that a yet greater efficiency of the gas engine will probably be attained, and the direction in which to look for such improvement is in utilizing the pressure now lost at the exhaust.

MANUAL OF ASSAYING GOLD, SILVER, COPPER, AND LEAD ORES. By Walter Lee Brown. Chicago: E. H. Sargent & Co.

This is a second edition, revised and enlarged, of a hand-book especially designed for the use of those who have not had previous technical experience or scientific training. It is simple and practical throughout, all the methods and apparatus employed being explained in great detail, in what might be styled such a common sense way that beginners can readily follow the directions without the need of a teacher.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) C. D. asks: What metal or compound of metals can I use to make small castings as hard (or nearly as hard) as brass. Said metal must melt in a common coal fire. A. Use type metal, which you can procure at a stereotype or type foundry, or can obtain by melting old type.

(2) W. E. S. asks: Is there any kind of a liquid that can be obtained at a drug store that will not evaporate, and which has no sediment, or very little, and will not freeze above 5 or 10 degrees below zero? A. We recommend you to try glycerine, or it is possible that kerosene or coal oil might answer the purpose. The temperature you give is so extremely low that all ordinary liquids will congeal at it. A mixture of glycerine and water might answer your purpose.

(3) W. B. asks how to make sodium amalgam. When heated, the explosions are so violent that some is lost. Also how to make zinc amalgam; cold it will not amalgamate, and hot it explodes. A. The formation of an amalgam of sodium is apt to be accompanied by much violence, unless the mercury is in large excess. Make a strong amalgam in small quantities by heating in a covered vessel, and mix with more mercury. Zinc and mercury will amalgamate without the least difficulty if a little dilute sulphuric acid is added. It needs little or no heat.

(4) J. W. K. asks what size an electro-magnet would need to be to lift or attract a weight of 10 pounds through a space of ¼ inch, and how many Leclanche cells? A. There is no rule for calculating the precise size for given strength of an electro-magnet. Leclanche cells are not good, except for intermittent work. Your magnet should be ten or twelve inches long, with ¾ inch cores, and 5 to 10 Leclanche cells would work it. 2. What effect will mercury have on lead if the lead be immersed in it, or *vice versa*, *i. e.*, will the mercury be affected? A. The lead and mercury will amalgamate, and the mercury will be injured for ordinary uses.

(5) Waco asks: 1. Can you tell me of any combination of minerals or chemicals that on coming in contact with extreme cold would produce heat? Can such a thing be done? A. Theoretically if the proper junction of a thermo-electric battery were cooled, an electric current will be generated, which current can be made to produce heat. 2. Would an engine using oil for fuel, and requiring only 30 lb. steam to give it the power of the ordinary locomotive "at its best," be of any market value? A. We cannot pronounce upon the value of such an engine without further and fuller details. It is all a question of economy of fuel.

(6) W. F. H. asks: 1. In an electro dynamo machine of the Gramme and Weston and other types, the commutator consists of as many segments as there are wires leading from the armature. Will a commutator consisting of 2 or 4 segments answer just as well, provided opposite ends of the armature wires are connected to opposite segments of commutator, or will there be a diminution in strength of the current? A. Any reduction of commutator leaves will impair the working of the machine, or may even stop it. The wire in the armature must form a full and complete circuit. 2. Have you working plans for a larger machine than the Siemens in SUPPLEMENT No. 161? A. We have not, but expect soon to publish a description of a larger machine.

(7) F. M. C asks: How many pounds of wire is required to make a spark coil to light one gas light? Also how many and what kind of batteries it would be best to use? A. Two or three pounds of No. 16 wire with two Leclanche cells should suffice.

(8) E. M. L. asks for directions for manufacturing a liquid shoe dressing. A. Take of shellac one-half pound, alcohol three quarts. Dissolve, and add of camphor one and a half ounces, lampblack two ounces.

(9) T. P. E. writes: If in fitting a crank and shaft or any other work, you get a loose fit, where you should have it to drive, and you heat the shaft to a low red, and allow it to cool, repeating the operation until the shaft is permanently large enough to make a driving fit, will the quality of the iron be injured thereby? A. The heating and cooling of the end of a shaft many times for the purpose of enlargement to receive a driven-on crank causes considerable change in its molecular structure, and is not considered safe where severe work is required from the crank. For ordinary use or for small shafts, there is no objection, except that it is bad practice.

(10) W. M. R.—For computing the safe working pressure for cylindrical shells of boilers: Divide the assumed tensile strength of the iron or steel of the boiler plate by 4 for safety, and this quotient again by one-half the diameter of the boiler shell or cylinder in inches. Then multiply the last quotient by the thickness of the plate in decimals of an inch, and again this product by 0·60 for single rivet seams, or 0·72 for double rivet seams. For example, assuming 50,000 pounds as the ultimate tensile strength of your iron, and a 50 inch boiler, the figures will be for ¼ inch iron, single riveted seams:

```
4)50,000
25)12,500
      500
      .25
   125.00
      .60
    75.00
```

or a safe working strength of 75 pounds per square inch. The heads should be 50 per cent thicker than the shell, and well braced. For internal square firebox boilers for flat stayed surfaces: Divide tensile strength of iron by 4. Multiply quotient by the least area of stay in decimals of an inch. Divide last product, the number of square inches between 4 contiguous stays. Multiply last quotient by the thickness of the plate in decimals of an inch, for the safe working pressure. For example: The leg sheets of a locomotive type, with stays 5 inches center to center, ⅞ in. stays, $\frac{5}{16}$ in. plates:

```
                    4) 50,000 lb. t. s.
                       12,500
Area of stay.....        .6
Area between stays 25 sq. ft.) 7500.0
                              300
Thickness of plate.....       .31
Lb. per sq. in. safe working press. 93.00
```

The crown sheet stays are more complex, as also the head sheet stays, in this class of boiler. They would require the inspection of a practical engineer in boiler work to make a safer computation. We refer you for further rules and illustrations for strength of boiler work, to Courtney's "Boiler Maker's Ready Reckoner," which we can furnish for $3.60.

(11) L. S. B. asks a receipt for making a good fire brick for ordinary stoves, one that can be mixed the same as mortar and put in place to set. A. A good lining for stoves may be made by pulverizing the old brick, or any fire brick, and mixing with a little fresh clay, just enough to make it plastic, with which line the fire plates. Dry out the water before making coal fire. The coal fire will bake and make a solid fire brick lining of your plastic back.

(12) G. F. writes: I have an iron tank in which I wish to keep water for drinking and cooking purposes. What can I do to keep its inner surface from rusting that will not affect the taste of the water? A. Paint the inside of the tank with Prince's metallic paint and boiled linseed oil 2 coats. Allow first coat to dry thoroughly before putting the second on.

(13) W. E. S. asks how to regild gas fixtures that have been soiled by fly specks. A. The cleaning of the lacquer from gas fixtures and redipping and lacquering is an art that requires much care and experience, too much for the occasional work of a plumber. If you wish to make a trial, we can recommend Spons' "Workshop Receipts," which describes the process of cleaning, dipping and lacquering gas fixtures, price $2.00. There is a cheap way of varnishing and bronzing with bronze dust as practiced by the painters, the material for which you may obtain through the paint trade. It is possible that washing with warm soap and water will improve them.

(14) Morrisiana says: Will you kindly inform me how I can make the cellar of my house dry? The floor is concreted and there are windows back and front. Still it is damp, and everything in it gets mouldy. A. The most thorough way to secure a dry cellar is to plaster the exterior of the cellar walls with the best Portland cement. But this in your case, the wall being already built, would be inconvenient. The next best plan is carefully to point up the joints of the wall upon the inside, with Portland cement made of one part cement and two parts sand. Scratch out the old mortar between the joints and substitute cement. Then you may plaster the walls a quarter of an inch thick with same. Use thorough ventilation. Success will depend upon the care and thoroughness with which the job is done.

(15) G. A. asks a receipt for preparing milk to keep a long time. A. Add bicarbonate of soda in the proportion of about six grains to a quart of milk, and then place in sealed bottles.

(16) D. R. D. asks a recipe for making prepared kindling wood, such as is sold in the grocery stores all through the large cities. A. Dip the wood in melted resin. The following composition is sometimes used: 60 parts melted resin and 40 parts tar, in which the wood is dipped for a moment. Or, take a quart of tar and three pounds of resin, melt them, then cool, mix as much sawdust with a little charcoal added as can be worked in. Spread out on a board, and when cold break up into lumps the size of a hickory nut, and you will have enough kindling to last a good while.

(17) J. H. asks how to remove the paper pasted on the inside of the cover of an old book. There is a book plate under it and the cover is calf over board. Inside paper is old ribbed linen strongly pasted on. A. The only way in which the paper can be removed is by covering it with a damp cloth, until it is sufficiently moist, when it can be easily taken off.

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Donald G. Mitchell's very interesting paper in the *American Agriculturist* for December, on "Washington as a Farmer," embraces several unpublished letters.

A splendid engraving (18 by 25 inches) accompanies Mr. Mitchell's paper, illustrating Washington's early home, and various incidents in his career from boyhood to old age. James Parton has already described the *farm life of Jefferson and Jackson.* The next in the series of engravings and papers will be the farm life of President Garfield. All these engravings are sent free to the subscribers of the *American Agriculturist* without extra cost. Those who subscribe immediately will receive all of the series of engravings free, since May last, also the balance of the *American Agriculturist* for this year free. Send six cents in stamps for sample proof of these engravings and sample copy of the *American Agriculturist.* Price of the *American Agriculturist.* English or German, $1.50 per year, single numbers 15 cents.

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TO THE STEEL MANUFACTURERS OF THE UNITED STATES OF AMERICA.
UNITED STATES NAVY DEPARTMENT,
WASHINGTON, D. C., August 21, 1886.

The attention of all steel manufacturers of the United States is hereby invited to the requirements of the Navy Department in the way of armor-plates and heavy gun forgings, for the prosecution of work already authorized by Congress.

This advertisement invites all domestic manufacturers of steel to specify, in competition with each other, upon what terms they will engage to prepare for the production of and produce the forgings and armor-plate required for modern ordnance and armored ships; and no bids will be considered except such as engage to produce within the United States either all the gun-steel or all the armor-plate (or both) specified in this advertisement; nor will any bid be accepted unless accompanied by evidence satisfactory to the Department that the bidder is in possession of, or has made actual provision for, a plant adequate for its fulfillment.

Bids are hereby invited for supplying this Department with the under-mentioned material:

About 1,310 tons of steel gun-forgings, of which about 328 tons will be for guns of six inches caliber, 70 tons for guns of eight inches caliber, and 912 tons for calibers between ten inches and twelve inches (both inclusive).

These forgings are to be delivered rough bored and turned, and when in that state the heaviest forging which enters into the construction of a gun of each of the desired calibers will be about as follows:

6-inch	.....	.....	3¼ tons.
8 "	.....	.....	5 "
10 "	.....	.....	9½ "
10½ "	.....	.....	9⅝ "
12 "	.....	.....	12⅝ "

All these forgings must be delivered within the following times from the closing of a contract, viz.:

For 6 inch guns, 28 within one year, and the remainder within 18 months.
For 8 inch guns, within two years.
For 10 inch and larger guns, within 2½ years.
Preference will be given for earlier deliveries.

Also, about 4,500 tons of steel armor-plates, to be of the best material and manufacture, shaped accurately after patterns to fit the form of each vessel for which intended, and of such sizes as may be required, varying somewhat as follows:

20 feet by 8 feet by 12 inches thick.
17½ feet by 6 feet by 17 inches thick.
11½ feet by 4¼ feet by 6 inches thick.
There will also be thinner plates.

For information concerning shapes and weights of the gun forgings and armor-plates, what parts must be manufactured in sets, time of delivery of each set, the chemical, physical, and ballistic tests, which the metal must sustain in each case, and for all other particulars, apply to the Chief of Bureau of Ordance, Navy Department, Washington, D. C.

Each bid upon armor-plate must specify the time within which the bidder will engage to make delivery; and preference will be given to earliest proposed deliveries.

Proposals must be in duplicate, sealed and addressed to the Secretary of the Navy, Navy Department, Washington, D. C., the envelopes indorsed "Proposal for steel gun-forgings and armor."

They will be received at the Navy Department until 12 o'clock M. on the 10th day of December, 1886, at which hour the opening of the bids will take place.

The right is reserved to waive defects in the form of, and to reject any or all bids.

Ten per cent. of the contract price will be retained from the payment for each article delivered, until the contract, as far as relates to articles of that class, shall have been completed.

Separate bids may be submitted for the gun steel and for the armor, if any manufacturer so desires; but bids covering both will receive preference, other things being equal.

Bids will be compared in two classes.
First. Gun Forgings.
Second. Armor-plate.

And the total sum for which, and the time within which the whole of the material covered by each class will be produced and delivered will be alone considered.

WILLIAM C. WHITNEY,
Secretary of the Navy.

NOTICE.
NAVY DEPARTMENT.
WASHINGTON, *November* 6, 1886.

The time fixed by the foregoing advertisement, dated August 21, 1886, for receiving proposals for steel gun-forgings and armor-plates, viz.: December 10, 1886, is extended to 12 o'clock noon, March 15, 1887, at which hour the opening of the bids will take place.

WILLIAM C. WHITNEY,
Secretary of the Navy.

SINKING MINE SHAFTS.—Description of Mr. Fœtsch's method of sinking mine shafts in watery earth by means of freezing. With 2 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **537.** Price 10 cents. To be had at this office and from all newsdealers.

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MUNN & CO., Editors and Proprietors of THE SCIENTIFIC AMERICAN, cordially invite all persons desiring any information relative to patents, or the registry of trade-marks, in this country or abroad, to call at their offices, 361 Broadway. Examination of inventions, consultation, and advice free. Inquiries by mail promptly answered.

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