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REMOVAL OF THE OBSTRUCTIONS AT HELL GATE.

This great work is making steady, though necessarily slow, progress, as compared with works of similar character, in which softer rocks are met with. The rock to be penetrated is principally gneiss streaked with veins of quartz, and is extremely hard to drill. The work now in progress at Hallett's Point contemplates the removal and breaking up into pieces sufficiently small to be easily handled, of the whole of the point or reef which now obstructs navigation, leaving a channel of ample depth for the largest vessels, with a vertical shore of rock on the land side. To effect this object, a vertical shaft has been sunk within a coffer dam, one side of the shaft corresponding to a portion of the proposed shore line. From this shaft radiate ten headings, the first and tenth headings following the proposed shore line.

The numbers, names, and the distances to which the headings had been pushed, up to the 7th of May of the present year, at which time we visited the works, are as follows:

No.	Name.	Extent reached.
1	Farragut	50 feet
2	Madison	48 "
3	Humphrey	49 "
4	Hoffman	44 "
5	Sherman	49 "
6	Jefferson	68 "
7	Grant	89 "
8	McClellan	53 "
9	Franklin	34 "
10	Jackson	45 "

The work proceeds, without intermission, night and day, except Sundays, under the direct superintendence of G. C. Reitheimer, C. E., a gentleman of large theoretical and practical knowledge, whose experience in this class of work has probably been as extensive as that of any other living engineer. We are informed that this is the 323d operation of a similar character that has been performed under his direction. One of his great feats of blasting was performed in the harbor improvements at Holyhead, North Wales, when 21,000 pounds of powder were fired, May 21, 1857, and 160,000 cubic yards of rock were broken into pieces of from five to forty tuns in weight, at a single blast. In this work, 7,000,000 tuns of rock were moved in six years.

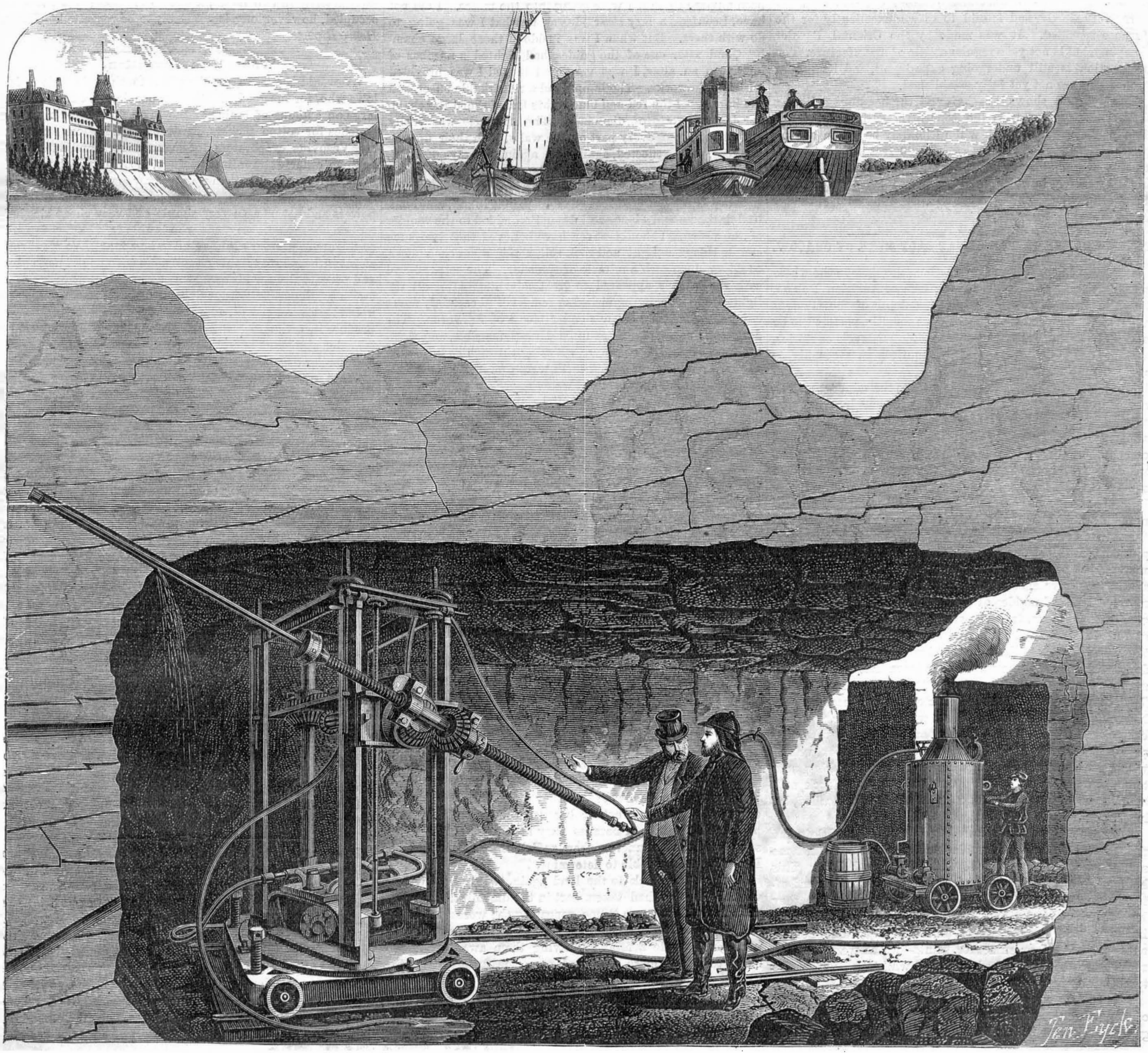
The headings are to be crossed at intervals by galleries, and the piers left standing are to be penetrated by chambers, having a ground plan of the form of the letter T. In these chambers the final charges will be placed and fired, when it is expected the entire mass of rock, left standing after the cuttings, will be broken in pieces of such a size that they can easily be fished up and removed.

Our notice of this work, in our issue of May 6th, is, as we found upon our visit to Hallett's Point on the 7th inst., calculated to mislead our readers as to the importance of the diamond drills of Severance & Holt, in connection with the operations in question. The principal portion, in fact, practically the whole of the work, has been done by Cornish miners, imported for the purpose, with hand drills. The statements made in our previous article were made upon what we supposed to be reliable information, but we find upon examination of the books, that, in all, since the diamond drilling machine reached the work in January, only 55 cubic yards of stone have been removed by it. We further find that the average rate of boring made by it, during the last month of its working, is, for a shift of eight hours, sixteen feet. It requires the attention of three men. This number of men, of the kind employed in hand drilling, will drill a hole of the same size from six to seven feet in depth during a shift of eight hours, so that the diamond drill performed at most a little more than double the work of six men, as shown by the records.

It is not employed by the Government. A single machine has been placed in Franklin heading at the request of the proprietors. It is only fair to say, however, that this heading presents the most refractory rock met with in the progress of the work, and, also that the machine has important defects in its design—easily remedied in future machines—which, corrected, will doubtless render it more efficient for this class of work.

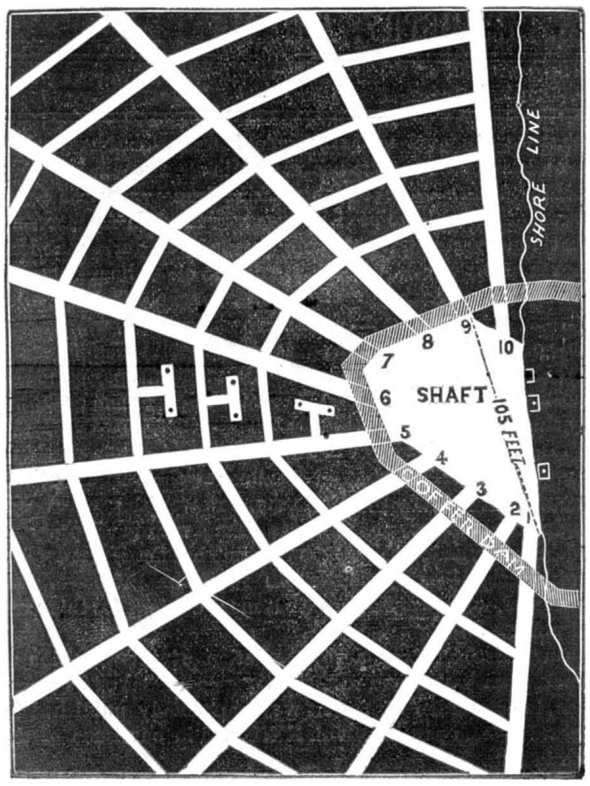
Our artist has given a representation of this machine at work, from which our readers may gain an idea of its operation, in connection with what we have already published in regard to it on page 282, Vol. XXII., and in our issue of the 6th inst.

Some inconvenience has been met with during the progress of the work, arising from the inflow of water through fissures. The methods employed for closing such fissures will be of



REMOVAL OF THE HELL GATE ROCKS---VIEW OF THE DIAMOND DRILLING MACHINE.

interest to the general reader. When the fissure is vertical, holes are drilled along each side of it, at a little distance from its margin. The holes are charged with slow powder, which is simultaneously discharged by an electric battery, the effect being to close the crack. When a horizontal fissure in the wall of a heading is met with, oak wedges are driven into the seams of the strata underlying it, which close it. Other leaks are stopped by means of oakum and cement. What little water flows in from small crevices is drained into a well at the foot of the shaft, and removed by a pump.



A new kind of powder, called carbolic powder, has been used by Mr. Reitheimer for closing fissures. We were told its ingredients are saw dust and oxidized carbolic acid. It burns very slowly, and is said to answer excellently for the purpose specified. It was made by the Oriental Powder Company, but is not yet a regular article of manufacture. The preparation is still undergoing experiment, and its proper proportions are not yet fully established.

The diagram shows the shaft and the headings radiating therefrom, together with the concentric galleries, and the T-shaped chambers, which will ultimately be cut in all the piers. The tunnel headings average 20 feet in hight by 13 feet in width. The concentric galleries average 16 feet in hight by 10 feet in width. The shaft is 105 feet in length by 105 feet in width, and is sunk to a depth of 32 feet below mean low-water mark.

A NEW YORKER IN THE GREAT SALT MINE OF CRACOW.

The most celebrated and productive salt mines in the whole world are those of Wieliczka, in Galicia or Austrian Poland, ten miles from Cracow. The greatest depth of the mines is about eight hundred feet, though it is sometimes stated to be over a thousand. They have seven different levels or stories, one above the other, connected by countless passages, flights of steps and bridges.

The apparatus for letting us down into the mine was a species of iron basket, in which we sat, with our legs hanging outside, holding to ropes fastened above to a ring encircling an iron shaft. This ring slipped smoothly down the shaft, carrying us, clinging to the ropes, down with it. The entrance to the mines was something like a well, though rather square than round; and, as we sped downward, the feeble light of the torches rather increased than lessened the darkness; and, flashing fitfully and throwing shadows here and there, made it seem as if the ropes that held us had snapped asunder. But I had no fears of that kind; indeed, I doubt if any well-balanced man has such apprehensions of absurd possibilities as travelers and adventure seekers are inclined to represent. I had no idea of the depth, which appeared much greater than it was, from the silence and the darkness that surrounded me. I did not know but we might be going to the lowest depths of the mines, and when we stopped in our downward course, I was surprised to learn that we were little more than two hundred feet below the surface of the earth. Then our real journey began. One of the torchbearers went before, and the other behind me, as we walked over a wooden bridge, and down a flight of stairs, and through several passages, all cut out of what appeared to be solid rock, veined with quartz. I asked the guides to stop, and, lifting up a torch, saw that what I had taken for quartz was rock salt, and that most of the rock was green salt, as it is called, being largely mixed with clay.

After walking up and down, right and left, and left and right, we entered a considerable cavity, which reminded me somewhat of the Star Chamber in the Mammoth Cave. This had been hewn out by the workmen, I was informed, and after they had gotten all the salt contained in the stratum, they had abandoned it for another field of operations. I noticed in the chamber several crosses, an altar, and a number of images—intended, I presume, for saints—which were made of rock salt, and which looked beautiful while the light of the torches fell upon them.

We went on again, over more bridges, down more flights of steps, through more passages, until we reached what the guides styled the "river." It wasn't enough of a river to do any harm, however, and better deserved the name of a pool. It was just such a river as the Lethe or the Styx in the great Kentucky cave, and we crossed it in just such a boat—a muddy scow, which might have been built in the earliest infancy of navigation. The guides, in a few seconds, pushed the boat over with poles, and we got out on another bridge, and began descending one of the longest and worst series of steps I had encountered. At the bottom, we branched off into a crooked passage, at the end of which was still another tiresome and rickety flight of stairs. I believed we were getting further and further into the bowels of the earth, and so we were, as I learned from one of the grim fellows, who said we were some four hundred feet underground. I examined the walls about me, and could plainly perceive that they had more of a crystal appearance than they had had; the crystal, of course, being the veins of rock salt.

One thing which had astonished me was, that we had met so few workmen. We had passed them here and there, using pickaxes and crowbars, but nothing like the number I had expected to find. The reason, as I learned by inquiry, was, that the parts through which we had gone had been mostly worked out, and the laborers had been removed to lower and richer strata. About twenty minutes later, we observed several men making a new passage. They had just begun it, and were lying down on their backs, and striking their picks into the salt overhead. One might believe that the falling particles would have destroyed their sight; and so they would, no doubt, had not the men drawn a kind of coarse hat over their faces, and shut their eyes, while they actively employed their implements. This was the first instance I had observed of men doing work effectively with their eyes shut.

After crossing several more pools or rivers—there are at least twenty of these, formed by the percolations of water through the strata—we entered a very large open space, some four hundred feet broad, and at least a hundred feet high, known as the Chamber of Letow; and, fifteen minutes later, another of still greater dimensions, the Chamber of Michelawic. These were fitted up like chapels, having altars, candlesticks, statues, chairs, thrones, and various kinds of ornaments, all cut out of rock salt.

Before I left Cracow, I had purchased some fireworks—blue and red lights, serpents, and catharine wheels—as I had been advised to do if I were going into the mines. I did not have, I confess, a very clear idea as to what I was going to do with them. But when I was inside of those large chambers, and after one of the guides had lighted a number of lamps on an altar, I was very glad indeed I was provided with the fireworks. The lamps had a remarkable effect, and the burning of the red and blue lights transformed the chamber into a grotto of diamonds. The spectacle was really splendid. From every part of the walls, with their uneven surfaces, were reflected, again and again, the rays of light, until the place was a blaze of radiance and glory. It was more like a fairy scene than any thing else, and the thought that it was six hundred feet or more underground, amid natural darkness and silence and desolation, added to the wonder of the vision. I should never have believed that two such simple things as light and rock salt, acting upon each other, could produce such a miracle of splendor. The serpents and catharine wheels appeared to great advantage after all the lights were either extinguished or removed. I certainly never enjoyed so much such a slender stock of fireworks. The darkness was so intense as to be almost tangible, and when the serpents and wheels were whizzing through it, it seemed as if the whole night of the earth were compressed into that small and pitchy compass.

The larger of the chambers, Michelawic—it is over a hundred feet square—is dedicated, I understand, to St. Anthony. Once every year, on the third of July, a grand mass is celebrated in the chamber, or chapel, as it is usually considered, and afterward a banquet is given of a most sumptuous character. Whenever any members of the imperial family visit the mines, the most extensive preparations are made to receive them. The principal passages and chambers are brilliantly illuminated; the workmen are given a holiday, and festivals are held in which they participate. These are long remembered by the poor laborers, who then receive gratuities, and have what they regard as a most pleasurable time.

The Infernal Lake—a large pool of water some seven hundred feet long, three hundred feet wide and forty deep—particularly impressed me. I went out upon it in a boat, and burned some of the fireworks, while a number of the workmen awoke the echoes of the dreary place by crying, "Gluck Auf, Gluck Auf," (Welcome, Welcome,) until the cavern seemed peopled with invisible imps and demons, screaming with sardonic satire to the last victim they had ensnared. There certainly was something bitterly ironical in the idea of associating that gloomy pool and pit with a welcome of any sort. I have been told that the workmen sometimes show the words "Gluck Auf" in illuminated letters, in an arch at the lower end of the lake; but they did not do so on the occasion of my visit—whether because they were less enterprising than usual, or because they thought a single sight-seer would not remunerate them sufficiently for their trouble, I have never been able to determine.

After getting back to the land again, twenty or thirty of the fellows who had taken part in the diabolical chorus of "Gluck Auf," came up to me, repeating the words, and holding out their hands. The guides swore at them in a vile gibberish, and made a feint of driving them away. I understood this as a mere ruse, and gave the unfortunates the kreutzers they were so desirous to get.

During the remainder of the journey, I saw a great many of the workmen, who were getting out the salt very much as coal is gotten out, with bars and picks. In the lowest regions, where we then were, the salt was much purer, being sometimes in solid blocks as clear and white as crystal. The laborers were muscular and stalwart fellows, with very little intelligence in their faces generally, and their features, for the most part, were coarse and harsh. They were usually stripped to the waist, and many of them were entirely naked, except a cloth about their loins. Nearly all the workmen, I believe, are Poles, poor and ignorant, of course, who pass their lives in these mines, toiling night and day for barely enough to keep body and soul together. Their pay varies from thirty kreutzers to a florin a day, very few earning the latter amount. I was constantly importuned for *trinkgeld*, and having provided myself with considerable copper coin, I was astonished to see with what delight two or three kreutzers were received.

Some five hundred horses are employed in the mines to draw the boxes or cars of salt to the entrance shafts, where it is sent to the surface of the earth. When these horses are once brought into the mines, they seldom go out until crippled, or too old for further use.

The salt varies a great deal in quality. The so called green salt contains six or seven per cent of clay, which destroys its transparency. Another sort, *spiza*, is crystalline, but mixed with sand; while the perfectly pure, *szybik*, is found in large crystallized masses. The general yield of the mine is, I think, about 500,000 tuns annually, valued at twenty florins, or ten dollars, per tun, making the revenue $5,000,000. When the mines were discovered is not known, though it is certain that they have been worked nearly nine centuries. From the twelfth to the latter part of the seventeenth century they belonged to Poland. In 1856 they were ceded to Austria; but, twenty-seven years afterwards, they were recovered by John Sobieski. When the first dismemberment of Poland took place, in 1772, Austria again obtained them, and, an interval of six years excepted, has held them ever since.

After spending three or four hours in the mines, and seeing all the features worth seeing, I retraced my steps, and went out the same way I came in. I might have passed two or three weeks underground, if I had traversed all the passages and excavations, whose combined length is over three hundred miles. The extent of the mines, from east to west, is about thirty-two hundred yards, and from north to south, fourteen hundred yards. It is easy to examine the mines satisfactorily in two hours, if one be in haste; but the time occupied, however long, is not likely to be regretted.—*Junius Henri Browne.*

Wanted an Invention.

We would beg leave to offer a hint to those ingenious fellows who, for the good of Southern people, are expending so large an amount of brains in the invention of labor saving pouches for cotton pickers, lightning seed hullers for planters, Vesuvius evaporators for sugar makers, and a thousand and one other extraordinary things, most of which turn out to be of far less value than was the raw material from which they were constructed. Cannot you concentrate all your powers and get us up a very simple and very cheap rice huller—so cheap that every man who is able to own a coffee mill or a sausage grinder could afford to buy one? We want such an invention above all things, to enable each one of us to grow and prepare rice for his own family use. Almost every plantation south of thirty-three degrees north latitude will grow upland rice very well, and yet, few persons undertake to produce it, owing to the fact that the great cost of getting it hurled at distant and expensive establishments, renders it cheaper for us to buy our supplies at ten cents per pound.

What say you to undertaking the thing? If you can get us up a cheap little hand machine that will enable the good woman to prepare her rice for the pot, along as she wants it, your fortune is made.—*Illustrated Journal of Agriculture.*

Plating and Gilding without a Battery.

Watt's *Electro Metallurgy* says: A very useful solution of silver or gold for plating or gilding without the aid of a battery may be made as follows: Take, say, 1 ounce of nitrate of silver, dissolved in 1 quart of distilled or rain water. When thoroughly dissolved, throw in a few crystals of hyposulphite of soda, which will at first form a brown precipitate, but which eventually becomes redissolved if sufficient hyposulphite has been employed. A slight excess of this salt must, however, be added. The solution thus formed may be used for coating small articles of steel, brass, or German silver, by simply dipping a sponge in the solution and rubbing it over the surface of the article to be coated. I have succeeded in coating steel very satisfactorily by this means, and have found the silver so firmly attached to the steel (when the solution has been carefully made) that it has been removed with considerable difficulty. A solution of gold may be made in the same way, and applied as described. A concentrated solution of either gold or silver thus made, may be used for coating parts of articles which have stripped or blistered, by applying it with a camel hair pencil to the part, and touching the spot at the same time with a thin clean strip of zinc.

IT is stated that the Michigan Central and Great Western railways have decided to commence the tunnelling of the river at Detroit as soon as possible, on the plans described and illustrated in the last volume of the SCIENTIFIC AMERICAN. The stream is not too wide to be bridged—about half a mile—but a bridge high enough to clear the masts of the vessels sailing on the lakes would be very costly, and the commerce is so great that a draw-bridge would need to be open almost constantly during the season of navigation. A charter has been obtained for the tunnel, and also authority to construct it, from both the United States and the Dominion of Canada.

RUMFORD'S SCIENTIFIC DISCOVERIES.

From a Paper recently read by W. Mattieu Williams, F.C.S. at the Royal Institution of Great Britain.

The researches of Rumford are especially worthy of general attention, as his subjects literally come home to all of us, the greater part of his life having been devoted to studying and applying the philosophy of common things; he may be, in fact, regarded above all others as the philosopher of common things, the science of feeding, clothing, warming, and sheltering of mankind having been his chief pursuit.

All his practical successes were effected by the application of scientific principles, Rumford's method invariably being to set before himself the task to be performed, then to determine the philosophical principles involved, and having done this, to apply these principles practically.

In order to determine the best material for the soldier's clothing, he first considered the function of clothing, and determined that in winter it should act by resisting the transmission of the animal heat to the cooler atmosphere, and thereby maintain the body at the temperature required; that for this purpose a non-conductor or a bad conductor of heat is required. The relative conducting power of different clothing material being in his time unknown, he constructed a theoretical soldier in the form of a thermometer, which he could clothe with the materials to be tested. By heating this clothed thermometer, and allowing it to cool in an apartment of constant temperature, he obtained the following results:

Thermometer surrounded by	Air	cooled from 70 deg. to 10 deg. (Reaumur)	in 576 sec.
"	16 grs. fine lint	" "	1,032 "
"	" cotton wool	" "	1,046 "
"	" sheep's wool	" "	1,118 "
"	" raw silk	" "	1,284 "
"	" beaver's fur	" "	1,296 "
"	" eider down	" "	1,305 "
"	" hare's fur	" "	1,315 "

Finding that the raw silk only occupied one fifty-fifth of the whole bulk of the outer bulb containing it, he calculated that if it were an absolute non-conductor it should, as compared with the envelope of air contained in the same space, only increase the resistance by ten seconds, but the experiment showed that it had above seventy times the effect. Therefore the resistance of the silk fiber cannot account for the result.

Connecting this with his previous investigations on the convection of heat by liquids, Rumford inferred that air is a non-conductor of heat, that the fibers acted by inclosing the air between them, and preventing those convective movements by which alone it can carry heat away from a body in contact with it. He confirmed this explanation by a series of experiments. He found that when the thermometer was surrounded by the same quantity of the above named materials more closely twisted or woven, so as to leave less air space between the fibers, their power of resisting the passage of heat was diminished proportionately to the closeness of the weaving, twisting, or packing.

He thus not only solved his practical question of clothing, but made important discoveries respecting the laws of transmission of heat by gases, and further applied these to retaining heat in furnaces and buildings by means of cellular walls, or double walls and windows.

The question of what is the best material for summer clothing was decided in like manner. He first considered how the body retains its temperature when exposed to direct summer sunshine in hot climates or otherwise, when a thermometer similarly exposed rises above blood heat. He concluded that it is by the evaporation of the insensible perspiration. How, then, may clothing aid this? Evidently by its power of absorbing the aqueous vapor. Do clothing materials thus absorb vapor? If so, do they differ in their powers of absorption?

To answer these questions, he exposed the following substances, carefully cleaned, upon china plates for twenty-four hours, in a room that had for several months been dried by a German stove, its atmosphere having for six hours previous to the experiment been raised to 85° Fah. After this exposure, 1,000 parts of each were weighed in the dry room; then this quantity was exposed for forty-eight hours in an uninhabited room and weighed again; then for seventy-two hours in a very damp cellar. The results were as follows:

1,000 PARTS OF	After 48 hours in room, weighed	After 74 hours in cellar, weighed
Sheep's wool	1,084	1,163
Beaver's fur	1,072	1,125
Fur of Russian hare	1,065	1,115
Eider down	1,067	1,112
Silk — Raw	1,057	1,107
Silk — Ravelings of white taffety	1,054	1,103
Linen — Fine lint	1,046	1,102
Linen — Ravelings of fine linen	1,044	1,082
Cotton wool	1,043	1,089
Silver wire—Ravelings of gold lace	1,000	1,000

For these and other experiments he concluded that light flannel is the best clothing for summer, and he strongly advocates its universal adoption. The soundness of his conclusion is confirmed by the subsequent experience both of soldiers and sailors, and of cricketers, rowers, furnace men, and all who are engaged in work that induces much perspiration.

Count Rumford's researches and inventions connected with his greatest subject, that of cookery, afford abundant examples of his applications of philosophy and practical affairs. As an example of his theoretical work, his speculations on the movements of the molecules of a heated fluid may be cited; also his "Inquiry Concerning the Chemical Properties that have been attributed to Light." He made a number of experiments upon compounds of gold and silver, by which he showed that the decompositions usually attributed to light could all be effected in precisely the same manner and degree by obscure heat, a temperature below the boiling point of water being sufficient when the salts were in aqueous solution, or a higher temperature when the dry salts were used.

The time did not permit the speaker to develop these speculations and connect them with modern philosophy as intended, and he therefore passed on to Rumford's celebrated experiments on "The Source of Heat excited by Friction."

These experiments are so well known that it is unnecessary to repeat their details here. It will be remembered that after taking every precaution to insulate his apparatus from any communication of heat from without, and ascertaining that the specific heat of the borings was unchanged, Rumford found that the heat evolved by the friction of a blunt borer against the inside of a metal cylinder was sufficient to boil 18·77 pounds of water in two and a half hours, and to keep it boiling as long as the friction was sustained. His own conclusion is thus expressed: "It is hardly necessary to add that anything which an insulated body, or system of bodies, can continue to furnish *without limitation* cannot possibly be a *material substance:* and it appears to me extremely difficult, if not quite impossible, to form any distinct idea of anything capable of being excited and communicated in these experiments, except it be MOTION."

The italics and capitals are Count Rumford's. As Dr. Tyndall says: "Rumford in this memoir annihilates the material theory of heat. Nothing more powerful on the subject has since been written," and "hardly anything more conclusive has since been adduced in the way of establishing that heat is what Rumford considered it to be—Motion."

This memoir and the one immediately connected with it, "On the Weight or Ponderability ascribed to Heat," and his investigations on the transmission of heat through gases and liquids, are perhaps the most important of Rumford's purely philosophical works, and he is the father of the Royal Institution. All who have followed the recent progress of physical science must admit that this institution has been a dutiful child, and has worthily cultivated its patrimonial inheritance.

Old-fashioned story tellers were wont to conclude their discourse with a "moral." This old fashion may be profitably followed in the present instance, when we remember that Benjamin Thompson began life in extreme poverty, was a poor teacher in a poor colonial village school, that step by step he rose to such honor and distinction, that when Bavaria was so sorely threatened that its sovereign was obliged to fly from Munich, full powers of temporary sovereignty were placed in Rumford's hands, and he wielded this power with complete success. He practically solved great social problems and achieved great social reforms, such as to this day, after a lapse of above seventy years, we all desire to see repeated, and yet cannot achieve again. He abolished mendicity from a country where it prevailed to an almost unprecedented extent; he succeeded in making the rogues and vagabonds of Bavaria pay all the expenses of their food, clothing, and lodging, and leave a handsome balance towards the maintenance of the police who apprehended them. He thus provided for the poor of an excessively pauperized country without any poor rates.

He was a great statesman, a practical soldier, the greatest of practical military reformers, a skillful mechanic and engineer, and a successful philanthropist, besides being a distinguished philosopher. All his success is clearly traceable to the fact that whatever he did, from the eating of a slice of pudding to the dictatorship of a nation, was done by rigidly obeying those principles of inductive reasoning which have led to the marvelous triumphs of modern science.

If, therefore, you would make your son a successful soldier, a successful lawyer, a successful statesman, successful in any business or profession whatever, you should give him a sound, practical, scientific education; let him learn how to observe and investigate facts, to generalize them, and from such inductions to deduce sound rules for practical conduct.

Modern science affords the best, the highest, and the most useful school of intellectual culture; the great business of the present day is to give to science that decided educational precedence to which it is entitled, and the whole career of Benjamin Thompson, Count Rumford, affords a striking example of the kind of intellectual results we may expect to obtain when sound scientific knowledge and training are afforded to every human being—male and female.

Readers of the SCIENTIFIC AMERICAN will remember that Count Rumford was a native of this country. He was born in Woburn, Mass., in 1753, and in early youth manifested an investigating turn of mind, especially with reference to the natural sciences. Soon after he became of age, he went to England; subsequently to France, where he met the afterward King of Bavaria, and the two became great friends. He held many important official positions in Bavaria, which he discharged with eminent ability. During all his public employments he was more or less engaged in scientific investigations. A title of nobility, and many other honors were conferred upon him, in token of his wonderful services and extraordinary talents. He bequeathed to Harvard University, Cambridge, Mass., the funds by which was founded the Professorship of the Application of Science to the Art of Living. He died in 1814, aged 61 years, at Auteuil, near Paris.

Chinese Ink.

The lamp black, which is employed for the preparation of Chinese ink, is prepared, according to Champion, a French chemist who has lived for some time in China, partially from oils and fats, and partially—and this is the more common way—from pine wood and other trees that are rich in rosin, and also from the rosin itself. The material is burned at the mouth of a furnace which, by a square opening of about two feet, is eight to forty or even fifty feet long. At the farthest end of it the best black for the finest quality of ink is deposited; but the slowness of the combustion is not without influence in that respect. The best black, however, is obtained from lard, then from oils and other fats. The quality of the ink depends also on the care with which the black is made to pass through a silken bag or sieve. The ink itself is prepared by stirring into boiling glue, of very good quality, a sufficient amount of black, and after adding a small quantity of oil, kneading the dough at the temperature of 55° C. until it is perfectly homogeneous. The mass is then pressed into flat cakes weighing from one to two pounds, and left to ripen for a couple of days, after which it is formed into the customary shape. The molder takes for this purpose a piece of the dough, and warms it by means of a basin full of live coals, kneads it long enough in his hands, and then fills the form, which he puts under a long lever, pressing it by his own weight, while in the meantime he works the next piece of the mass. The molds are made of wood, and also the pistons on which are cut the letters. The lustre is produced by brushing the dried ink with a hard brush saturated with rosin, which also prevents the ink from blackening the fingers afterwards. The peculiar odor is derived from a small quantity of camphor or musk, which is incorporated with the warm dough. All ordinary inks are without it.

The colored letters are painted on with a fine brush, the gold and silver colors, by suspending the finely divided metals in water, to which has been added a little gelatine. The Japanese manufacture ink in a similar way, which, however, is greatly inferior to the Chinese, owing, probably, to the exceeding care which these latter give to the preparation of the black.

Increasing the Flavor of Fruits.

For a number of years past, says the *Farm, Stock and Poultry Journal*, there has been a decided tendency on the part of fruit growers, and more especially of those who cultivate for market, to grow only large fruit, or rather varieties of small fruit of a large size. We are not suprised at this, from the fact, that however insiped and flavorless a strawberry may be, it will always command the highestprice in the mark if it be only large and fine looking. Hence, with the cultivator, it becomes a matter of dollars and cents. Fruit growing for profit in his business, and it is to such, generally, a matter of indifference whether the fruit is of a fine flavor or otherwise, so that it finds ready purchasers at good figures. It would be simply folly to argue against sush a spirit, and as long as people are content to sacrifice the sense of taste for that of sight, we have no right to object.

But it does not follow, necessarily, that large fruit is obtained at the expense of its flavor. Every horticulturist, knows that a wet, cloudy season invariably produces greatly increasing acidity in small fruits, and this is especially noticeable in the peach and strawberry. The result is of course beyond human control. But not so in some other cases. We believe that it is in the power of a cultivator, who has not too keen an eye to profit, to command a flavor. "The method," says a first class authority on this subject, "is to thin out severely."

This same writer assumes that if a peach or plum tree be allowed to mature five or six dozen of fruit where only one-half that quantity should have been permitted, the result will be a flavor of decidedly inferior quality. By thinning, you make indifferent fruit good. By crowding, you make good fruit bad. We are aware that it is asking a great deal of an amateur to thin out fruit, but it will pay in the end when quality and not quantity is desired.

The Prussian Field Artillery.

No official report has yet been made, but we have it upon excellent authority, that not a single gun broke during the late campaigns. There are some guns used up which had the Prussian system of obturation by a copper ring placed in the wedge piece. There are Krupp guns which have fired 300 rounds in one day, scoring actually above 8,000 rounds, and it is quite certain that with a war material of bronze the whole artillery would have been reduced to a perfectly useless state.

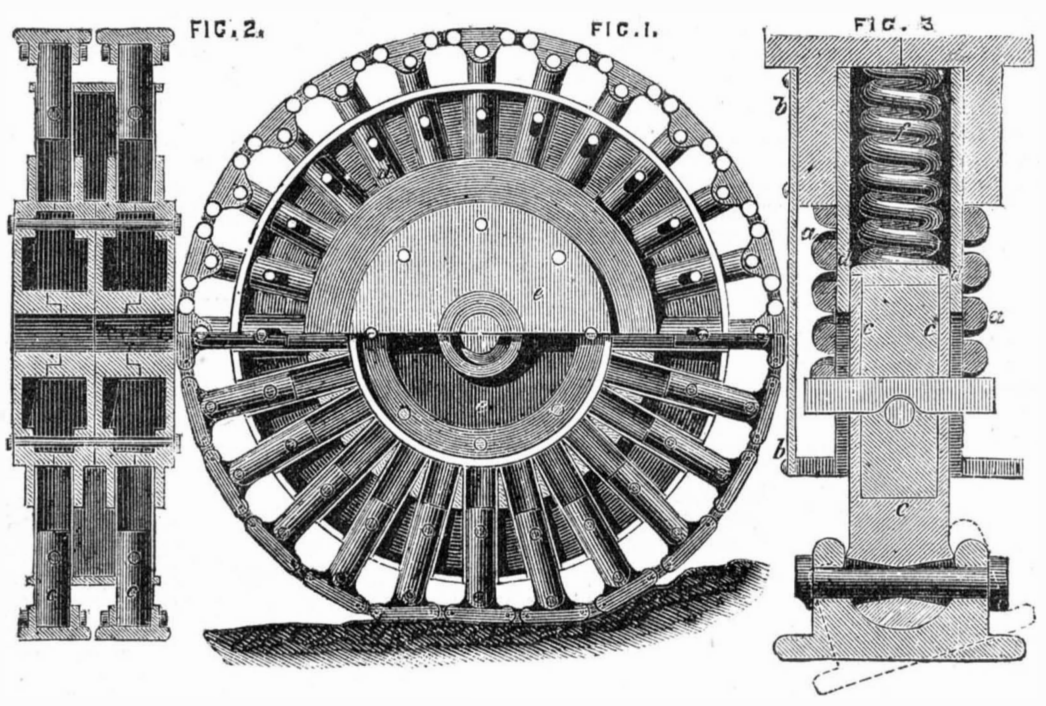
In some of the guns at Berlin, out of service, there are radial outburnings on the surface of the breech holes, but which could be repaired in a few days. The Saxon artillery, with Krupp's wedge and Broadwell ring, stood perfectly, and remains quite fit for further service. The twenty-four pounders suffered most severely; in fact, these were the only weapons which, with heavy charges, sent their projectiles into Paris. The outburnings are considerable, as the wedges bent, not being strong enough. It is only fair, however, to add that Herr Krupp had always protested against this construction; and experience has now shown him to have been right. There is doubtless a struggle going on between steel and bronze, but this controversy can be but superficial, for no intelligent artillerist would admit a return to the latter metal.

ARCTIC EXPLORATION.—A further investigation of the geography and phenomena of the ice regions of the Northern frigid zone will be made in the summer of the present year. A government vessel, the *Polaris*, schooner rigged steam tug, is to leave the port of New York, about the middle of May, under the command of Captain S. O. Burdington, of Groton, Conn. A three years' voyage is contemplated, a crew of twelve picked sailors being engaged. The *Polaris* has boiler furnaces specially constructed for burning oil, so that, in the regions of the seal and whale fisheries, she will always have fuel at hand. A body of well known scientific men will sail in her and we wish them a prosperous voyage. The public will look with great interest for their return.

Elastic Wheels for Traction Engines.

We illustrate herewith from *Engineering*, one out of several forms of wheels, designed by Mr. Woodford Pilkington, of London, England, with the object of superseding the use of tho costly india-rubber tyres, and of obtaining an ample amount of elasticity and extended bearing surface. The wheel consists of a cast-iron nave, formed in two parts, with a number of radiating sockets, each part of the nave having one half of the sockets formed upon it, so that when they are bolted together the sockets shall be complete. If it is desired to give a greater amount of bearing surface to the wheel, a second nave may be bolted through to the first, in the manner shown in Fig. 2.

Within the sockets just spoken of are placed short tubes, as shown; the ends of which extend as far as the fixed periphery of the wheel, the spaces between the tubes being filled up to strengthen the construction, as shown. Within each of these tubes is placed a solid plunger, with a hemispherical outer end, the inner end being flat, and abutting against spiral springs placed within the tube, shown in Fig. 3; a pin passes through each of the plungers, and the ends play up and down in slots cut in the tube. The ends of the plungers are provided with an adjustable foot, which has, within moderate limits, a universal motion, and is kept in place by a pin passing through a double-coned hole in the end of the plunger, as shown in the detail. The feet are all linked together, sufficient play being left in the bolt holes of the links to permit the feet to adjust themselves and take a fair bearing. By this arrangement it is expected that the sensitive sole plates of the wheel should adjust themselves exactly to the contour of the road, form as perfect springs as do the rubber tyres, and regulate the amount of bearing surface according to circumstances.



ELASTIC WHEELS FOR TRACTION ENGINES.

Something Wrong with Jupiter.

Mr. Proctor, in an article in *St. Pauls Magazine*, says:—During the last two years the planet Jupiter has presented an extraordinary appearance. The great equatorial belt, which is usually white, has been sometimes ruddy, sometimes orange, then coppery, ocherish, greenish yellow, and, in fact, has passed through a number of hues, mostly tints of red and yellow; but has at no time, so far as observation has shown, exhibited what may be called its normal tint. Then, again, this belt, and the two belts on either side of it, have changed very rapidly in form; great dark projections have been flung (I speak always of appearances) into the great equatorial belt, which has thus seemed at times to be divided into a number of ovals. The whole aspect of the planet has suggested the idea that mighty processes are at work, tending to modify, in a most remarkable manner, the condition of the planet's atmospheric envelope.

Now, it certainly is a remarkable circumstance that at the very time when Jupiter has been thus disturbed, the solar atmospheric envelope has also been subject to an exceptional degree of disturbance. As most of my readers know, the face of the sun has been marked by many spots during the last twenty or thirty months; some of these spots have been of enormous magnitude, even so large as to be clearly visible to the naked eye, and the spots have been of such a nature, so long lasting, and so variable in figure, as to imply the action of long continued processes of disturbance acting with extraordinary violence. It may seem at first that the very circumstances of the case should prevent us from tracing any connection whatever between the solar disturbances and that which seems to be taking place in the atmospheric envelope of Jupiter. Two orbs separated, as the sun and Jupiter are, by an interval of about four hundred and fifty millions of miles, cannot be simultaneously affected, it would seem, by any disturbing forces. Nay, more: it seems so reasonable to infer that both in the case of Jupiter and of the sun, the forces at work to produce change lie far beneath the atmospheric envelope of either planet, so that the idea appears at once disposed of, that these forces can operate simultaneously except by mere coincidence.

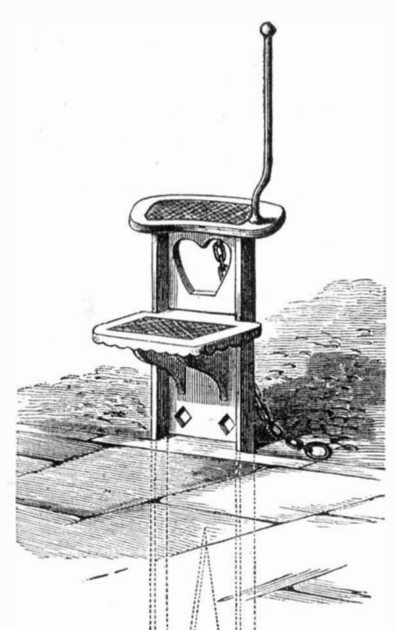
Carpets.

Carpets were first manufactured in Persia and Turkey; and Turkey carpets, even at the present time, are hardly excelled by any of the European manufactures. Aubusson carpets, composed of wool, are manufactured in France, usually in one piece, to suit the dimensions of the room. They are the finest and most expensive carpets brought to the United States. Axminster carpets are the next in quality and value, and these are also frequently in one piece. The warp of the Axminster is of strong linen, ingeniously concealed by the small tufts or bunches of different colored woolens or worsteds, and in such a manner as to form the patterns. They are manufactured in France, Great Britain, and the United States. Wilton carpets are next in value. They differ from Brussels in this, that the loops of worsted are all cut through, and the carpet assumes a velvet appearance. The best are made in Saxony; they are also made in Great Britain and the United States. Brussels carpets form the greatest part of the carpet trade. They are usually 27 inches wide, and are composed of linen and worsted. The cloth is entirely linen, with two threads of linen for the shoot, one above and the other below the worsted. Patent velvet, or tapestry velvet, differ only from tapestry in being cut like Wilton. They come in widths of 27 and 54 inches. Tapestry Brussels carpets differ from regular or body Brussels in being woven in a common loom, and printed in the warp. An inferior kind is produced by being printed in the piece. Kidderminster, or Ingrain, or, as sometimes called, Scotch carpets, are formed by the intersection of two or more cloths of different colors. They sometimes are composed of three thicknesses of cloth, and are then called "Three-ply;" but more commonly of two pieces, and called "Two-ply." They are so woven that the back of the carpet is exactly the same pattern as the front, but the colors are reversed. They are usually 36 inches in width.

All the above-described carpets, except the Turkey and Aubusson, are produced at various places in Great Britain and in the United States, and their names do not denote either the present or the original place of manufacture. In addition to the foregoing, there are several kinds of carpets made in India, of cotton; and in Scotland, hemp and jute carpets are manufactured on a large scale. In the United States there are also made hemp carpets, and also a kind of domestic manufacture called rag carpets; both the latter are usually 36 inches in width. The style, quality, and colors of certain kinds of American carpets are not inferior to those of France or England.

HORSE BLOCK AND HITCHING POST.

Our engraving illustrates a neat device for a combined horse block and hitching post, made of cast iron, with wrought iron vertical hand rail. A heart-shaped opening, between the upper and lower steps, has its lower edge formed



into a boot scraper, and a chain with a ring is used when it is desired to tie a horse to the post. The device is designed to be set in the margin of a sidewalk, as shown. It is the invention of Geo. W. Prescott, Corning, N. Y.

THE French Atlantic cable, from Brest to St. Pierre, works at about 10 words per minute. Mr. Varley calculates that an uninsulated solid conductor of the same weight per mile must be only 1,100 yards in length to compete, in speed of signalling, with 25,000 miles of the same conductor insulated.

The Pot on the Fire.

There is one mode of preparing food in general use in many parts of Europe which we should do very well more generally to adopt; that is, "gentle simmering." In every or almost every French household there is the *pot au feu*. This permanent "pot on the fire," after the manner of the old-fashioned "digester," occupies a quiet little corner of the stove or fireplace. It can hardly be said to boil, but it simmers on gently, very gently, for hours. There it is the receptacle of many a little bone, whether the trimmings of poultry or butcher's meat. It matters not, every little stray fragment of wholesome meat finds its way there. A bit of liver is considered a great improvement; and any vegetables that happen to be about, add to its pleasant flavor, whether the tops of celery, Jerusalem artichokes—which, *par excellence*, make it delicious—or otherwise carrots, turnips, leeks, etc. But supposing it were to be made altogether of fresh materials—which, indeed, in France, it rarely is—this would be the proper recipe; Put a gallon of water into a pot; put into this either three or four pounds of shin of beef, or any similar thing. Add to this an onion or two, or some leeks, carrots, or some other vegetable, three or four teaspoonsful of salt, one of black pepper three cloves. Give it one boil up; skim carefully. Now cover the pot closely, and let it cook gently, for four hours at the least. About every hour throw a wineglassful of cold water into it, to make it clear. Taste; it may require a little more salt or pepper, according to taste. Pour this soup over toasted crusts of bread. Both soup and meat will be found delicious. The whole secret of this lies in the gentle simmering in a covered vessel, whereby the flavor is wholly preserved, and nothing is lost.

Camphor.

Camphor is a concrete, acrid drug, obtained from trees in China, Japan, and the islands of Formosa, Sumatra, and Borneo. Two kinds are known in commerce; one of these is entirely monopolized by the Chinese, who set a fictitious value upon it, from 70 to 100 times the price of the other variety; it is known as the Malay camphor, and is the product of a large tree that grows in Sumatra and Borneo. This tree attains a hight of 100 feet, and a diameter of 6 or 7 feet, and even much larger in rare instances. The camphor is found in this tree in concrete masses, secreted in fissures and crevices in the heart wood, and is extracted by splitting the trunk in pieces, and picking out the lumps with a pointed instrument. The product of a large tree is rarely as much as 20 pounds; while many fine trees are cut and split up which furnish none; hence its high price. The Chinese pay for it from $7.50 to $25 per pound, according to its quality, while the Japan camphor, obtained in their own ports, and known as Chinese camphor, is sold for 9 or 10 cents per pound. Of the cheaper kind of camphor there are two commercial varieties; one, the Dutch, Japan, or tub camphor; and the other, the Chinese or Formosa, which is carried in junks to Canton, where it is packed in square chests lined with lead, and thence finds its way to Europe and the United States. It is a crude article, in dirty gray grains, massed in lumps, and contains many impurities. The tub camphor is obtained in Batavia, whence it is exported in tubs containing 100 pounds or more. These tubs are covered with matting and an outside tub. This kind is in pinkish-colored grains, coarser and generally purer than Chinese camphor; both these varieties are obtained from the same tree, *laurus camphora*, an evergreen resembling the American linden, and bearing a red berry. All parts of the tree possess the odor of camphor. The camphor is obtained from the chipped wood, roots, and leaves, by distillation, and condensed by sublimation into a solid form. All the camphor of commerce is a crude article, requiring purification before it is fit for use. The annual exports of camphor from China to Europe and America are from 3,000 to 4,000 piculs, at prices ranging from $19 to $25 per picul of 133⅓ pounds. An artificial substance, much resembling camphor, is obtained by the action of hydrochloric acid on oil of turpentine.

Remarkable Hailstorm.

A great hailstorm was experienced about the middle of April last, in Mississippi, which was attended with "striking" peculiarities.

At Forest, the stones measured 6⅝ inches in circumference and the fall inflicted serious damage to dwellings and growing crops. Shingles upon the roofs of houses were split; even tin roofs were ruined—the hailstones cutting gashes in them from three to six inches in length. Window panes and skylights, of course, were shattered into fragments. At other points similar disastrous effects were produced.

A local paper says, "these hailstones, falling in such extraordinary size and plentifulness, were flavored with turpentine, but not sufficiently so as to be used as a medicine. In some were found particles of sand. They were not perfectly solid, but rather porous, and of an orange or globular shape, with each end slightly depressed."

Calico.

In England this is a general term for plain white cotton cloth, or fabrics coarser than muslin. In the United States the term is applied only to printed cotton cloths upon which colored patterns are impressed by the use of dyes. The name is derived from Calicut, on the Malabar coast, whence the goods were first imported. The calico interest of the United States is an important one. The total product in 1826 was about 3,000,000 yards. In 1836 it reached 120,000,000; in 1855, upwards of 350,000,000 yards. The total production of printed goods in 1860, according to the census of that year, was estimated at about $8,000,000. There are 6,000,000 cotton spindles now in operation in the United States, of which over 2,000,000 are running on cloths for printing, and produce 450,000,000 yards.

The following extract from Postlethwaite's Dictionary of Trade and Commerce, published in London, in 1857, is curious, and, as a historical reminiscence, is of permanent interest: "Callicoe is a kind of linen manufacture, made of cotton, chiefly in the East Indies. There is a great trade in the Province of Bengal in this commodity, which is transported in prodigious quantities into Persia, Turkey, Arabia, Muscovy, and all over Europe. Some of them are painted with flowers of various colors; and the women in the Indies make veils and scarfs of them, and of some, coverlets for beds, and handkerchiefs. At Seconge they are said to make the best sort of callicoes; in all other parts the colors are neither so lively nor lasting, but wear out with often washing; whereas those made at Seconge grow the fairer the more you wash them. This is said to arise from a peculiar virtue of the river that runs by the city, when the rain falls; for the workmen, having made such prints upon their cottons as the foreign merchants give them, by several patterns, dip them into the river often, and that so fixes the colors that they will always hold. There is also made at Seconge a sort of calicut, so fine, that when a man puts it on, his skin shall appear as plainly through it as if he was quite naked; but the merchants are not permitted to transport it, for the governor is obliged to send it all to the Great Mogul's seraglio, and the principal lords of the court, to make the sultanesses and noblemen's wives shifts and garments for the hot weather.

"This manufacture is brought into this nation by the East India Company, which is re-exported by private merchants to other parts of Europe and America.

"The general wear of stained or printed India callicoes in this nation having, in the year 1719, become a general grievance, and occasioned unspeakable distress and calamity upon our own manufactures, especially the weavers, the following acts of parliament very justly took place, to prevent the wear of this manufacture:

"By stat. 7 Geo. I., chap. 7. If any person shall use, or wear, in any apparel, any printed, painted, stained, or dyed callicoe, being convicted thereof by the oath of one or more witnesses, before a justice of the peace, they shall forfeit the sum of *5l.* to the informer—the penalty to be levied by distress and sale of goods.

"If any mercer or draper shall expose to sale any such callicoe, or any bed, chair, window curtain, or other furniture, made up, or mixed with callicoe (unless it be for exportation), every such person shall forfeit the sum of *20l.*, and persons using the same are liable to the like penalty; but callicoes made into furniture in families are exempted; and this act shall not extend to callicoes dyed all blue. And not to extend to linen yarn or cotton work, manufactured and printed in Great Britain, provided that the warp thereof be entirely of linen yarn."

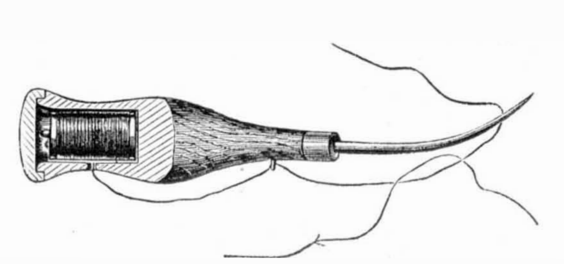
Marine and Storm Signal Light.

A new English invention—"Holmes' patent inextinguishable self-igniting marine and storm signal light"—is produced by the contact with water of a chemical compound, inclosed in an air tight chamber. The mixture is decomposed, and a highly inflammable gas is generated, which ignites on contact with atmospheric air. This chamber is a cylinder four inches high by three inches in diameter, through the center of which a tube three fourths of an inch in diameter passes, open top and bottom. The tube has numerous perforations in the portion within the chamber. The top of the tube is covered over with a suitable conical shaped nozzle, having an opening one eighth of an inch in diameter for the emission of the gas. The lower end of the tube, which projects some four inches, is open for the admission of the water into the chamber, when the lamp is prepared for use. Both these orifices are hermetically closed by soft metallic caps, soldered down, after the body of the lamp has been charged, and in which airtight condition the *English Mechanic* says it will keep for years. On using the lamp, the soft metal caps are easily removed by means of a knife or the finger.

In order to give the necessary specific gravity to the lamp in water, a wooden flatboard is fitted to each, and is so contrived that on throwing the lamp into the water, it assumes an upright position. When the lamp is in use, the water enters by the bottom of the tube, and passes through the perforations into the chamber, decomposing the chemical compound. The evolved gas also passes through these holes, and by pressure is forced through the nozzle; and it inflames upon contact with the external atmosphere, producing a most powerful and brilliant light, fully fifteen times that of the best gas. The flame thus given off is some eighteen inches in hight, and burns with an equal intensity over a space of five minutes. The light then becomes gradually reduced in intensity as the internal pressure in the chamber is relieved, the gas giving off a brilliant flame some six or seven inches in hight, which continues burning some thirty or forty minutes. The light thus produced is inextinguishable by either wind or water. From the powerful nature of this flare, bursting out as it does instantaneously on exposure to water, and being perfectly inextinguishable by the effects of storm, through which it will burn for some forty minutes, it is singularly applicable to all purposes where a brilliant signal light is required. Attached to a life buoy, it will mark the position of the life saving apparatus to the drowning sailor on a dark night. Fired in connection with the line of the Manby rocket apparatus, it will instantaneously point out the position of the fallen line in the ocean. In shipwreck, when the unfortunate vessel is stranded on a dark night, a few of these lamps, cast upon the turbulent sea, will give a light sufficient to enable assistance to be promptly and successfully rendered in saving life and property. As a "flash" signal from pier and harbor heads, to indicate the time of high water for the passing of vessels over a bar, it is equally available. As a rescue signal in connection with lifeboat services, it will prove invaluable, as also for use as a danger signal for railway guards in times of accident, on account of the peculiarly brilliant nature of the light, and the subsequent duration of the flame over so long a period of time. The chemical compound employed is phosphuret of calcium

EYE POINTED LASTING AWL.

This unique invention is due to C. K. Bradford, of Lynnfield, Mass. It consists in placing a bobbin in the handle of the awl, leading the thread out through a hole in the handle, and passing it through an eye in the point of the awl. In



use, the awl, being passed through the leather, carries with it the thread; then being slightly drawn back, it forms a loop through which a second thread is passed. The entire withdrawal of the awl then makes a lock stitch, similar to that made on some sewing machines.

The Thirty-five Tun Gun.

Engineering speaks of the thirty-five tun gun, recently forged at the Woolwich Arsenal, England, as follows:

"The thirty-five tun gun appears to be very refractory—almost a War Department Frankenstein—a monster created to give trouble. It won't burn powder as its lesser brethren do, nor will it give the results anticipated by the sages of the War Office. It is given to indulging in all sorts of freaks and vagaries never known to the science of gunnery before, and, in fact, bids fair to become a white elephant to the Government. On its first proof, owing to its eccentricities, it set the Committee on Explosives to work again; and having tried some further experiment with R. I. G. and pebble powder, they came to the conclusion that the latter must be the correct thing. And so the committee, in conjunction with the superintendent of the gun factories, met at Woolwich, and fired the monster five times. It was intended to have fired twelve rounds, but the programme was not carried beyond the fifth round. The proposed course was four sets of three rounds, each with 110 pounds and 115 pounds of Waltham pebble and Belgian pebble power, respectively and alternately, with 700 pounds projectile. The object of the trials was to ascertain the velocities and pressures obtainable with these charges. Accordingly three crushers to ascertain pressures were placed in the gun; one in a copper cap at the base of the chamber; another at the base of the bent, and the third in the rear end of the projectile. The velocities were taken by screens in the usual manner. The copper cap was crumpled up at the second round, and was not replaced until the fifth round. What were the results of pressure and velocity, is known only to the officials at present, who were especially careful to keep the information to themselves. Judging from experience with pebble powder in the thirty-five tun gun, we conclude that the results in the present case cannot be otherwise than unfavorable. In previous trials the pressures have varied greatly, ranging from 21 to 63 tuns per square inch, while the velocities have rarely reached 1,320 feet. We still incline to the opinion expressed in the article to which we have already referred, that a smaller kind of pellet powder would give better results in this monster.

The Medical Education of Women in India.

On this subject, the *Edinburgh Courant* thinks it may be interesting to know at this time, when so much difficulty is experienced by the females of different countries to get a medical education, that no such difficulty is felt in India, as may be seen by the following excerpt from a letter from the Inspector-General of Vaccination, in the North-West Provinces: "I have just paid a visit to a girl's medical school in Bareilly. There were thirty girls, whose ages ranged from twelve to seventeen, all studying medicine under the sub-assistant surgeon and a matron. I examined them, and they answered very well indeed. They had a skeleton which they took all to pieces, and then one of them fitted it up again, giving the bones their Latin names. They are taught bandaging, which they do very neatly. One of the girls was supposed to have a broken leg, another a collar bone broken, another a jaw-bone, etc., and all the different bandaging was done most expertly. They study three years, and if they pass a satisfactory examination they are allowed to practice amongst poor Europeans and high caste natives. Their real function is midwifery, and it must be a great boon to native women who are not allowed to see a doctor to have such well educated doctresses to attend them in their confinement. Twenty eight of the girls were native Christians, and two were Mahomedans."

Observation an Element of Success.

Many people, says Wm. M. Thayer, in the *Phrenological Journal*, seem to think that luck constitutes the chief difference between successful men and the opposite class, unless it is where a sort of legerdemain or sorcery lifts them to the highest pinnacle of fame. This is a very superficial view of life and labor, and he who entertains it is doomed to failure. The inspired penman was right when he declared "The wise man's eyes are in his head"—not in his elbows or feet, though multitudes act as if they were. In other words, the "wise man" is a careful observer; he possesses this faculty of comprehending the nature and reason of things. He views things as he ought, both in business and morals. His eyes being just where they ought to be, and being used just as they should be used, the result is good—success. Not that observation alone insures success; but this is one of the leading, indispensable elements of success. One man possesses a higher type of it than another by nature; but all may cultivate it as they cultivate other powers.

In daily life, we notice a striking difference among men at this point. Ten men observe a steam-engine only to admire its novelty, while one studies each valve and screw until he understands, in a good degree, the principle on which it is constructed. Ten travelers pass through the country without noticing special peculiarities, while one observes each tree, flower, hill, valley, and river. One purchaser discovers the least defect in the cloth or other article which he is buying while another makes a purchase without noticing defects at all. One reader skims over a book, catching only its general drift, while another criticises style, expression and thought; is rapt with its beauties and sensitive to its faults. One scholar commits his lessons parrot-like, with little or no disposition to understand the whys and wherefores, while another studies and inquires until he comprehends the reason of all that he learns; one masters each branch of study, and the other does not.

In these and kindred examples, there can be traced the prominence and use of this faculty clear back to childhood. Newton was the youthful inventor of the kite and windmill. Other boys knew how to use them; he knew how to make them. Others cared only for the sport which they furnished; he cared for the principles behind the sport. Galileo was a toy mender in his boyhood. All the boys in the neighborhood resorted to him for assistance when their toys were reduced to wrecks. He knew just how to repair them; they did not. The power of observation was large in him, but small in them.

The celebrated Ferguson owed his triumph as much to observation as to any one thing. In his boyhood he learned how to make a clock by examining his father's. Then he desired to know how to construct a watch. He could not comprehend the motion principle of the watch, though he knew something of its mechanism. About that time a gentleman was passing his father's house, on horseback, and stopped to inquired the way of young Ferguson. After giving the information required, the lad asked the traveler what time it was. He was told, when Ferguson asked for the privilege of looking into the watch. His curiosity was gratified, when the boy inquired:

"What makes that box go round?"

"A steel spring," replied the gentleman.

"How can a steel spring in a box turn it around so as to wind up all the chain?" inquired the lad. His question was answered, but the boy said, "I don't see through it yet."

"Well, my young friend," continued the accommodating gentleman, "take a long, thin piece of whalebone; hold one end of it fast between your finger and thumb, and wind it around your finger; it will then endeavor to unwind itself; and if you fix the other end of it to the inside of a small hoop, and leave it to itself, it will turn the hoop round and round, and wind up a thread tied to the outside."

The whole thing was plain to him now. He went to work and constructed a wooden watch, which he put into a case about the size of a tea-cup. To be sure, these are remarkable cases; but an observation akin to the foregoing is indispensable to success in every pursuit.

Inventions Wanted.

The *American Gas-light Journal* calls for the following inventions. It says: Let us, first and foremost, in behalf of housekeepers of every civilized country, bespeak the invention of some safe contrivance for the washing of dishes, which shall do this branch of domestic work with the least possible drudgery.

Another great want of the household is the invention which shall render inodorous the kerosene, which has come to be the mainstay, of most people outside of the cities, as an illuminating agent.

Another want is a smoke preventing apparatus, which will permit the consumption of bituminous coal in furnaces and stoves. The essentials of a perfect combustion are well enough known. Seeing that this fuel is vastly more plentiful in the United States than anthracite coal, and, in some sections, is the sole dependence of the people, there surely are sufficient incentives for the development of some simple process of eliminating its only disagreeable characteristic.

WE are very much mistaken, if we believe we act from a single motive.—LA ROCHEFOUCAULD.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Some Useful Suggestions.

MESSRS. EDITORS:—Whenever I read a number of your paper—and that is once a week, without skipping a sentence—a "thousand thoughts revolve," suggested by the various new, valuable, and practical ideas therein set forth in order. I claim to be well posted in mechanical science, and must say that I give the SCIENTIFIC, which has been my teacher for years, the most credit therefor, since the foundation was first laid in the "old red school house."

The last forty years have been the golden age of science and mechanics. Probably the world will never see another like period, filled with such a succession of brilliant discoveries and valuable inventions. At least, it seems impossible, until some great new principle, like gravitation, for instance, is brought to light; or some wonderful motor, that will virtually offset gravitation, is found out, so that we can soar into other worlds at will, and range through new fields of observation.

As you said in your paper, a year or two ago, it seems that all we can do here further is to polish up and put in useful shape the great discoveries made. And yet it is but a decade since that great regulator of mechanics, the correlation of forces, was generally accepted as a truth, and the most daring theorist would have laughed if you had guessed that sometime we could tell what the stars are made of.

In your last number, you give the particulars of a great discovery—carving, drilling, and dressing stone with a jet of sand for a chisel, and a current of air or steam for a mallet. Why, Nature has been fashioning wonderful forms by this method for myriads of centuries, and why did we not apply it before? Like setting the egg on end, every one sees that it can be done, as soon as the happy idea is presented to them, and wonder that they did not see it before. But you speak of jets of steam, or air. How would it work with jets of water, or heavier fluids? In drilling holes, especially downwards, the water would wash away the *débris*, and, it seems to me, be more effective. As there is scarcely a limit to the speed that might be given to the moving cutters, and as their efficiency would, no doubt, be much more than proportioned to their speed at high velocities, as is the case with grinding stones, I predict for this invention a great future. To how many useful purposes it could be applied! Among them, I would suggest the dressing of millstones.

Some time ago, you had a communication upon the use of artificial grindstones, in which the writer claimed that if they could be made of even "temper," which he stated seemed almost impossible (judging by his own experiments), they would be far superior to the natural stone. Now, in my opinion, the trouble lies in the fact that by simple pressure a body of sand cannot be made of even consistency, on account of the formation of a multitude of minute arches, by the particles bearing on each other, and thus resisting, in various directions, the pressure applied; so that some parts are pressed much more than others. To remedy this, the material should be put in the mold, and then tamped with sharp pointed iron bars, and also hammered, till every arch formed is broken up, and each particle has found its fitting cavity. Or, what might perhaps be better, let the material be washed into the mold, by partial suspension in water or the cementing solution, in the same manner in which the solid ocean beaches are formed by the action of the waves, each particle being kept suspended till it finds its exact fit, so that the current will, as it flows over it, disturb it no more. This is the way in which Nature has worked in the formation of all our natural sandstones, and I believe it will be found the best for artificial stones.

Every one has noticed how hard a wave-washed sand beach always is, and this is the reason: that each particle of sand has been washed to and fro until it has found a lodgment from which it could no more be detached, a crevice into which it exactly fits, thus forming a compact, solid mass, with but little room for the cementing substance afterwards interposed. When in this state, even water acts as a partial cement; and it is found that chunks of such stone may be handled with considerable violence without being broken when wet. I think molds might be so made as to oscillate upon their centers of gravity, and the material gradually fed in with a little superincumbent silicate of soda, chloride of magnesia, or other cement, in solution; which, by being washed back and forth, at the proper speed, would finally settle each grain in its place, and thus form a more homogeneous mass than can be made by any other possible process.

One other idea, and I have done for this time. In the Bessemer process for making steel, or soft iron, it seems to me that the cumbrous "converter" might be dispensed with, and the air introduced into the molten mass in the cupola itself, or in the kettle under the top, or in a "hole in the ground," for want of a better place, by the use of a hose and nozzle inserted in the same, and through which reagents, like nitrate of soda, may be blown if wanted (as in another process); and in this way, besides allowing it to be carried on in small founderies, without much expense. A single kettle full at a time might be manipulated in this way, till formed into a mass, ready to put under the squeezer, or trip hammer, or into the rollers.

I have no opportunities to experiment in any device, but if my suggestions should prove "new and valuable," I hereby give notice to the patent examiners that I claim them as mine; and if you print this, they will have been "published in a public journal," and no one else can claim them.

CHAS. BOYNTON.

Boss Blacksmiths.

MESSRS. EDITORS:—Some time ago a machinist wrote to you complaining of the knavery of *boss* machinists. All his remarks are applicable also to *boss* blacksmiths, with a little more added.

The generality of *boss* smiths do not like to have extra good workmen in their shops, except when they can't possibly do without them, especially when, in addition to being good workmen, they are educated, sober, and respectable. A knowledge of drawing, mensuration, etc., are sins punished by discharge the moment business slackens.

If trade happens to be brisk, the *boss* tries to make the man leave the shop in disgust, by annoying him in divers petty ways, sometimes with an appearance of civility—by giving him light forgings to work on, if he thinks the smith likes heavy better, and *vice versâ*; by giving him unskilled helpers (the greatest annoyance a smith can be subjected to) who frequently hurt him by awkward striking, and keep him in anger continually, if he be not as patient as Job.

Then the *boss* always has the ear of the firm, and can insinuate whatever he likes about the man or men he fears, without a chance of contradiction.

The men who are kept in constant employment are the mediocre ones, who go on a spree now and then, dress shabbily; send presents to the *boss's* house; appear to regard the *boss* as a very superior being; have neither talent nor desire to move to a higher plane; who truckle to the *boss* in everything, and never invent a new tool or method.

I do not think the publication of my name would better my situation; therefore I sign myself STEAM HAMMER.

From Ireland.

[We trust the picture drawn by "Steam Hammer" is not a fair showing of the character of *bosses* in the large forging shops of this country. Certainly our personal acquaintance with this class of men does not corroborate "Steam Hammer's" statements. Is it not just the least probable that "Steam Hammer" is one of those thin skinned individuals too easily wounded by fancied neglect? or, perhaps, a little vain of his own accomplishments, and inclined to assume an offensive air of superiority, which of all things will render a man most speedily unpopular in a shop? The man who really possesses superior skill, and, instead of intruding it upon others' notice, lets them gradually discover it for themselves, rarely fails to win respect for it, if otherwise worthy. —EDS.

Aymara Indians in Peru.

MESSRS. EDITORS:—In the SCIENTIFIC AMERICAN of April 15, inst., under the above caption, appears the statement that, at an elevation of 7,800 feet above the level of the sea, the rarefaction of the air is such that the ordinary workmen could not be employed upon the Arequipa railway, the suffering being in some cases intense; and hence 16,000 Aymara Indians were imported from Bolivia.

Having always regarded your journal as high authority in such matters, I am the more surprised at the statement. If such be the fact in Peru, the cause must be peculiar to the location and not general to all places of said altitude. Here in Central City, Colorado, at an elevation of 8,300 feet, laborers of all classes, perform nearly, if not fully, as much labor as they would if working at the sea level. Miners from England, Nova Scotia, and Michigan, suffer little or no inconvenience from the rarefied atmosphere. It is true there is a quickening of the respiration, but nothing approaching "intense suffering," not even inconvenience. And even at the hight of 12,000 or 13,000 feet, we construct wagon roads, and work mines, without difficulty. The pick and shovel do not perhaps fly quite as lively as they would, in the same hands, in New York, yet a fair day's work is accomplished.

I have no doubt that a person who can chop four cords of wood per day, in Michigan, can, with no greater inconvenience, cut three and a half cords in the Rocky Mountains at an elevation of 10,000 feet. H. M. H

Central City, Colorado.

Long versus Short Lamp Wicks.

MESSRS. EDITORS:—Allow me to give your numerous readers the benefit of my experience with long wicks. I cram all the wick that I possibly can into the lamp, fill up the interstices with sponge, and saturate the whole thoroughly with kerosene. I have always found the supply sufficient for the longest winter's night; as long as any oil remains in the wick, the lamp keeps burning. I have had this fairly tested. One of my little ones—a two-year old—contrived to upset a small table supporting a lamp. With the exception of breaking the glass, no further damage was done, not even soiling the carpet. In fact, my plan was brought about from a similar accident, and a narrow escape from serious damage. As the wick burns away I keep filling up with sponge, and I think I have the nearest approach to a safety lamp.

I have heard that there is an asbestos non-inflammable lamp wick in the market, but as the vender of it does not appear to advertise in your columns, and as I, in common with many other mechanics, take no other paper, I am in ignorance where to get them. SAFETY LAMP

Type-setting Machines.

MESSRS. EDITORS:—It seems to me that the varying size of types, as we use them, must be one difficulty in the way of setting and distributing them by machinery. Can it not be agreed upon to have all small caps, lower case letters, double letters, figures, quotation marks, parentheses, brackets, reference marks, hyphens, etc., of one uniform thickness—equal to en quads, or a little less? M and w can be compressed, by some conventional understanding, and f, i, j, r, s, t, comma, colon, semi-colon, period, and "spaces," can all be expanded to the required size. Capitals, index, dash, etc., can be just twice that size. Have no "justifying," more than to fill out the line with quads of the standard size, when the last word or syllable, that would go in whole, was in. Make the newspaper columns wider, say something like the width of the SCIENTIFIC AMERICAN columns. Have it understood that a six-quad space denoted a new paragraph, and we would get about as much reading as we do now on a newspaper page, and might, perhaps, get it cheaper, without diminution of publishers' profits. R. J. WOOD.

Hancock, Portage, Lake Mich.

Water Shed by Roofing.

MESSRS. EDITORS:—In all estimates for the amount of rain water shed from the roof of a building, that have come under my observation, there has been an error, in my estimation, in allowing, or taking into account the pitch of the roof.

The common method of calculation would be: Take the size of the building on the ground, and then add in proportion as the pitch of the roof may be, one third, one fourth, or whatever else. Now there is only a given amount—commonly 36 inches in depth—of annual rain fall on a given horizontal surface; by covering this horizontal surface with a larger number of superficial feet of roofing, the amount of waterfall does not increase, nor does the quantity shed from that horizontal surface. Take a building 40 by 50 feet, covering 2,000 square feet; now add any amount for pitch of roof, and there is no increase of water shed over what would naturally fall on the 2,000 square feet of horizontal surface. This fact admitted, it becomes a very simple matter for any one to estimate the amount of rain water shed from the roof of his farm buildings: Compute the number of square feet the buildings cover of horizontal surface, then multiply that by 22·44 gallons—the amount of annual rain fall to the square foot—and you have the annual amount of water shed from the roofing. W. H. WHITE.

[Correspondence of the Scientific American.

EASTERN VIRGINIA.

NORFOLK, VA., April 13th, 1871.

An old time city—Hampton Roads—Cypress lumber and the Dismal Swamp—Navyyard—Air line railroads—"Truck" oysters and shad—A tall fish story.

This is one of the oldest cities of the Union, and it has the finest harbor on the Atlantic coast, not even surpassed by that of our great Gotham. We ran into Hampton Roads on the staunch steamer *Wyanoke*, after "one of the most severe short storms," Captain Bourne says, "I ever had to encounter;" and we found the waters of that spacious haven as calm as a summer sea. We saw, riding safely in its limits, many a craft which had there sought shelter from the short, sharp northeaster, which had given us a taste of that feeling which has made many a one think he would rather die than live. One of our fellow passengers counted ninety-three craft thus sheltered; and he stopped counting long ere he had finished the fleet.

Yet, with their unsurpassed harbor, both this city and its sister, Portsmouth, have a dilapidated look. The people ask querulously, why is this? It is too near to New York ever to be a great commercial city; and it has not the climate or water power to be a great seat of manufactures. Its day has passed, and henceforth it must be content to take a position as one of the suburbs of New York. Yet, there is considerable business done here, and it may be largely increased. Petersburgh and Richmond, however, will ever be the manufacturing sites. They have water power and coal. The great drawbacks to Norfolk were, first the yellow fever visitation of 1855; then the late war. The first swept off many of her best citizens, and created the panic idea that it might at any time return; the latter destroyed, in great measure, the splendidly equipped navy yard, which had supported thousands of mechanics. We have never believed, however, that Government works of any kind are of permanent benefit to any town or city. They kill out more active enterprise. Just now there is some activity in the yard, as the screw ship *Continental* is to be got ready to go into commission. They were to take on one hundred hands to-day, and, as I crossed on the ferry boat this morning, I found it well filled with men, all hoping for a place. Many of them had been out of work for months, and were ever looking towards the old dish to get a sop, however small.

THE LUMBER OF THE DISMAL SWAMP.

The only species of manufacture ever likely to flourish in this vicinity is lumber and its products. South and southwest of this city lies the great Dismal Swamp, which, in itself and its surroundings, contains probably the largest amount of valuable cypress and juniper timber, in one body, in this country. Still further south is eastern North Carolina, with its vast pine forests. This section is cut by various sounds and deep sluggish rivers; but their outlets to the ocean are shallow. These sounds communicate with Norfolk by the Dismal Swamp and Chesapeake and Albemarle Canals. The first has 5½ feet depth of water, the latter 7 feet. The last was intended to benefit Norfolk; but the schooners load in the sound, and go direct to Baltimore, Philadelphia, or New York. Nevertheless, it creates life in the harbor, and most of the operators must have offices here; hence, as they pay off their workmen, much of the money is spent in Norfolk. That this great trade does not benefit Norfolk is the fault of the people themselves, in a measure; that is the inevitable tendency of commerce and trade. These immense timber resources are being developed to produce lumber, bucket, tub, and barrel staves, railroad crossties, fence rails, posts, berry and fruit crates and baskets. One firm, Messrs. Baird, Roper & Co., told us they had, the previous week, sent off seven vessels loaded with these various products. They own 20,000 acres of juniper land, and have leased the Dismal Swamp Company's tract (26,000 acres) at $12,000 per year, with the privilege of working 100 hands. Their mills are about ten miles from Norfolk, having, in this city, a warehouse and office. There are many others engaged in the same line of business, though none so largely. The business of supplying railroad crossties is becoming a large and important one. We were told that more than 20,000 had been shipped in one week. The cypress or juniper tie is light, and easily handled, and lasts very well; on roads of light traffic or intended to be heavily ballasted, they are deemed as good as the costlier oak.

Before the war, Norfolk built a railroad to Petersburgh. Great hopes were entertained of this route. Now it is consolidated in one continuous line to Bristol, and thence to Memphis, Tenn., and, under the management of General Mahone, has become one of the great freight lines of the country. But a great many claim that it does not benefit Norfolk, that the freight over it passes on directly to New York by the steam line, whose punctuality of arrival and departure has caused it to be termed the New York and Norfolk Ferry Boat Co. If the terminus of this railroad and steamboat line were Jamestown or Suffolk, these grumblers would soon learn that it is, even now, of benefit to their place. They say of the 75,000 bales of cotton carried over it, none stopped in Norfolk. If they had a cotton factory there, which could manufacture the cotton cheaper than can be done in New England, it would stop, as some of it does in Petersburgh. Or, if they had capitalists with the nerve to buy a cargo for Europe, it would stop, and go from their port instead of New York. Now they talk largely of a steamer line, but until full freights are certain, no vessel owners will send ships or steamers to their port.

The other railroad having a terminus here, is the Seaboard & Roanoke. It is also a great freight route, *viâ* steamers to Baltimore and New York. The freight lists of these routes are an interesting commentary upon the new system of things in the South. Articles, heretofore unheard of, come forward in large quantities. Zinc and copper ores, barytes, marble, sumac, quercitron, dried fruits, ginsing, and hundreds of other things, once wasted, are now yielding revenues to the people who have energy enough to gather them.

Not the least of these new industries is the "trucking" business. It comprises all the range of early fruits and vegetables, but especially of green peas, strawberries, and tomatoes. One firm told me that they had made this year 100,000 bushel crates for the latter vegetable. The first is now coming forward from farther south. These were all raised here to some extent previous to the war, but the business has been largely increased; and there are sections of country around this place which are one immense garden—acres upon acres without a fence.

FISH AND OYSTERS.

Crossing to Portsmouth on the dapper little old ferry boat —the identical one we were on fifteen years ago—we noticed a flag on a schooner at half-mast, and a hundred little boats around. We thought some sailor dead, but were told that it was a sign the schooner threw out to let all know her captain would buy oysters. "Formerly," said our informant, "they hung up an empty basket on the mast."

The oyster business is an immense industry of all this section, thousands of men being engaged in it. They are shipped in the shell to New York for eating and planting, and they are canned here and in Baltimore.

On the Albemarle and Pamlico Sounds, in North Carolina, are large shad and herring fisheries. Seines over a mile in length are used, and millions of fish are caught every season. Formerly the seines were sent out in flat boats with oars, and hauled in by windlass and mill power. Now steam is used for both purposes. This new idea was introduced by a Northern man in the employ of Mr. Ned Wood. We have, in days gone by, seen 125,000 herring and 5,000 shad caught at one haul. Mr. Ghio, Superintendent of the Seaboard & Roanoke Railroad, told us that he sent about 9,000 pounds of fresh fish per day from these fisheries. The great bulk are salted.

H. E. C.

Berard's New Process for Steel.

M. Berard employs gas as the calorific and purifying agent, the purification being partially completed before such deleterious substances as sulphur, phosphorus, arsenic, etc., are thrown off. By the combined action of air and gas, he is enabled to reduce the waste to a minimum by means of alternate oxidization and reduction, which regulate at will and with certainty, by means of decarbonization and recarbonization, the nature and quality of the product. The starting point in his process is the employment of gas as a calorific agent, and the first difficulty was to fix upon the best kind of gazogene or retort. The thickness of the bed of coal which the current of air should traverse is limited by the natural draught; this is invariably insufficient for the saturation of the oxygen of the air, and its transformation into carbonic oxide—an indispensable condition of thorough action and a good quality of gas. M. Bérard overcomes this difficulty by a current of air supplied by a blast engine, by which means the bed of coal is made of the necessary thickness for the carbonic acid to be converted into carbonic oxide; while the operation of cleansing is rendered easy by a movable bottom. When the combustible is wet, steam mixes with the gases, and, by reducing the temperature, prevents the complete transformation of the tar into carbureted hydrogen. To avoid this result, the gas is made to traverse a bed of incandescent coke, by which means the decomposition of the steam and tar is completed, no trace of carbonic acid being left; while the gases retain a very high temperature, and do not require reheating. By this method, the gas obtained is of excellent quality, being rich in hydrogen and carbureted hydrogen, containing but a minimum of nitrogen; and it is free from carbonic acid, steam and tar. M. Bérard gives the cost of 350,000 cubic feet, at about $10 in gold.

Pig iron contains, as a rule, carbon, silicon, manganese, sulphur, phosphorus, etc., and it is necessary, for its conversion into steel, to remove these substances, with the exception of from a half to one per cent of the carbon. This is generally accomplished by the action of air, or by the addition of metallic oxides; but the result is rarely perfect. However, by the combined action of air and gas, these foreign bodies are more completely expelled; and, by slackening or hastening decarburation, the operation is thoroughly under control.

The *rationale* of the process consists, according to M. Bérard, in the expulsion of foreign bodies, as silicon, manganese, the greater part of the carbon, etc., by intermolecular combustion of these substances by means of a powerful current of air, pure or mixed with carbureted hydrogen, the temperature of the metallic bath being thus raised and maintained with great economy; in the reduction of the oxide of iron formed during the period of oxidation, by the employment of a current of purified and superheated carbureted hydrogen; in maintaining the metal in contact with the scoriæ, by the injection of incessant and energetic currents of air and gas, thus continually renewing the surfaces of contact. During the period of oxidation, the metalloids, such as sulphur and phosphorus, form sulphates and phosphates, which pass into the slag; while the process of reduction acts solely on the oxide of iron, bringing it back to the metallic state. The carbureted hydrogen exercises a double action; by its carbon in retarding the decarburation of the iron, and by its hydrogen in reducing the oxide of iron, and expelling sulphur and phosphorus by forming them into volatile sulphureted and phosphureted hydrogens.

M. Bérard also considers that the hydrogen enters into combination with the steel in some unknown manner, probably analogous to the occlusion of that gas by palladium. It is known that oxide of iron, even if impure, when reduced by hydrogen, yields a very soft iron. Steel, obtained by the method of working above described, from common, unselected pig iron, furnished files of the best quality, and some soft steel, made for no particular purpose, was found capable of withstanding the severe tests usually applied to the metal intended for the manufacture of scythes.

The Manufacture of Ozokerit.

Condensed from Engineering.

Ozokerit is a vegetable wax, and its raw and, native state is of a yellowish color, of light specific gravity, and somewhat fibrous in its structure. It will not burn of itself, but will readily melt on a light being applied to it. On being roughly wrapped around a central even in its native state, it is easily and regularly consumed. In fact, a rude candle can be made of the raw material and a cotton wick. It is found principally in Austria, Moldavia, the Caucasus, and near the Caspian Sea where it is obtained, in great quantities being largely used in those countries for illuminating purposes. It was discovered about two years since by a Russian military officer, who communicated the fact to M. Gustav Siemssen, who has introduced it into England.

The works, at which the conversion of the raw material into a white semi-transparent wax, ready for manufacturing into candles, is carried on, are situated in the Wellington road, Battersea, Eng. Ozokerit is imported in two conditions, one as dug from the earth, and the other as roughly melted down for convenience of storage in transit. In the latter condition it forms a dark colored mass, and is packed in barrels, the native or unmelted ozokerit being sent over in canvas bags. From the stores the crude material is conveyed into melting tanks, holding from 2 to 3 tuns each, and where it is melted down by means of a steam coil. From these tanks, which are situated in a gallery some 15 ft. above the ground level, the ozokerit is run off by gravitation to a series of stills placed outside the main building, and holding from 2 to 3 tons each, and in which it is distilled over, partly by steam, and partly by bottom heat. The dirt and bottoms from the crude ozokerit are run off from the melting tanks into another set of tanks beneath them, where they are remelted, the finer products being afterwards distilled over. The ozokerit comes over from the stills in the form of an oily distillate, which is run from the condensers into molds and allowed to cool. This gives a deep yellowish wax-like substance of a spongy nature, the pores being filled with on which exudes under a slight pressure. These cakes are packed between oil skins and canvas cloths, and placed in hydraulic presses, of which there are three of large capacity. The pressed cake after removal is put into re-heating tanks and again melted down, and is pumped from these tanks by a steam pump into the acidifiers where it is treated with a sulphuric acid. These acidifiers are steam jacketed, and are fitted with revolving agitators, by which the ozokerit and acid are agitated together for a certain time, after which the mixture is allowed to settle. After settling, the purified ozokerit is drawn off from the lower part of the acidifiers—the acid remaining on the top—and run into vessels which are heated by bottom heat. This is the final heating, and from these vessels the fine stuff is drawn off into moulds, the result being a hard white wax, the melting point of which is 140°, that of paraffin wax being 128°. From these blocks the now well known ozokerit candles are made.

There are several by-products, the chief of which is a very clear colorless oil, without smell, and of very high illuminating power.

An ingenious method of overcoming a nuisance in connection with this manufacture is worthy of a passing notice; it may offer a suggestion to others who are troubled in a similar manner. The waste water from the condensers, as well as liquid refuse of various kinds, were run off from the works into the main sewer, but they carried with them a stench which escaped from the drains and through the gully gratings, and proved a nuisance to the neighborhood. To remedy this, a close intercepting tank was constructed in the yard of the works, and through this, the waste liquors are run on their way out. They enter near the top at one end and impinge upon a diaphragm plate placed across the upper part of the tank, and which is carried some distance down. On reaching the bottom they meet another similar plate, over which they have to pass on their way to the point of exit, before reaching which they come against a third plate fixed in a similar position to the first. After passing this plate, the drainage matter leaves the separator by an opening on a level with the entrance point. By this means the waters are well broken up and the foul odors released, the latter passing away through a flue into the main shaft of the boiler furnaces, and an intolerable nuisance is thus effectually remedied in a simple and inexpensive manner.

With regard to the ultimate results of the processes we have been describing—the candles—we have only to add that they are a novel and successful addition to pre-existing means of illumination. From a trial of them, we find them subject only to one drawback, that is, smouldering and giving off a very offensive smell when blown out. This, however, is not peculiar to these candles alone, but is also a fault common to wax candles, and arises from the rapidity with which the wax cools. The remedy, of course, is to use the extinguisher, but we scarcely like to see this old-fashioned utensil reintroduced, and would suggest as a possible remedy the treatment of the wick, before insulation in the candle, with some material which takes a longer time to harden than ozokerit.

Dip your Razors in Warm Water.

Recently says the *London Medical Press*, we have professionally seen two of the worst cases of *Sycosis Contagiosum* which have ever come under our notice. Both patients were shaved by the same barber, and no doubt by the same razor as that used—for the barber acknowledges his fault—in shaving "a man with a bad chin." In one patient the yellowish scales have extended to the upper lip and sides of the face covered by hair. The vegetable nature of the disease, and the rapidity with which the seeds are transmitted from part to part, until the cryptogamic plant surrounds every hair follicle, is only too well known for repetition here. Our chief object in directing public attention to a most serious matter is, that barbers will learn, through us, to be more careful in indiscriminate shaving, and that the public, seeking their aid will, for its own sake, insist upon what we hope will now become an universal practice in the barber shop: namely, the immersing the razor in warm water before applying it to the face. This is pretty sure to destroy the vegetable organism, should any exist, on the instrument. The transmission by contagion of *sycosis*, from the use of a razor employed in shaving an affected person has been repeatedly noted.

Diseases of the Eyeball.

Very few of the diseases of the internal parts of the eyeball, says Dr. Jeffries in *Good Health*, present, externally, any indication of their presence. Varying degrees of pain, intolerance of light, and dimness of vision, up to total blindness, are all the symptoms the ophthalmic surgeon formerly had to guide his treatment, till the invention of the ophthalmoscope by Prof. Helmholz, revolutionized ophthalmology, or the study of the diseases of the eye, by allowing us, through this instrument, to see perfectly the interior of the eyeball, and tell exactly what disease exists, in what membrane, whether in the crystalline lens, the vitreous humor, the optic nerve, the retina, or the choroid coat, etc.

Of course, therefore, it is useless to speak here of these diseases, which the ophthalmic surgeon alone can see by means of the ophthalmoscope, and understands how to treat. Some forms of the diseases of the membranes within the globe are not amenable to treatment, are not curable. Before we could see what they were, the unfortunate patients were naturally subjected to all sorts of treatment; of course, perfectly useless, and sometimes very hurtful both to the eye and general system. For instance, there is a form of blindness which begins to show itself as dimness of vision, mistaken for near-sightedness, in childhood, and goes steadily on to total blindness at about forty-five years of age. The eye exhibits no external symptom, but the ophthalmoscope shows a most remarkable deposit of pigment in the retina, which tells the ophthalmic surgeon at a glance what the trouble is, and he knows nothing can be done. About one third of such cases have been found to occur in the children of parents related to each other; first cousins, for instance. It certainly argues directly against such consanguineous marriages, distinct from many other reasons, equally convincing. Blind relatives, undoubtedly, run great risk in marrying.

SUCCESSOR TO THE LATE PROFESSOR BOLLEY.—The Council of the Swiss Polytechnic School at Zurich have appointed Dr. Emile Kopp as Professor of Technology, in the room of the late lamented Dr. Bolley, a memoir of whom we published at the time of his death. Professor Kopp has won considerable distinction as a teacher, at the Institute Superiore at Turin, and his loss will be severely felt by the Italian Government. The Swiss are to be congratulated on having secured the services of a man so eminently fitted to succeed Dr. Bolley.

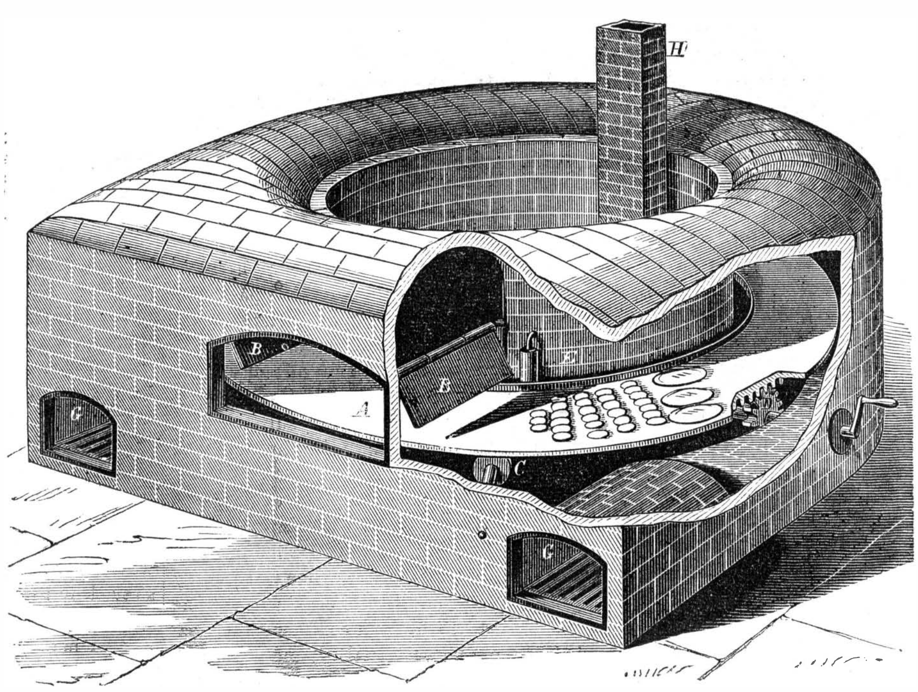
NATURE is grandest where sensual impressions reflect into depth of thought.—HUMBOLDT.

Improved Baker's Oven.

Our engraving illustrates a newly invented baker's oven, devised by a practical baker, Mr. W. C. Wedge, of Chicopee, Mass. In its examination, men familiar with the working of reel ovens, etc., will be at once impressed with the simplicity of the improvement, and will recognize the soundness of the principles upon which it is constructed. Its adaptation to the manufacture of bread and crackers, in short, to any kind of baking, will, we think, be equally obvious.

The object sought by the inventor has been to combine the advantages of the old fashioned brick oven with those of the continuously acting mechanical ovens heretofore employed. The latter have failed to produce as sweet and wholesome bread as the old brick oven. The reason for this is undoubtedly owing to the fact, that they are made with so much space between the bottom and top, as to remove the "crown"—usually made of brick—too far from the dough to be baked, thus lessening the reverberatory action of the oven. Especially is this the case with reel ovens, in which the bread is placed upon swing shelves and carried around through a large heated chamber, there being a space from 10 to 15 feet between the top and bottom of the oven, and in some cases even more than this. This surplus space becomes filled with gases from the coal employed to heat the oven, and also from the dough during the process of baking, and the bread or crackers are more or less impregnated with and flavored by these products.

In the old style of oven, the crown is from 15 to 18 inches from the dough, and instead of being cooked by immersion in a bath of heated gases, the bread is baked by radiated heat, which forms a thicker crust, and imparts to the bread that rich delicate aromatic flavor arising from the partial distillation of a small portion of the flour in the crust, so much admired in what is known as French bread.



WEDGE'S ROTARY OVEN

The construction of the oven is shown in the engraving, a small portion of the exterior masonry being broken away to show the arrangement of the revolving annular platform on which the dough is placed to be baked. A represents this annular platform. The dough is put in, and when brought around again, by the rotation of the platform, is taken out at the open door in the front of the oven.

Swinging damper doors, B, prevent the escape of heat from the oven. Friction rollers, C, sustain the weight of the rotary platform, and other friction rollers prevent its rubbing against the internal masonry, E. D is a pinion, which, being driven either by hand or power, acts upon a circular rack on the under side of the platform, A, to rotate it. The furnaces are shown at G, and the fire is led about through flues to the chimney, H.

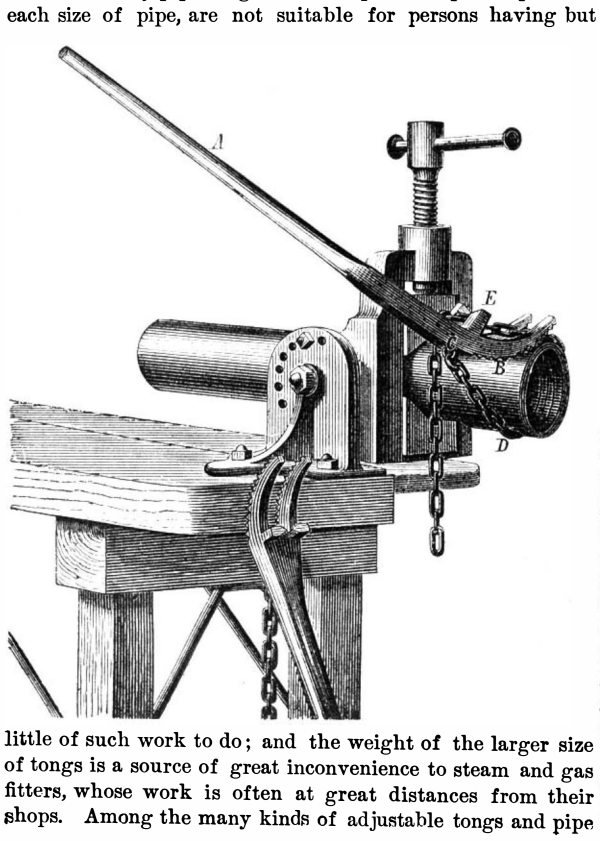
The crown of the oven is 14 inches above the rotating platform or table. The platform is covered with soapstone slabs. The damper doors, B, are kept constantly closed when baking crackers. Their lower edges are one inch from the upper surface of the soapstone plate, and therefore allow the passage of the crackers without being opened, as when baking bread.

It is claimed that this oven bakes equally well on the top and the bottom of the bread, and will bake anything in the superior manner accomplished by the old-fashioned brick oven. It is also said to excel in economy of fuel and labor.

Patented by W. C. Wedge, July 27, 1869. Address, for further information, Wedge & Patrick, Chicopee, Mass., or A. Gilbert, 57 Morris street, Jersey City, N. J

ROBBINS' IMPROVED PIPE WRENCH.

The ordinary pipe tongs, which require a separate pair for each size of pipe, are not suitable for persons having but



little of such work to do; and the weight of the larger size of tongs is a source of great inconvenience to steam and gas fitters, whose work is often at great distances from their shops. Among the many kinds of adjustable tongs and pipe wrenches now in use, many of them have such serious faults as to make them very undesirable. In order to meet with universal favor, such an instrument should be so simple in its construction that it can be sold at a low price, and be repaired by any blacksmith. It ought not to require frequent repairs. It should have the greatest amount of strength that can be obtained from a given weight of metal. The tendency to crush an old thin pipe should not be as great as that of ordinary tongs. It ought to have the widest possible range in the sizes of pipe that any one wrench can grasp. It should release its grasp the instant it is moved in the opposite direction.

The engraving accompanying this article represents an improved pipe wrench designed to secure the advantages named. The instrument is extremely simple, and its operation will be easily understood on reference to the engraving. It is a bar, A, terminating in two serrated bifurcations or jaws, B. To a staple, C, is attached a chain, D, which, when the instrument is in use, passes about the pipe in the manner shown, and has one of its links passed over one of the lugs, E, as shown. An upward movement of the handle then tightens the chain, giving a powerful bite to the serrations of the jaws, and turning the pipe. The reverse movement of the handle slackens the chain and gives a new hold to the jaws. The extreme simplicity of this device, together with its convenience in use, and its efficiency, are apparent. It was patented, through the Scientific American Patent Agency, May 2, 1871, by Eugene H. Robbins. For further information address Rice, Robbins & Co., Pittsfield, Mass.

Gunpowder Experiments.

Some very important gunpowder experiments were made lately at Woolwich, says the *Mechanics' Magazine*, before Lord Northbrook and a large staff of artillery officers and gentlemen connected with the manufacture of explosives. The results, briefly stated, were such as to establish this proposition beyond doubt, and it may now be taken as certain, that the thirty-five tun gun, with its caliber of 11·6-in., will not burn more than 110 lbs. of gunpowder at one discharge, if so much. As it is thought necessary to have a gun which will burn 115 lbs. or more, it remains to be decided whether a larger gun shall be built, or the caliber of the present one enlarged; and, at all events experimentally, the latter course will probably be adopted. It has been proved by the tests which modern research has rendered easy, that a certain charge exercises less pressure upon the interior surface of a 12-in. than a 10-in. gun, and hence it is concluded that, by enlarging the bore of the big gun half an inch, the decreased thickness of the walls will be no element of weakness, inasmuch as the lateral strain will be diminished.

The other experiment was designed to assist the investigations in which the officers of the laboratory are engaged to insure greater safety in the manufacture of ammunition. Anxious to ascertain whether the regulation distance of 20 yards between the workshops was sufficient, consistent with the presence in each shop of the regulation quantity of 50 lbs. of powder, Captain Majendie had erected five rough sheds 20 yards apart, and placed 50 lbs. of gunpowder in the one which stood in the midst, a smaller quantity being strewn upon shelves on all the others. The charge being fired, the shed in which it occurred was blown into a thousand fragments; but, though in some cases the powder had been shaken off the shelves of the other sheds, and a few timbers started, none of the powder had been ignited. It would, therefore, appear that an isolation of 20 yards is sufficient, and some gunpowder manufacturers who had been invited to witness the experiment were much gratified by the result.

SUBWAYS IN LONDON—Mr. Haywood, London, in his report on Street Tramways, says: "There can be no doubt that the tramways will have to be disturbed at times by the gas and water companies, nor that, when such is the case, much more inconvenience will ensue both to the companies and the public than at present is the case; indeed those companies are, in the City, likely to prove the source of great inconvenience to the tramways, and this, with other circumstances, points to subways as the remedy. It seems probable that in the course of a short time the gas company lighting the City will pay its maximum dividend of 10 per cent., after which its surplus profits must go towards a diminution in the price of gas, and it is worthy of consideration whether such surplus could not in the public interest be best employed in the formation of subways, so that the opening of the street surface might be obviated afterwards."

THE EARTH CLOSET SYSTEM---AN IMPROVED EARTH CLOSET.

The earth closet system is making friends daily. The superior convenience of water closets still keeps them in favor in cities having general water service, and it is not likely that earth closets will very soon supplant the wasteful unhealthy system of pouring into our rivers the sewage of large towns; but in rural districts, where water closets are impracticable, the earth closet has proved, and is still proving, a most serviceable invention. Aside from its freedom from effluvia, it serves, in a convenient form, for application as an unequalled fertilizer. Let those who have any doubts as to the superior quality of deodorized night soil as a manure, mix it into a compost with grass, sods, and leaves from the woods, rolled, and saturated with a year's showering of waste slops from the kitchen and laundry, and apply it to any worn-out land, and they will need no further evidence.

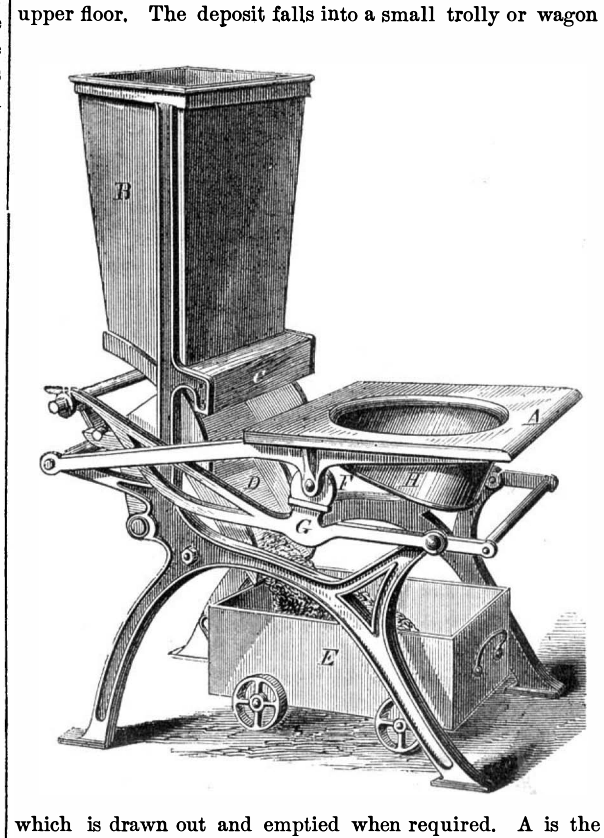
The economizing of the sewage of large cities, which act as huge drains upon the fertility of the sections furnishing their food supplies, has perhaps been discussed at greater length, and attracted more attention, than almost any other economical and sanitary question of the age. A general application of the earth closet system, or such a modification of it as should supersede water closets, seems to us the most practical solution of the problem. There is room for a good deal of inventive genius yet left in this field.

With a view to keep this subject before the minds of inventors, we this week publish an engraving of a new English invention in this line, which we copy from the *Mechanics' Magazine*.

The apparatus consists of a cast iron frame, firmly bolted together with wrought iron stays, supporting a cast iron valve moving on two pivots beneath a zinc hopper, which contains the earth. The valve is so arranged as to form a measure, and receives a certain quantity of earth, which is cut off and thrown on to a movable shoot hung at the lower part of the valve, by which it is guided to and spread upon the required spot.

The valve is worked by the weight of a person sitting on the seat, by means of a lever and friction roller. When the seat is depressed, the upper part of the valve slides from below the hopper and opens a passage for the earth, the lower part of the valve rises, and with the two sides forms a receptacle for a certain quantity of earth; when the seat is relieved of the weight upon it, the lower part of the valve falls of its own weight, causing the upper part to slide back under the hopper, and, at the same time, to cut off the earth which has fallen, which is thrown off along the movable shoot.

The apparatus shown is intended for fixing in an internal or ordinary closet where there is no pit or vault, or on an upper floor. The deposit falls into a small trolly or wagon



which is drawn out and emptied when required. A is the seat, B the earth reservoir, C the valve and the piece of timber against which it strikes, D the shoot, E the wagon, F G the lever and roller for working the valve, H the pan.

Scientific American.

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Contents:

(Illustrated articles are marked with an asterisk.)

FACTS RELATIVE TO THE ERIE CANAL.

It is probable there never was a proposition made that did not meet with objection from somebody. From the earliest date of the conception of the Erie Canal, down to the passage of the recent bill offering a prize of one hundred thousand dollars for a means of propelling canal boats by steam, caloric, or electric engines, there has been nothing proposed relative to its construction or improvement that has not been strenuously opposed, on political or other grounds.

When it was first commenced, many predicted that the generation then living never would witness its completion. When, at the expiration of about eight years from the beginning, the unbelieving witnessed the grand jubilee which attended the triumphal voyage of DeWitt Clinton from Lake Erie to New York Bay, they then cried out with one accord, "It will never pay for itself. and our burdens of taxation have been increased to no purpose." When, however, in the brief space of nineteen years its debts were paid, and it thenceforward became an important source of revenue to the State, reducing taxes, increasing population, giving a new impulse to business and manufactures, and furnishing a market for the produce of central New York, the croakers' mouths were stopped for a time. At length when it was found that the business had outgrown the canal, and it was proposed to enlarge it, that found opposers also. But there have always been found enough who believed this great work to be of such vital importance to the State, that its interests have not been permanently injured by opposition.

Although the first appropriation, designed to cover the entire cost of constructing the canal, was $5,752,738, the actual cost at the time it was completed amounted to $8,401,394. In 1823, 10,000 barrels of flour were shipped at Rochester for transportation to Albany, and the boats containing it—the first that passed the canal—started on their voyage October 8th. During the same year the Champlain canal—an important branch of the system of internal navigation—was completed, and its junction with the Erie Canal made at a point near where the flourishing manufacturing town of Cohoes now stands. Subsequently the junction was made at a point nearer West Troy.

Even at that period the idea of navigating the canal by steam had possessed many minds. The passage of the steamboat *Erie Canal* through the feeder at Rochester, to take its place as the first steamboat upon the Genesee river, was thought to have demonstrated the feasibility of steam navigation from Albany to Buffalo. The difficulties that would arise were not then foreseen.

The benefits of the work were immediately felt throughout the West. In five years, the tunnage of vessels on the lakes discharging at Buffalo, was increased from 2,449 tuns to 16,300 tuns. In 1830 the competition of railways with navigable water commenced in the completion of the "Phœnix," the first locomotive ever built in the United States. It was constructed at the West Point Foundery, for the South Carolina Railroad. At this time there were 44 miles of railway completed, 422 in progress, and 697 projected. Among the latter was the Mohawk railroad, destined to grow into one of the most important in the country, the great "New York Central," and the immediate and formidable competitor to the Erie Canal.

The Erie Canal, as it now is since its enlargement, is 70 feet in width at the water level, and 42 feet wide at the bottom. Its depth is 7 feet, and the width of the tow path, 14 feet. It has one level 60 miles in length, but at Lockport a difference in level of 60 feet is surmounted by ten double locks. The descent from the Lower Aqueduct, as it is called—situated 4 miles above Cohoes Falls, on the Mohawk, to the level between West Troy and Albany, is made through a series of locks cutting the canal into short levels, some of which are scarcely more than four or five boats' length. The Upper Aqueduct is some ten miles or so west from the lower one. Both are used to cross the Mohawk river, which, from Schenectady to the falls, traverses a wide curve. These aqueducts are substantially built of stone, with timber inclosure for the water way. The entire length of the canal is 363 miles.

TORNADOES OF THE SOUTHERN STATES.

The above is the title of an important paper on the subject, about to be published by Prof. H. S. Whitfield, of the University of Alabama. It developes a new law, and demonstrates an inherent motive power in tornadoes, by which, when not under the control of elevated currents descending into their vortices, they move, through a tranquil atmosphere, always in one direction. The impulse is acquired from the diurnal motion of the earth, and is toward the northeast in the northern hemisphere, and the southeast in the southern hemisphere. According to Prof. Whitfield's theory, they are generated in calms, and require, as an indispensable condition, a lower stratum uniformly heated over a great extent. In the South, this is afforded in the cooler season of the year, during or after the prevalence of warm south winds; but never in the hot summer, when the surface of the earth, on account of its varying capacity, is unequally heated by direct solar rays. They are produced, not as heretofore supposed, by upward motion of the air, but by powerful descending currents; and herein lies the characteristic difference between them and the less violent storms that result from uprising columns.

We subjoin one or two paragraphs from this interesting paper, which present striking and original views of the formation and action of these storms:

"In an atmosphere supersaturated and unduly heated at the surface, let a calm prevail over many miles of territory. The equilibrium is powerfully disturbed. A great volume of elevated air begins to settle down, forcing up the lower strata. In descending, it meets and mingles with the warm, moist air beneath, forming cloud. Whatever latent heat may be evolved by condensation is at once re-absorbed by accessions of cold air from above. The descending stream, fed by oblique tributaries from all points of the compass, begins to gyrate. From centrifugal force result rarefaction, cooling, and further condensation. The center of the vortex is a partial vacuum, and from below a column is drawn up into it. This ascending column also takes on gyration, and the tornado spout is created. But this spout, the effect of which is so terrific, is nevertheless secondary and incomparable to the tremendous commotion to the great whirl above. The two columns meeting, vast volumes of air are thrown off by centrifugal force in all directions, and the cloud expands and enlarged with amazing rapidity. This expansion is often mistaken for the progression of the storm; the cloud appearing to approach one observer from the northwest, perhaps, while another sees it rolling up from the south. In the meantime the descending stream has pressed the cloud down upon the surface, where it envelopes everything along its path in almost total darkness. At length the superior vortex becomes so great in diameter that the spout is disrupted, or so diffused as no longer to exhibit the concentrated power of the tornado. The whirl becomes co-extensive with the overhanging cloud, and the meteor is now a rain or hail storm of tremendous violence.

"The cause of the greater violence of storms produced by descending air is not difficult to comprehend. When a downward column becomes well defined, it is fed, as before suggested, by tributaries flowing obliquely from all sides. The very top of the atmosphere sinks freely into the stream. The total force displayed may be regarded as the mechanical equivalent of the abnormal difference in temperature of two oceans of air, the colder superimposed upon the warmer one. The tornado is a process by which the one seeks to settle beneath the other, and is not unlike what would occur should an opening be made through the bottom of some great reservoir of water.

"On the other hand, when the transposition undertakes to be accomplished by a definite ascending column, the earth's surface presents a limit, and the tributaries cannot, as in the other case, flow obliquely in straight lines without leaving a vacuum beneath, and that is impossible. They must, therefore, though ever seeking to mount upward, still trail along the surface until they converge at the center. An impediment of this nature would find adjustment in many uprising columns of limited power, capped with cumuli, and resulting in showers, but no one vast, absorbing vortex could monopolize the whole movement, and shake the firmament with its might.

"The process of hail-formation takes place in the great vortex above the base of the cloud, probably at considerable elevation. There the gyration, not impeded as it is at the surface, presents a vast and rapid whirl, the centrifugal force of which causes extreme rarefaction, accompanied with intense cold at the center. The saturated air carried up into from below, by the spout, furnishes the material for hail. Congelation follows instantly upon condensation, and the stones, tossed about in every direction, are finally thrown out upon the circumference, where they are free to fall."

Our readers will remember a communication recently published in our columns, describing the effects of a tornado.

The effects are often, to all appearance, very anomalous and extraordinary. It strips the feathers entirely from fowls when the gust strikes them from behind. In a row of buildings in a line with its direction, it may throw down the middle one, and leave the others standing. This is possible when they are located on the central line of progression, for then the blow is delivered by the front and rear of the rim, gyrating at a right angle with the row, and every house must stand or fall, according to its own power of resistance. Or, if a firmly-built house withstand the outward shock, it may yield to the elastic force of its inclosed air, expanding, as it must, with a sudden and powerful effect, that instant the vortex, which is a vacuum, passes over it.

Again, pointed pieces of wood or iron pierce or penetrate wherever they strike end-foremost, and pebbles are imbedded in soft wood by the force of the blast. This is not so remarkable when we reflect that the velocity of gyration is three hundred feet a second—and it may go far beyond that—which is greater than the speed of an arrow shot from a bow

A QUESTION IN SOCIAL SCIENCE.

That the above title contains a present misnomer in the words *social science*, does not derogate from its appropriateness, as applied to the question we are about to discuss. As our readers are well aware, we believe there is no such thing as "social science" yet in existence; and our use of the term here is made with this protest. We use it only in view of that prospective time when the construction of society shall be made to rest upon general and immutable principles, thoroughly ascertained by scientific experiment, or logically deduced therefrom, and classified and reduced to a system, according to the true scientific method.

When that period arrives, the question of what we shall do with the mentally and morally diseased persons we now style criminals, will be settled permanently. It is even possible that this will be brought to rest firmly upon sound reason and science.

Criminals are now regarded by thinking men in a very different light from that generally entertained fifty years ago. Physiologists and psychologists are beginning to see that what we call moral obliquity is, in a great measure, if not entirely, the result of disease. The man who in a fit of *mania a potu* brains his wife with a frying pan; the wretch who, devoured by base passions, breaks by force through the restrictions society imposes for the protection of female honor; the man who, maddened by jealousy, shoots down the real or supposed destroyer of his peace; the wealthy kleptomaniac; the petty pilferer; the murderer in cold blood; the burglar; the pickpocket, and the highway robber, all are in the same category of people diseased, through the undue prominence of some passion or appetite, or through the absence or decay of those sympathies, affections, impulses and emotions that impel men to kind acts, and deter them from acts injurious to their fellows.

The application of the term "justice" to our dealings with these unfortunates, is as contrary to reason and fact as it would be to apply it to the removal of smallpox patients to pest houses. The crude idea mistaken for justice in most minds, is a desire to gratify a feeling of revenge. Science is teaching us that "justice," so far as the administration of human law is concerned, should mean the best means for protecting society from the contagion of crime, and the lawless acts of the depraved in body and mind, whether it be by enforced isolation from society, or by death. Science is teaching us that the terms "punishment," "penalty," "justice," do not assert that which society has a right to do with criminals. It teaches that, while society has the undeniable right to protect itself against crime, as against any other class of disease, it has not the right to revenge itself upon the morally sick, any more than upon the physically sick.

It thus throws a clear light upon the much debated question of the abolition of "capital punishment," as it is called. It teaches us that society, as well as the individual, has the right to use any and all means absolutely necessary for self-protection and defence; and that the question of means must be considered in no other light but that of expediency.

The individual does not argue the question of abstract right or wrong when called to desperately defend his life, even if obliged to resort to killing his antagonist; and neither need society debate the question. It has merely to determine what is necessary to save itself from destruction. If it be necessary to take the lives of criminals in order to insure the peace and good order of society, the necessity is the justification of the act.

This narrows the dispute down to the determination whether it be necessary for society to kill men in order to protect itself or not; and this determination must either be based upon the already acquired experience of the race, in social government, or upon new experiments, performed with a view to decide the matter.

The light of the past shows, we think, that for the protection of society against a certain class of crime, there has yet been found no adequate substitute for the execution of the criminal; but it does not convince us that such a substitute is not to be found, because there has been no thorough organized search for such a substitute, nor any proper trial of any thing proposed as a substitute. We think we could show the truth of the latter assertions, had we space to review the attempts made in certain localities to abolish capital punishment, and to point out the defects, considered in the light of experiments; but we cannot pursue this topic to greater length.

If crime be the result of disease, it should seem that remedies and treatment designed to cure and prevent the disease should more engage the attention of reformers than the protection of the healthy from its effects; because that is really the most difficult problem to solve. It is one, however, which society at large is reluctant to grapple with, because the search for ultimate causes reveals too plainly the fact, that in the faulty structure of present social organizations lies the principal germs from which crime originates and spreads to curse the earth.

FROM DULUTH TO THE OCEAN.

Many inquiries having been made respecting the communication, by water, from the head of navigation of the great lakes to the sea, we publish this week an epitome of the route, showing all the figures which bear upon the subject.

Starting at Duluth, the western extremity of Lake Superior, let us journey to the sea. From Duluth to the St. Mary River, the outlet of the lake, is 420 miles. Elevation of Lake Superior above the sea, 600 feet; average depth, 900 feet; coast line, 1,030 miles; area, 32,000 square miles. At St. Mary, there is a canal a mile long, with two locks, each 350 x90x12 feet, capable of passing vessels of 2,000 tuns. The fall of this canal is 19 feet. From the foot of the St. Mary canal to Lake Huron, down the St. Mary River, is 54 miles, with a fall of 8 feet. From this point to the entrance to St. Clair river, down Lake Huron, the distance is 270 miles. Elevation of the lake, 574 feet above the sea; average depth, 450 feet; coast line, 705 miles; area, 23,000 square miles. From the entrance to St. Clair River to Lake St. Clair, is 33 miles, involving a fall of 6 feet. Lake St. Clair is 25 miles long to the entrance to the Detroit River; elevation above the sea, 568 feet; average depth, 15 feet; coast line, 60 miles; area, 360 square miles. Thence down the Detroit River 18 miles, falling 4 feet, into Lake Erie, at an elevation above the sea of 564 feet, to Port Colborne, at the head of the Welland canal, 220 miles; average depth of Lake Erie, 90 feet; coast line, 570 miles; area, 10,000 square miles. From Port Colborne to Port Dalhousie on Lake Ontario, is comprised the Welland Canal, 27 miles long, with a fall of 330 feet; number of locks, 27; size of locks, two of 200x45x12, and twenty-five of 150x$26\frac{1}{2}$x$10\frac{1}{2}$; the large locks being of a capacity of 900 tuns, the smaller of 500 tuns. From Port Dalhousie to Kingston, at the foot of Lake Ontario, is 160 miles; elevation of lake being 234 feet above tide water; average depth, 412 feet; coast line, 410 miles: area, 6,700 square miles. From Kingston to the head of Galops canal is $66\frac{3}{8}$ miles, the St. Lawrence River falling 6 feet. The Galops canal is $7\frac{5}{8}$ miles long, falling $15\frac{3}{4}$ feet; three locks 200x45x9; canal 59 feet on bottom, 90 feet on top; capacity, 700 tuns. Thence down the river $4\frac{1}{2}$ miles, falling $3\frac{3}{4}$ feet, to the head of Rapid Plat canal, 4 miles in length, with two locks falling $11\frac{1}{2}$ feet; locks 200x45x9; canal 50 feet on the bottom, 90 feet on top; capacity, 700 tuns; then the river again, for $10\frac{1}{2}$ miles, falling $2\frac{3}{4}$ feet to the head of Farran's Point canal, three quarters of a mile long; one lock, falling 4 feet, 200x 45x9; canal 50 feet, and 90 feet wide; capacity, 700 tuns; then down the river five miles, falling 1 foot, to the head of the Cornwall canal, $11\frac{1}{2}$ miles long, falling 48 feet: 7 locks, 200x55x9; canal 100 feet on the bottom, 150 feet on top; capacity 700 tuns; then through Lake St. Francis, $32\frac{3}{4}$ miles, falling $1\frac{4}{10}$ feet to the head of the Beauharnois canal, $11\frac{1}{4}$ miles long, falling $82\frac{1}{2}$ feet; 9 locks, 200x45x9; canal 86 feet on the bottom, 120 feet on top; capacity 700 tuns; then through Lake St. Louis, $15\frac{1}{4}$ miles, falling $1\frac{1}{2}$ feet, to the head of Lachine canal, $8\frac{1}{2}$ miles long, falling $44\frac{3}{4}$ feet, 5 locks, three of them 200x45x9, and two of 200x45x16; canal 80 feet on the bottom, 120 feet top width; capacity, 700 tuns.

This brings us to the city of Montreal; the river then falls 11 feet, until it strikes tide water at Three Rivers, 86 miles below Montreal, showing a total fall, since leaving Duluth, of 600 feet, with a distance of 1,492 miles; comprised of lake navigation, 1,096 miles; river, 325 miles; and canal, 72 miles. Quebec is 74 miles below Three Rivers; and from that city to the open ocean, at the Straits of Belle-Isle, it is 826 miles.

In this connection, we may state that the locks of the Erie canal (enlarged in 1862) are 110x18x7. Total lockage, 655 feet. Those of the Champlain canal are 97x14x4.

It is proposed to increase the sizes of the locks between St. Mary canal and tide water to a uniform size of 270x45x9; capacity, 1,300 tuns.

THE WATER SUPPLY OF LONDON--SEA BATHS IN CITIES.

The water for the consumption of London, with its four millions of inhabitants, is provided by several joint-stock companies, of which the New River Company is the largest and most important. The New River is a canal, made by Sir Hugh Myddelton, an eminent engineer of the seventeenth century, chiefly from philanthropic motives. The payment to the company is made by each householder, and is proportioned to the number and size of the cisterns in the house. Although the price is not high, probably not higher than an assessment for water supply would be, the density of the population gives the water company an enormous revenue, so large, indeed, that the amount of the dividends, upon the stock, is kept a close secret, both by the company and the stockholders. Stock, of which the original par value was £100, has been renominated and sold, in many instances for over £20,000; but of course such property is not often parted with, and the real value of such a stock cannot readily be ascertained.

London lies in a basin of about fifty miles diameter, and the whole of the watershed of this district ought to be made available for the supply of water; but the greensand, which is the recipient stratum, lies at a great depth, and boring for water, to any great extent, has never been attempted. If wells were sunk on a sufficiently large scale, no doubt water could be found amply to provide all London with this indispensable element, at a merely nominal rate.

The water used for bathing and for watering the streets is an important part of the consideration, and a proposition has been often made to convey sea water from Brighton (52 miles from London, and the nearest point of the coast); and this idea is now again receiving public attention. A water main, with pumping engines, could be provided for £500,000, the main taking the "sixfoot" of the London and Brighton Railway, which line is nearly straight for the whole distance. To provide sea water baths for such a population is an undertaking of the highest importance to the health and comfort of the people.

As New York will some day rival London in its extent and population, it would be well for our city authorities to consider the desirability, and the means at their disposal, of establishing sea water baths in all parts of the island of Manhattan. The popularity of those already established shows the feeling of the inhabitants of the city, and any one taking up the subject and carrying it vigorously to completion, may depend on the public support. It could be done now, easily and cheaply; fifty years hence it will be a formidable and expensive undertaking. The sea is around the city, and the health-giving element can easily be pumped into swimming and other baths; but, when property has enormously increased in value, and population in numbers, the work may be as difficult to achieve as it is in London.

THE DRUG CLERK LAW.

The number of dispensing druggists and drug clerks in the city of New York, at the present time, probably exceeds one thousand. These are all regularly established in business; and although a good many complaints are made about the careless way in which prescriptions are put up, and the newspapers occasionally hint of the poisoning of whole families by some careless clerk, it is safe to admit that the average apothecary knows as well how to put up a prescription as the average doctor does how to write one: and that druggists are no worse than other people.

The Legislature has just treated us to a new law, the ostensible object of which is to protect the people from the wholesale poisoning to which all of us are exposed. In order to understand the law, it may be well to quote some of its most important provisions:

"SECTION 1. The Mayor of the city of New York is hereby authorized to appoint, within ninety days after the passage of this act, a board, to consist of one skilled pharmaceutist, one practical druggist, and two regular physicians of the city of New York, to hold office during the pleasure of said Mayor, to act as an examining board for the examination and licencing of all druggists and persons now employed, or hereafter to be employed, as clerks by any druggist, keeper, proprietor, or superintendent of any drug store in said city, who shall be engaged in preparing and putting up physicians' prescriptions or dispensing medicine. On and after six months from the date of the organization of such board, any person who shall not have passed an examination before, and received a certificate from, said board, who shall make up, or attempt to make up, a prescription—any physician's prescription—shall be deemed guilty of a misdemeanor, and shall, upon conviction thereof, be fined not more than $500, or imprisoned not longer than six months, or both, at the discretion of the court.

"SEC. 4. It shall be the duty of said board to examine, on application, all persons employed, or hereafter to be employed, in putting up prescriptions or dispensing medicine in the city of New York, and give a certificate of such examination to the persons so examined, if found competent to act in such capacity, and which certificate shall be deemed as a licence for such person to engage in such employment.

"SEC. 5. Said board shall, with the approval of the Mayor, fix the sum to be paid for such certificates by the persons to whom they shall be issued, and all sums or fees for certificates raised by said board shall be appropriated to the payment of the expenses and salaries of the members of said board, or so much thereof as may be necessary, the balance, if any, to be paid into the city treasury. Said board shall cause a true and accurate account of its receipts and disbursements to be kept, and shall, once in three months, make a return, of the amount received and expended, to the Comptroller of the city of New York."

Within six months after the organization of the board, every person, old and young, employed in putting up prescriptions, must be examined by four men to be designated by the Mayor. If we allow 154 working days in the half year, we can comprehend the amount of work assigned to these gentlemen, and may consider whether the execution of the law is within the bounds of possibility. We suppose that the examination must be conducted in the presence of the full board. It will hardly answer to examine by wholesale, but each individual case must be taken up separately, and a searching oral and written examination resorted to, before granting the certificate.

To put a thousand men through such an ordeal within the specified six months will occasion busy times at the rooms of the board, and probably sadly interfere with the dinner hour of some of the parties concerned. Every candidate ought to be cross questioned at least four hours; this will require a total of 4,000 hours to be got out of 154 days—a problem that we confess our inability to solve with satisfaction to ourselves, as twenty-four hours a day for 154 days will only yield 3,696 hours, and leave no time for eating and sleeping. It is evident that the four examiners will earn their salaries during the first six months; after that time, things will run more smoothly, and the gentlemen can rest from their exhausting labors. Practically, no doubt, the board will feel authorized to accept the diploma of well known apothecaries, dispense with the form of an examination, and grant the certificate at once. This will facilitate the work, and enable them to get through it by the appointed time. Why all of the physicians of New York should not be compelled to pass an examination before a similar board with as much propriety as the apothecaries, we cannot see; and if two druggists were appointed to examine the doctors, it would not be a whit more ridiculous than the proposition to have the doctors examine the apothecaries. Why a special law should be made for the city of New York, and not for other large towns, is difficult to determine, and it is a grave question whether such a law is not *ex post facto*, in so far as it relates to all persons who have complied with former laws, and have diplomas of full and regular standing in the pharmaceutical profession.

While we are about it, why not have an examining board for all the lawyers, clergymen, professors, and other professional men? This would create a few more offices, and occasion lively times about the City Hall.

The reform intended by the drug bill begins at the wrong end. Instead of waiting until the lion gets inside, and then calling upon all hands to help turn him out, the true plan is to prevent him from getting in at all. The only competent authority to licence apothecaries must be an incorporated college of pharmacy, and half the money this new commission will cost, if expended in support of such a college, would do more towards remedying the evil complained of than a dozen such examining boards. We have medical colleges to licence doctors, law schools to admit attorneys, and a pharmaceutical college to grant diplomas to apothecaries. The law ought to have recognized this college as a proper authority in such matters, and if the Legislature had made provision for the education of pharmaceutists, and then insisted that every one should first obtain a diploma, they would have begun at the right end. The effect of the law may be to send students into existing colleges, and thus help them, but under present circumstances, it appears to us to be of very doubtful expediency. As the wholesale dealers are not affected by it, they can sell what they please; but the retailers must take care what they dispense to the public. We shall be curious to see what comes of this new commission.

SCIENTIFIC INTELLIGENCE.

CHEAP BUILDING STONE.

A large number of houses have been constructed in Paris, for workingmen, of the following materials: 100 parts of plaster of Paris, 10 parts of hydraulic lime, 5 parts of liquid glue, and 500 parts of cold water, are intimately mixed and poured into molds of any desired size and shape; and in half an hour the form can be removed. The stones are then exposed in the open air for two weeks, until they are thoroughly dry. Artificial stone thus prepared, has the ring and hardness of the native rock; and, where the materials are abundant, is said to be 25 per cent cheaper than quarried stone. Houses constructed of this stone are remarkably dry, they can be painted or papered as soon as they are up, and can be built very rapidly. In Nova Scotia, and some of our Western States, plaster is so abundant that the finer portions are sometimes used directly for building. It would be well, in such localities, to try the artificial stone prepared according to the above formula. Such a cement would be convenient for farmers in repairing cisterns, drains, cesspools, cellar floors, and water pipes. It ought to be tried by some agricultural college, and reported upon for the benefit of the community.

LITHOFRACTOR FOR DESTROYING LARGE CANNON.

The colossal guns of Mont Valérien, and other forts about Paris, were entirely destroyed, on the 11th of February and the following days, at a very trifling cost, by means of the new lithofractor. The operation was conducted by an officer of engineers, Von Forster, assisted by the foreman of the dynamite and lithofractor factory at Deutz, who happened to be serving at the time as a private in the German army. It was sufficient to discharge four or five pounds of the powder, placed on the top of the gun, to break and crack it in such a way as to render it useless for further military purposes. For smaller cannon, not more than two pounds were employed. In the case of two very large guns, only cracks were formed the whole length of bore, but sufficient to destroy the value of the cannon.

A CHINESE WATER-PROOF CEMENT.

In the north of China, a cement, under the name of *schio-liao*, is employed for rendering articles of wood entirely water-proof. Travelers have noticed in Pekin, wooden boxes that had borne the journey to Siberia and back, and were still in excellent condition. Even straw baskets and willow ware can be rendered so tight as to be adapted to the transportation of oil. Willow packing trunks thus become preferable to wooden boxes, and would be lighter and more durable than leather. Pasteboard is also made to assume the color and durability of wood. Many of the public buildings of China are coated with the *schio-liao*, and acquire a dirty-red appearance, but are very durable. The cement is said to be prepared as follows: 3 parts of fresh, well beaten blood, deprived of as much fibrin as possible, is mixed with four parts of lime slaked to a powder, and a little alum. A thin, pasty mass is formed, which can be applied as soon as made.

The number of applications must depend upon the uses to which the objects are to be applied.

NATURE OF THE EARTH'S INTERIOR.

Based upon the law that the attraction which bodies exert upon one another is in the ratio of their respective magnitudes, physicists have come to the conclusion that the total weight of our planet is approximately five and a half times the weight of a similar globe of pure water. Upon this, Mr. David Forbes remarks: "Knowing thus that the mean density (or specific gravity, as it is called) of the earth is five and a half, and also, from direct experiments, that the mean density of the entire solid matter or rocks forming its external crust, cannot be higher than about two and a half, or less than half that of the entire sphere, it necessarily follows that the central parts must be infinitely more heavy than the surface, in order to account for so high a mean figure as five and a half; indeed, it has been calculated that if one suppose the earth to be composed of three concentric portions, of equal thickness, and respectively increasing in density towards the center, in arithmetical progression, that we should have an outer crust of specific gravity of two and a half, like our ordinary rocks; an intermediate zone of specific gravity twelve, or as heavy as quicksilver, and a central nucleus of about twenty times the density of water, or as heavy as gold. The balance of evidence appears to me to be decidedly in favor of the hypothesis that the interior of our earth is a mass of molten matter arranged in concentric zones, according to their respective densities; and that the whole is inclosed within a comparatively thin external crust or shell; and that our globe consists of: 1st. An external solid crust, not exceeding fifty miles in thickness; the upper third or more consists chiefly of stratified sedimentary rocks which rest upon some, to us at present unknown, species of igneous rocks, which at one period formed the lower part of the primeval crust. 2d. Below this again, a zone or sheet of molten rock extending all round the sphere, and reaching to a depth not exceeding 400 miles below the solid crust. 3d. A dense metallic nucleus, the outer part of which consists of the compounds of the metals with sulphur, arsenic, etc., while in the very center, we shall expect metals in an uncombined condition, or alloyed with one another, to predominate."

Although these views are theoretical, they will be read with interest on account of the high reputation of their author. It will be seen that the old notion of the fluidity of the interior of the earth is retained.

ELASTICITY AND TENSILE STRENGTH OF WROUGHT IRON.

Paper read by Prof. Plympton before the New York Society of Practical Engineering, at the monthly meeting, April 26, 1871.

Having occasion a few years since to test a large number of iron rods which were to be used in a Murphy Whipple bridge, I found it convenient in some cases to extend the experiment so far as to determine the breaking strain, and also the highest tensile strain at which the elasticity remained unimpaired.

As the rods were designed for diagonal ties of a rectangular truss of 150 feet span, the testing machine was of unusual dimensions. It consisted of a heavy framework formed of two pieces of pine 16 × 20 inches, and 30 feet in length. They were 18 inches apart. Heavy cross pieces of oak at each end completed the framework or bed piece.

The strains were applied by means of a screw 3 inches in diameter, working through a thick iron plate and one of the oak head pieces. The outer end of the screw was furnished with a ratchet wheel, 12 inches in diameter, and a lever which worked on the extended screw as a fulcrum. A stout ratchet on the lever completed the movable outside portion at the head of the machine. Inside the head piece, the screw terminated in a stout cast iron crosshead, in which it turned freely. The crosshead carried a pair of parallel flat bars, to which the rod under test was made fast. To facilitate the fastening and to render the apparatus adjustable for testing rods of different lengths, the parallel bars were furnished with inch holes, 6 inches apart, exactly opposite in the two bars, and a sliding crosshead which could be firmly attached by pins at any pair of holes in the bars.

At the other end of the machine, the strains were measured by a balance beam, 10 feet long. A $2\frac{1}{4}$ inch bolt, carried through the head piece, was furnished with an eye on the inside end, and on the outside was (after being passed loosely through a thick iron plate which formed the end of the balance beam) forked so as to hold securely a steel block with a face at right angles to the axis of the rod; this face was made to bear upon a knife edge when the machine was in operation.

The balance beam was constructed like a king-post truss, with an extra rod following the line of the inclined studs. At the end next the machine, the plates above referred to were secured by bolts so as to form the extreme end of the beam. The plate had two blunt knife edges, one on each side; the one towards the machine rested on a plate attached to the oak head piece; the knife edge on the other side, which was one tenth of a foot higher, had for a bearing the steel block which received the strain of the rod under test.

To the extremity of the balance beam was hung a platform to receive weights. It will be seen that the tensile forces were therefore measured by a bent lever, whose arms were respectively one tenth of a foot, and ten feet. The machine was designed by Mr. J. W. Murphy, of Philadelphia, and constructed under his direction.

The tests to which the great majority of the rods were subjected were made in accordance with the terms of the bridge contract, which required that the wrought iron rods should prove perfectly elastic under a strain somewhat greater than that to which they would be subjected when in place by the maximum load on the bridge.

As this computed maximum strain was supposed to be about one fifth of the ultimate strength, the tests were extended to one third or two fifths of the breaking strain. The rods of course extended under the strain; any rod that failed to recover its original length when the strain was released was condemned

In order to verify our estimates of the ultimate strength as well as to determine the limit of elasticity, an occasional rod was subjected to the proper tests. The results obtained under these conditions form the subject of this paper.

The measurements by which the extensions were determined were made with a rod 10 feet in length, and its measure on the rod under strain was marked with a knife blade. The extensions corresponding to the length were carefully measured by a finely divided scale.

Many of the rods subjected to the breaking test were prepared for the experiment in such a way as to bring to trial the different modes of fastening at the ends. Some of them therefore had threads cut on stub ends welded on, some had threads cut on the original rod slightly upset at the end, while others were furnished with a turned eye only. Many rods, showing a high degree of elasticity in the sound portion, broke at a comparatively tensile strain in the thread or weld.

The results of these experiments, as deduced from the tables prepared at the time, may be briefly summed up as follows:

(1.) The breaking strain of wrought iron rods, of American manufacture, varies from 45,000 to 42,000 lbs. per square inch of section. A few of professedly poorer quality parted at 40,000 to 42,000 lbs. per square inch. The relative tensile strength was slightly greater in the smaller than in the longer rods.

(2.) The extension of a rod under a gradually increasing strain varies directly as the strain, up to the limit of the elasticity of the rod; beyond this limit the extensions are in a much higher ratio than the increments of tensile force. An illustration of this is furnished by the first case in my tables. A three quarter inch rod of "Howard" iron under a strain of 11,000 lbs, per square inch extended $\frac{13}{100}$ of an inch for ten feet in length; at 20,200 lbs. it has extended $\frac{22}{100}$ inch; at 26,450 lbs. its extension was $\frac{29}{100}$ inch, and upon being relieved of strain recovered its length; at a strain of 41,600 lbs. its extension was $5\frac{50}{100}$ inches; upon being relieved of strain, it set with an extension of $5\frac{23}{105}$ inches. The rod broke under a strain of 49,580 lbs.

(3.) The limit of elasticity under the circumstances which necessarily governed such a trial proved to be about three-fifths of the breaking strain; in no case lower than a half of it.

(4.) The amount of extension of the rod before the limits of elasticity was in no case lower than $\frac{1}{410}$ nor higher than $\frac{1}{560}$ of the length.

(5.) The amount of extension which iron exhibits before parting varies greatly in the different brands, and bears moreover no discovered relation to the elastic limit or ultimate strength.

(6.) Although among the rods broken both kinds of fractures (granular and fibrous) were exhibited, no peculiar advantage could be claimed for either, at strains below the limit of elasticity. Those which in breaking showed a fibrous character extended by far the most before parting.

(7.) A rod strained beyond its limit of elasticity and then laid aside for a time, proved (in each of several cases) upon repeating the test to be a rod of lower limit of elasticity than at first.

(8.) As a matter of curiosity, it may be remarked that the permanent set of an overstrained rod proved in the several cases to be its greatest length, under strain, minus its extension before losing its perfect elasticity.

(9.) The usual factor of safety employed by engineers, namely, one fifth of the ultimate strength, is well within the elastic limit, and is perfectly safe for bridges and roofs. It is moreover safe to test such rods up to the amount of proper working load before using them in the structure.

(10.) Although many rods from old bridges were tested in this series, no support for the popular theory that iron deteriorated under use could be gathered from our experiments. It may be remarked here that the late John A. Roebling, whose experiments were in progress about the same time, drew the same conclusion after a series of experiments upon a very wide range of varieties of wrought iron and steel.

The limit of elasticity would undoubtedly have appeared lower, if longer time could have been allowed between the separate additions to the strain; but after a careful consideration of the published experiments, both in this country and Europe, it is believed that the practical conclusions drawn from the above tests are substantially correct.

Protecting Roofs from Fire.

The *Fireman's Journal*, which ought to be good authority on such matters, says: A wash composed of lime, salt and fine sand, or wood ashes, put on in the ordinary way of whitewash, is said to render the roof fiftyfold more safe against taking fire from falling cinders or otherwise in case of fire in the vicinity. It pays the expense a hundredfold in its preserving influence against the effect of the weather; the older and more weather-beaten the shingles, the more benefit derived.

Such shingles are generally more or less warped, rough and cracked. The application of wash, by wetting the upper surface, restores them to their original or first form, thereby closing the spaces between the shingles; and the lime and sand, by filling up the cracks, prevents it warping.

LAUNCHING OF THE CAISSON FOR THE NEW YORK TOWER OF THE EAST RIVER BRIDGE.

This caisson was successfully launched May 8th, 1870, at 11:40 A.M., in the presence of a large concourse of spectators assembled to see the huge structure of wood and iron slide into the water. Several tugs were connected to the caisson by cables, in case their aid should be required to start the caisson. Their help was, however, not required.

A number of distinguished engineers were present, and the assemblage of ladies and gentlemen gathered upon the deck of the steamer Dakotah and in the yard, gave the scene a very animated appearance.

The structure rested upon seven ways, upon which it slid with graceful steady movement into the water. Upon its plunge into the river, it created an immense swell, which rocked the tugboats about in a ludicrous manner, but did no damage.

Before the caisson is towed to its final destination, it will receive seven more courses of timber upon its upper surface. The entire success which attended the launch was a source of much gratification, and is another evidence that this great engineering work is in the charge of men able to see it through, and to meet all emergencies as they arise.

EDITORIAL SUMMARY.

ACCORDING to Dr. Letheby, more of the French conscripts are rejected from the soft water districts, on account of the want of strength of muscle, than from the hard water districts, from which it is concluded that the calcareous matter is favorable to the formation of the tissues. Dr. Letheby further states that the mortality in England is greater, on an average, in places where soft water is used, other circumstances being equal, than where the water is hard; and it is suggested that the sparkling hard waters of the limestone districts are relished, not only because they are pleasant to the eye, but on account of some hygienic properties in the excess of carbonic acid they contain, and possibly because the percentage of lime acts medicinally upon the system. The Doctor concludes by expressing his preference for the very slightly hard water of London over a softer quality, although reprehending the use of water containing an excess of mineral matters.

STEAM CULTIVATION.—At a recent exhibition of the process of steam ploughing, in England, the engine at work was a 12-horse power portable. The windlass, which is the principal feature of the apparatus, is an invention of Mr. Hayes. It has been described by the *Engineer* as one of the most ingenious combinations of mechanism in use. Its great advantage is, that when the cultivator reaches the headlands, the mere turning of a hand by the engine driver throws the strap on the opposite pulley, and the work goes on continually without stopping or reversing the engine. If it should be necessary to stop the cultivator at any point, the belt is thrown on to a loose pulley, occupying a central position between the working pulleys, the engine not being interfered with. There is also an arrangement by which the anchormen in the field can stop the cultivator, if all of them are out of sight of the engine-driver.

LIGHTNING conductors frequently have not as good a connection with the earth as they should have. A lightning conductor having its earth extremity partially insulated, soon becomes charged if a storm cloud passes over it, and then a lateral discharge takes place; hence the accidents which have frequently taken place in buildings supposed to be adequately protected. Sand and gravel, brickwork and stone, are bad conductors of electricity, and if the rod has such a base, and the surrounding earth be likewise dry, it is practically insulated. The difficulty of getting what telegraphic operators call a good earth is one that should weigh with those putting up lightning conductors. They should not rest satisfied that all is secure unless they can reach a running stream of water, or else sink a considerable surface of copper plate till permanently damp earth is reached.

CAMEL'S HAIR is imported occasionally into the United States, in bales, from Persia *viâ* England, or directly from Russian ports, and is mostly used in the manufacture of pencils for drawing and painting. Camel's hair is longer than sheeps' wool, and often as fine as silk. There are three kinds of colors, black, red, and gray, the darkest of which is considered the most valuable. It is said that the hair on a camel weighs about 10 pounds. In Bokhara the camel is watched while the fine hair on the belly is growing. This is cut off so carefully that not a fiber is lost, and when sufficient has been collected, it is spun into a yarn unequalled for softness, and then dyed all manner of bright colors, and used chiefly for shawls. The Arabs and Persians make of camel's hair, of a less valuable kind, stuffs for carpets, tents, and wearing apparel, and cloth is made of it in Persia.

BRITISH MANUFACTURERS COMING TO THE UNITED STATES.—From an advertisement on another page, it will be seen that the extensive agricultural implement manufacturers—Messrs. J. & F. Howard, of Bedford, England—have established an agency for the sale of their goods in this country. Their works are very extensive, and their reputation for good work is very large.

THE microscope, like most useful inventions, has been brought to its present perfection, not by a single vault of inventive genius, but by slow and thoughtful steps of progression.

IT is immeasurably difficult to refute false doctrines, because they rest on convictions that error is truth.—LIEBIG.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

TO RESTORE RANCID BUTTER.—If R. (Query No. 7, Vol. XXIV., No. 18,) will pack his rancid butter in a firkin; and then take a barrel, put in about one bushel of charcoal, set the firkin of butter inside the barrel, and cover with good brine, letting it stand three or four weeks, he will find it restored, unless it is very bad.

CHEAP BATTERY.—The error made by F. R. S. and his friends arises from their unacquaintance with the first principles of voltaic electricity. Putting the sulphate of copper into the copper vessel can only be done by a person who does not know that the fluid should have its opposite metal to act upon; and such an union as he describes is a marriage within the prohibited degrees of affinity, and therefore the banns are forbidden. Let F. R. S. change the relative positions of the copper and salt solutions, and he will find that A. G.'s directions are correct.—D. B., of N. Y.

T. A. T.—The mineral specimen from Rhinebeck, submitted for examination is yellow ocher, or earthy hydrated oxide of iron, a variety of limonite. If found pure as this sample, it may be useful as a cheap paint and for polishing.

A. S. E., of Ohio.—Your method of ascertaining the hight of the atmosphere seems to us impracticable, for many reasons. You can not produce a vacuum by inverting a tube filled with water; the space will always contain vapor of water. If you could, we fail to see how you could in that way, by allowing one inch of water to expand in what would otherwise be a vacuum, determine the extreme limit of expansibility possessed by air. Your communication is respectfully declined.

BRITTLENESS IN BRASS WIRE.—A similar circumstance to that mentioned by J. H., the April (29th,) number of your journal, was communicated by Dr. Chilton to the *American Repertory*, in 1840, and as the explanation may be useful to J. H., I give the article: "Professor Mapes:—*Sir:*—I noticed the following curious circumstance, a few days since, and although a similar thing may have been observed before by others, yet, so far as my memory serves me, I have not heard of it, nor seen it mentioned in any publication. Two coils of brass wire, of different sizes, No. 4 and No. 25, have been hanging up in my laboratory for three or four years, in a situation where they have been more or less exposed to acid vapors. Having occasion to use a piece of the large wire, I was surprised to find that it was exceedingly brittle; the least attempt to bend it, caused it to break into three or four pieces. On examining the broken surface, it was observed to be highly crystaline and bright. The coil of fine wire was found to be in the same state. On heating a piece of it to incipient redness, a light blue vapor passed off, and, on cooling, it was found to be as soft and pliable as copper. A portion of the wire in small pieces, was heated in a close tube; it emitted a white vapor which condensed on the upper part of the tube, and which on analysis proved to be chloride of zinc.—J. R. C."—W. W.

R. C., of N. Y.—For calculating the width of belts required for transmitting different numbers of horse power, multiply 36,000 by the number of horse power, divide the amount by the number of feet the belt is to run per minute; divide this quotient by the number of feet or parts of a foot in length of belt contact with smaller drum or pulley; divide this last quotient by six, and the result is the required width of belt in inches. For calculating the number of horse power which a belt will transmit, its velocity, and the number of square inches of belt in contact with the pulley being known—divide the number of square inches of belt in contact with the pulley by two; multiply this quotient by the velocity of the belt in feet per minute, and this amount divide by 36,000 and the quotient is the number of horse power. These rules are those given in Bacon's "Richards' Steam Engine Indicator." They are not intended to give the maximum power that can be transmitted, but that which belts will transmit, and wear well in practice.

J. W. P., of Mass.—There are two chlorides of tin, the protochloride and the perchloride. The commercial protochloride of tin is sold under the common name of "salt of tin." It is not generally kept by druggists. You can easily make it. Put one part of granulated tin or tin cut into small pieces, into a porcelain or glass vessel, and pour upon it one part of hydrochloric acid. Place the vessel in a sand bath and heat it, allowing free access of air to the tin. After some hours of exposure to the action of heat and the acid, add three parts more of the acid, and stir until a saturated solution is obtained. Set the solution aside to crystallize. When the first crop of crystals is obtained, concentrate the mother liquor, and again allow it to crystallize, repeating the process as often as crystals can be obtained.

G. S., of New Mo.—You have in your region, probably, the materials to make a good hydraulic cement. For full information upon the subject of the manufacture of cements, we refer you to Reid's work on "Portland Cement," and Gillmore's treatise on "Limes, Mortars, and Cements," which any bookseller will obtain for you.

C. G., of Pa.—The various recipes for boot blacking may be found in any good book of general recipes. Some recipes have been recently published in this column.

F. P. B., of N. Y.—A caveat confers no exclusive right to sell an invention. Your other queries will be placed in our query column.

TO CUT GEAR WHEELS IN AN ENGINE LATHE.—In answer to query No. 10, issue of April 22nd, I would say, any small gear wheel may be cut quite as accurate for all common purposes, in an engine lathe, as on a gear cutter, and at a trifling expense. The lathe I used was a New Haven lathe of 24 inch swing. Take two cast iron standards, 1½ inches thick, 5 wide, and 26 high. They should each have a slot an inch wide, extending from an inch of the top to within 8 inches of the bottom, and should be in the center of the standard. These standards must have feet on one end, at right angles with, and projecting 4 or 5 inches from, the outside of the standard. Next, take two small boxes, cast with a flange running crossways with the bearing of the box; the flange should be 6 x 4 inches, with a rim or guide on each end of one side, ⅜ of an inch high, and a little less than 5 inches apart. Make the flanges an inch thick. Plane up the standards and flanges, and fit the flanges on the standard. Hold the boxes to their place by ⅜ bolts, with a collar under the head of the bolt passing through the slot in the standard, and into a hole in the center of the flange into which it screws. Bolt the standards or uprights on the saddle block of the lathe, one over each shear, and exactly opposite each other. Take a piece of 1½ inch iron, long enough to make a shaft to rest in the boxes, which should project an inch or more from the edge of the standard. The boxes should also have caps on the under side. Turn one half of the shaft down to 1⅛ inch to receive the cutters and a movable sleeve held in place by a thread and nut on the shaft. Thus the shoulder on the shaft and the sleeve will form two collars, between which to hold the cutters. The shaft must also have a small tit on it for holding the cutter, the edge of which must be on a line with the lathe centers. On the large end of this shaft fasten a small driving pulley, and belt from a counter shaft overhead. Next take the face plate of the lathe, which should be nearly as large as will swing, and solid 3 or 4 inches from the rim; strike a number of lines round its face near the rim, and space them off as to the number of teeth you wish; prick-punch, and drill holes ⅜ inch diameter, and ¼ inch deep—thus: 100 holes will cut a wheel with 100, 50, 25, 20, 10, or 5 teeth, by skipping the requisite number of holes each time. Lastly, take a stout steel spring, one foot long, in one end of which, 2 inches from the end, rivet a hardened steel pin, ⅜ inch long, pointed so as to enter the holes; bolt the other end to an iron block, which clamp to the inside edge of the front lathe shear, near the face plate, so that the spring will hold the pin firmly in the holes. Put the wheel to be cut on a mandrel, and put on a carrier, and put it in the centers of the lathe. Put the cutter in motion, feed up the carriage until the cutter cuts through the face of the wheel, run back in same, cut, press out the spring, move the face plate round one or more holes, replace the point, and proceed as before. I have made and used this attachment with very satisfactory results, and any person having gear wheels to cut will find it to be well worth its expense. —J. C. S., of Ohio.

CUTTING SMALL GEAR WHEELS.—I am cutting wheels ½ inch to 2 inches diameter, and ¼ inch thick, by taking any gear wheel that will divide equally, and fastening it to the face plate of the lathe. The wheel that is to be cut is fastened in a mandrel. I fasten on the dog next to the gear wheel, and make the face plate on the lathe stationary. I bore a pin hole in the dog to suit the cogs on the gear wheel, which is the index to space by. If there are too many cogs, let the pin slip to suit the number of cogs wanted in the wheel to be cut. I cut by placing the cutting tool in the slide rest.—J. M. B.

J. O., of Neb.—What are the objections to brick arched roofs for buildings? Their great weight would be a serious objection; their great cost would be another. They would be difficult to keep from leaking we think, as the slightest settling would be likely to crack them.

J. K. B. of La.—The method described by you, for exploding volatile hydrocarbons, has no value as a test for the safety of such oils. A gas that mixed with air would explode, might be made from tallow in the same way, by carrying the heat far enough.

E. D., of N. Y.—The relative intensities of light, emanating from various sources, are measured by instruments called photometers. They are variously constructed, and act upon several distinct principles. You will find full accounts of some of these instruments in almost any good treatise on natural philosophy. They cannot be described intelligibly in such space as we can afford you in this column. If Sillimans' Physics," or Millers "Chemical Physics" is accessible to you, you will be able from it to get an understanding of this subject.

L. R., of N. H.—Some of the best engines and boilers now develop a horse power per hour by the consumption of little more than two pounds of coal; but this is better than the average. Three pounds of coal per horse power per hour, is excellent work. As a rule, a large engine will work somewhat more economically than a small one of similar construction. There is, however, no constant ratio of economy yet determined as holding good in practice, between the working of different sized engines.

C. H. H., of Ala.—If your boiler is delivering dry steam, you will gain nothing by putting a steam dome upon it. If, however, there is priming, a dome will allow the water to separate from the steam to a greater or less extent previous to its exit from the boiler, and you will save the heat otherwise wasted in the water mechanically carried over and also the train of evils arising from water in the cylinder of your engine.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

COTTON PRESS.—This is the invention of Henry J. Davis, of Wetumpka, Ala. The platen, or follower, of this press, moves in a horizontal line, being actuated by a screw, with worm gearing, by which power is transmitted to the screw from a belt and pulley. The cotton is put into the press through an opening left by the removal of a cover, which is drawn up out of the way by a windlass, with chains or ropes. When the cotton is put in, the cover is replaced and fastened down, and, power being applied to the screw, the cotton is compressed into a bale. The bale, when stitched and tied, is taken out at the bottom of the press, which bottom has a door provided for the purpose, the door being held by catches while the bale is being compressed. One side of the press is also made adjustable, so as to facilitate the removal of the bale.

SPINNING MULE.—The invention of William Greenwood, of Landenburg, Pa., relates to an improvement in spinning machines, whereby, it is claimed, a better quality of thread can be produced than by the ordinary spinning machine. It provides, in a way that cannot be intelligibly explained without drawings, for giving less twist to the sliver during delivery, previous to the draft, by giving less speed to the spindles during that period, and then increasing the speed during the action of the draft, the device being adjustable, so as to proportion the relative rates of speed to the production of a more even thread than is produced by the ordinary method.

BIRD CAGE MAT.—This is the invention of Charles S. Schenck, of New York city. It is a cheaply constructed and easily renewed device, consisting of a compound mat made of sheets of waterproof paper, connected at the edges, so that they can be successively stripped off as they become soiled. Any equivalent material may be used in the construction of the mat, the claim being confined to the construction, and not the material. The mat is intended to facilitate the cleaning and maintaining in a clean state the cages of birds, and other small animals.

SUPPORT FOR THE SASHES OF CARRIAGE DOORS AND WINDOWS.—This invention provides a supporting frame for the sashes of carriages, which supporting frame rises after the sash is elevated about half way, while its lower portion remains in the grooves of the framework of the door or body of the carriage, the sash sliding in the grooves of the supporting frame, and the latter sliding in grooves formed in the framework of the body. The sash is raised or lowered by the usual sash strap, the supporting frame being moved by the engagement of stops on the side of the sash, with the ends of slots in the supporting frame. The groove in the latter is so formed that the ordinary mode of holding the sash when raised is retained. The inventor is John C. Ham, of New York city.

CRUSHING AND GRINDING ROCK PHOSPHATES.—F. J. Kimball, Philadelphia, Pa.—A number of horizontal rollers have spiral grooves cut or cast in them, the spirals running in opposite directions on the surfaces of each pair of rollers. The pairs of rollers are placed one above the other, and the distance between each pair diminishes, from the upper to the lower pairs. The rock is fed to the machine through the upper pair of rollers, and, passing down, is successively crushed finer and finer, till it leaves the lower pair comminuted to the degree of fineness required. It is necessary, in order to fully understand the efficiency of this machine, to remember that the phosphatic materials to be ground are not hard like quartz, but easily crushed. The distances between the rollers are adjusted by set screws.

WEIGHING SCALE.—Darius D. Allen, of Adams, Mass.—This improvement pertains entirely to the graduation of the scale beam, so that the value of the article weighed, at a given rate per pound, shall be indicated, as well as its weight. The platform, upon which the article to be weighed is placed, slides on graduated ways, the graduations being marked to indicate different prices per pound. The portion of the beam which carries the counterpoise weight, is divided into 100 notches, each notch indicating one cent when the platform is set to any of the price graduations. A suspended plate on the end of the beam carries weights which indicate dollars, so that, when the article is weighed, its value is expressed in dollars on the suspended plate, and the fractions of a dollar by notches on the beam which indicate cents. This obviates the necessity of computation, in the retailing of such articles as are sold by weight.

MACHINE FOR CUTTING AND BENDING SHEET METAL.—This is the invention of Jones R. Maitland, of Little Rock, Ark., and is intended for cutting and bending roofing plates, so that when they leave the machine they shall be ready for use, without further preparation. The machine seems well adapted to subserve its purpose.

WASHING MACHINE.—J. M. Kimball, of Woodstock, Ill.—A tub has a vertical shaft passing down through its cover, with cross arms at the lower end, carrying vertical paddles, slotted in the direction of their length. The shaft being oscillated, or operated by a winch or lever, agitates the suds with the goods to be cleaned, thus purifying them without rubbing.

SAFETY CAN.—Wm. H. Lawrence, Williamsburgh, N. Y.—The object of this invention is to provide a safe receptacle for oily rags, waste and other spontaneously combustible substances, so that, if they should ignite, they will be extinguished by the action of the heat generated. It consists of a vessel placed within an outer one, which contains water, and having a conical cover, intended to guide the steam, generated by heating the water in the outer vessel, into the inner one, so as to put out the fire.

CHILD'S BIB.—Adaline L. Thompson, of Hudson City, N. J.—This bib is made of any suitable waterproof material, to cover and protect the front of the dress, and has formed on the lower edge a pocket, which catches and holds crumbs or liquid spilled upon the bib, which is formed with armholes, and is fastened at the back. It is also provided with sleeves of the same material, attached to the armholes by elastic cords.

SHINGLE MACHINE.—This invention is designed more particularly to use up the refuse and waste left by other shingle machines. The saw revolves horizontally on a vertical shaft, and the block or bolt to be sawed is placed upon ways, in such a manner that the shingles are cut from the under side of the bolt. Rollers bear upon the bolt to hold it down to its place on the ways. The inventor states that with this machine any piece of sufficient thickness to form a single shingle may be cut into a shingle, and that thus the waste of ordinary machines is largely reduced. Patented by Uriah D. Mihills, Fond-du-Lac, Wis.

DRYING PHOSPHATES.—In this machine the phosphates to be dried are put into the dome of a furnace by means of a chute or inclined apron. Passing along down this apron, they fall into a drying chamber or trough, in the bottom of which a screw revolves, which screw or worm forces along the material, until it finally issues dried from a chute. The phosphates are subjected to heat during the entire passage over the apron, and through the drying chamber. An air tube enters the dome, through which air is forced by a fan or other blower, to better consume the heated gases, and thereby intensify the heat. The flame from the firebox passes first under the drying chamber, and thence under the apron, which acts partially like a bridge wall, intercepting the heated gases, and passing them over into the open upper part of the drying chamber. Thus the hottest flame is brought under the drying chamber, in which the phosphates, already heated in their passage over the apron, are deposited, so that the hottest flame comes in contact with the hotter material, and as it loses its heat, is led along to cooler surfaces, to utilize the heat to the utmost, as should be the case in all well constructed heating and drying apparatuses. The invention is due to Frederick Kimball, of Philadelphia, Pa.

LUBRICATING DEVICE FOR LOOSE PULLEYS, ETC.—This lubricating device provides for the discharge of the oil, by the action of centrifugal force operating upon a solid of greater specific gravity than the oil to be discharged. The oil is contained in a suitable reservoir, having a central tube provided with a screw thread, by which it is attached to the hub of the pulley, and in the other end, another thread, upon which the head of the reservoir is screwed. A weight of lead slides upon the tube within the reservoir, and is provided with a packing disk, so that the oil cannot pass by it. An orifice in the tube permits the oil to pass through the tube to the bearing of the pulley, the oil being forced by the pressure of the weight and packing disk, originating in the greater centrifugal force of the latter, depending upon its greater specific gravity. Invented by Cotton Mather, of Steubenville, Ohio.

HYDRAULIC ENGINE.—This invention relates to the valve gear of hydraulic engines, and supplies a new method of operating the inlet and exhaust valves, intended to secure exactness in their operation. The valves are operated by pinions on their stems, which pinions are actuated by racks. The racks are all attached to a single sliding bar, so that they actuate all the valves simultaneously. In the center of the rod is a slot, in which a pin slides, moving the rod whenever it reaches either end of the slot. The pin is fixed to the crosshead, which takes its motion from the pistons in the cylinders, the engine or pump to which the valve gear is applied being double acting. The valves are plates or disks turning on vertical arbors. The inventor is Phineas Franklin Powers, of Genoa, Nevada.

CAR COUPLING.—Samuel S. Sartwell, of Camden, N. Y.—The draw or buffer heads work one upon the top of another to make the connection, each being connected at its rear end to an oscillating bar, the end of the draw head passing through the bar, so as to slide back and forth, to relieve the cars of sudden shocks or jars. Below each drawhead is a flat spring which supports the drawhead to prevent rattling. The head of each buffer is beveled on the upper side, and notched back of the bevel, so that no matter which happens to be the higher when they meet, they will engage each other. Each buffer is moreover provided with a link, under which the nose of the uppermost one slides, till the link falls down and engages with the notch, back of the bevel. A modification of the same device enables it to be applied to the ordinary link and pin coupling. The links are disengaged by levers when the cars are uncoupled.

BRIDGE.—Charles B. Shrives, of Atchinson, Kansas.—This is a combination of wood and metal framework, wherein the wood is neither mortised nor bored, and therefore retains the full strength due to its cross section. It consists of metal end pieces, provided with sockets and holes for the reception of the ends of the bottom and top chords, the ends of the bottom stringers, and for the binding rods and arched timbers. The upper and lower chords are connected by right and left threaded rods and braces, which screw into yokes fitted around the timbers constituting the upper and lower chords, etc. The lateral braces are screwed into the yokes in a similar manner at one end, the other ends converging in groups of four to a ring, into which they are also screwed.

GAS PRESSURE REGULATOR.—A vessel of any suitable shape is divided into two compartments by a partition, the upper compartment being preferably the smaller. A valve port connects the two compartments when its covering valve is raised. This valve is a puppet valve, and is raised or lowered to regulate the flow of gas from one apartment to the other. The flow will be constant for any given pressure and area of opening, or rather for any given difference of pressure in the two chambers. If this difference of pressure be exceeded, the gas flowing over the edge of the valve causes it to vibrate and emit a humming sound, which shows that the pressure in the upper chamber is either too low for the number of burners supplied, or that it is too high, some of the burners having been turned off. The valve is then adjusted to compensate for the change in the number of burners by means of a screw thread on its stem, which latter passes out through the upper wall of the upper chamber, and is supplied with a hand wheel. The stuffing box contains disks of leather or rubber, through which the valve stem passes, and above the disks and within the box is placed quicksilver which makes an airtight joint. It is claimed that this regulator, attached to the service pipes of buildings, will effect a material saving in the amount of gas required to supply illumination. Invented by Otis Dean, of Richmond, Va.

JOINT FOR METAL ROOFING.—John C. Wands, Nashville, Tenn.—This invention has for its object to prevent sheets of metal roofing from being cracked or broken, at the point where the sheet is bent backward, near its edge, for the purpose of forming a lap, and this object is attained by inserting a wire between the sheet and the lap at the line of flexure, which wire sustains the lap when under pressure. The invention consists in the joint formed by the connection of two lapped sheets, each lap being inserted between the other sheet and its lap, in combination with the supporting wires aforesaid.

FIRE EXTINGUISHER.—J. B. Van Dyne, Covington, Ky.—This invention consists in an arrangement of parts whereby a jar supplied with a soft metal cap and containing any suitable acid, and held in an inverted position within a reservoir that is filled with any suitable alkaline solution, may be lowered so as to cause an inclined cutter, which is located within the reservoir directly beneath the soft metal cap of the acid jar to pierce said metal cap gradually, as the jar descends, and thus allow the acid, contained within the latter, to escape, and, mingling with the surrounding alkaline solution, to generate carbonic acid gas, which both aerates the solution, and, by its expansive force, ejects from the reservoir a carbonated stream, that, when thrown upon fire, completely smothers it.

BUCK SAW FRAME.—Leonard Hancock, Alton, Ill.—This invention consists in a curved forked brace or tension device for buck saws, whereby a saw frame is produced of less weight, cost, and bulk than those heretofore in use. It is conveniently and quickly adjusted, and renders the operation of the saw easier.

ROCK DRILL.—Jacob W. Spangler, Jackson township, Pa., and William L. Boyd, York, Pa.—This invention relates to a mechanism by which three separate movements are imparted to the drill, namely, an intermittent rotary motion for cutting a cylindrical hole, a plunging vertical descent alternating with the necessary ascents for cutting the rock and a gradual vertical descent for feeding the drill down to its work.

HEATING APPARATUS.—Alexander C. Pentland, Philadelphia, Pa.—This invention has for its object to heat a building by means of hot water circulating within a system of pipes through all the parts of such building that it is desired to warm; and it consists in an improved cheap and simple apparatus for effecting this result.

RAILROAD SWITCH.—James M. Maxwell, Webster, W. Va.—This invention consists in a pivoted rail placed at the point where two tracks intersect, and so conjoined with a lever mechanism that it may be vibrated on its central pivot so as to connect with either of the intersecting tracks; and in a wedge connected with one of the rails of one of the tracks, and so arranged and placed between said rail and the adjacent intersecting track, that it may be slid forward far enough to afford support to the pivoted rail when the same is in connection with a track over which a train is running.

STEAM RADIATOR.—Elijah M. Bosley, Baltimore, Md.—This invention relates to that class of heating apparatus, which does its work by radiation from the exteriors of metal tanks into which steam is conveyed, said tanks being piled one above another, so as to form a radiator of any desired dimensions.

STEAM RADIATOR.—Elijah M. Bosley, Baltimore, Md.—This invention relates to an indirect steam radiator for heating purposes, that is, a radiator enclosed in a case to which cold air is supplied, and from which warm air is conducted by means of pipes, such a radiator being intended to supply the place of a furnace in the lower part of a building, the main radiator being made up of a series of small radiators placed side by side, and communicating one with another, each of which is provided with a central vertical diaphragm, and, near one end, with a trough to receive the water of condensation.

COMBINED CORN AND COTTON PLANTER AND FERTILIZER DISTRIBUTOR.—William B. Townes, Grenada, Miss.—This invention relates to the combination in one machine of a corn planter, a cotton planter, and a fertilizer distributor, the former being operated by the rotation of the latter, and the said distributor being so contrived as to enable the fertilizer to be dropped in hills, or in an almost continuous drill, in greater or less quantities, as may be desired.

FAN-BLAST REGULATOR.—Daniel Garver, Ringgold, Ind.—This invention has for its object to automatically regulate the air supply of a fan blower for the purpose of maintaining a blast of uniform and proper strength; and the result is effected by a new arrangement of devices.

GRAIN OR SEED SEPARATOR.—Daniel Garver, Ringgold, Md.—This invention relates to a mechanism for conveying grain, seed, straw, etc., after being threshed, from the thresher to the separator, and for separating grain or seed from chaff and filth.

Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—OILING FURNITURE.—Will some one tell me the proper way to oil fine walnut furniture? Is anything but linseed oil required, and is it to be used boiled or raw? Are two coats of varnish to be applied before rubbing down?—A. H.

2.—MOLDS FOR PLASTER CASTS.—What is the best known material for oiling wax molds to take plaster casts from? At present I use sweet and lard oils. I would also wish to know if there are any terra cotta works in the United States. I would like the address. There used to be a little shop in Worcester, Mass.—D. H.

3.—INDELIBLE PRINTING INK.—Will some reader of the SCIENTIFIC AMERICAN tell me how to make an indelible ink, for printing names on cotton and linen with common printer's type, that will not injure the type?—W. S. S.

4.—DRILLING GLASS.—Can any of your correspondents tell me by what means the holes in the glass plates of electrical machines are drilled?—R. A. P.

5.—CLEANING BRASS.—I desire a good method for cleaning brass and copper on steam fire engines.—F. M. G.

6.—SAFETY VALVE.—I wish to know a rule whereby the horse power of a boiler being given, I can compute the area of the safety valve port, the length of lever, proper weight, etc.—J. C. C.

7.—OILING WHITE COTTON.—Will some of the readers of your widely circulated journal tell me how to oil thin white cotton, so as to make it soft and pliable? I want to have it, when finished, a pale yellow.—S. C. B.

8.—POUNDING OF PISTON.—I am running a seventy-five horse power engine in a woolen factory. It was intended to be a first class engine. It has Dunbar's patent steam packing, Ives's patent balance slide valve, and a Judson governor with link motion. The cylinder and steam pipe are well protected to prevent condensation, yet there is occasionally a knocking in the cylinder. I have examined the piston head and packing, and can find nothing wrong. I should charge it to the accumulation of water in the cylinder by condensation, were it not that we use a trap on the cylinder, which is designed to keep the cylinder free from water while in motion; and it seems to work well. Now, what is the cause of the knocking in the cylinder? Can some correspondent inform me?—S. E.

9.—COAL SLACK.—What are the advantages and disadvantages of burning slack instead of coal, as fuel for steam boilers?—S. E.

10.—ANTIFRICTION METAL.—How can I prepare the best antifriction metal for common mill machinery bearings? Full directions are desired.—E. H.

11.—ALUMINUM BRONZE.—What flux is used, and what is the process of combining copper with aluminum, say nine parts copper and one part aluminum, known as aluminum bronze?—N. F. E.

12.—MILL STONES.—I have added a new run of 4 feet wheat buhrs to my mill. The eye of the runner is 18 inches through. The bed stone is level and the runner is true, both running and standing. They have nine quarters, and 4 furrows to each quarter, 3-16 inches deep and 1⅛ inches wide. I have power to grind 8 bushels per hour, but cannot do it, as the stones smoothen. How shall I remedy this? I cannot now grind more than 4½ bushels per hour.—J. A. P.

13.—TO REMOVE INDIA INK FROM TRACING CLOTH.—Is there any method known by which India ink spots etc., may be taken out of tracing cloth without leaving an ugly mark?—N. S.

14.—DIES FOR JEWELRY. GOLD SOLDER.—Will some of your correspondents favor me with a description of how to make dies for jewelry, etc.? Also a good recipe for gold solder?—J. L. W.

15.—CEMENTING METALS WITHOUT HEAT.—Is there any known cement or amalgam which will join two thin metal plates together without the application of heat?—F. W. F.

16.—PREVENTION OF RUST.—I have heard that fine steel is softened and consequently rendered more liable to rust, by being kept for any considerable length of time lubricated by even the purest oil. Is this true? If so, what is the best method of preserving, from rust, very delicate steel instruments which the least corrosion would ruin? Should they or should they not, be freely exposed to the air?—C. S.

17.—OXYHYDROGEN MICROSCOPE.—Will some of your readers please inform me how to arrange the tubes for an oxyhydrogen microscope? What diameter lenses, of what focus, are required to magnify about 500 or 1,000 diameters?—U. S. C.

18.—CEMENT FOR IRON, ETC.—Is there any cement which will unite iron? Is there such a process as cold brazing, and if so, how is it done? Is there any book on tempering?—F. P. B.

19.—CHEAP BATTERY.—I wish to know how I can make a cheap galvanic battery of moderate power. Will some of your correspondents who are acquainted with such matters please answer me through your paper?—C. W. H.

Inventions Patented in England by Americans.

April 18 to April 24, 1871, inclusive.

[Compiled from the Commissioners of Patents' Journal.

BOOTS AND SHOES.—W. F. Pruslia and another, Marlboro, Mass.
BRUSHES.—E. F. Bradley, New Haven, Conn.
CEMENTS.—J. L. Graham, New York city.
DISTILLING.—J. S. Oliver and E. Harris, New York city.
FIBER.—J. Brown, New York city.
LOCK.—S. N. Brown and A. O. Miles, Providence, R. I.
MECHANICAL MOTION.—J. Harrod, Union, O.
OIL EXTRACTOR.—E. S. Hutchinson, Baltimore, Md.
PHOTOGRAPHS.—E. A. Goodes, Philadelphia, Pa.
PRINTERS' RULES.—C. N. Morris, Cincinnati, O.
SEWING MACHINES.—C. W. M. Smith, San Francisco, Cal.
SHOE NAILS.—L. Goddu, Mass.
TEETH.—I. S. Hyatt and others, Albany, N. Y.
TURBINE.—E. P. H. Capron, Hudson, N. Y.

Foreign Patents.

The population of Great Britain, is 31,000,000; of France, 37,000,000 Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars, with full information on foreign patents, furnished free.

Official List of Patents.

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FOR THE WEEK ENDING MAY 9, 1871.

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114,510.—LOCK.—J. T. Adams, Washington, D. C.
114,511.—COUPLING.—W. D. Alford, Cuyahoga, Ohio.
114,512.—LATHE.—J. B. Allen, Springfield, Ohio.
114,513.—LAMP.—J. N. Aronson, New York city.
114,514.—MOVEMENT.—J. and W. F. Barnes, Rockford, Ill
114,515.—IRONING BOARD.—A. G. Beek, Philadelphia, Pa.
114,516.—TRAY.—Levi Beemer, Libertyville, N. J.
114,517.—ACETATE OF LIME.—John Bell, Dover, N. H.
114,518.—LAMP.—John Benson, Yonkers, N. Y.
114,519.—DRYER.—H. S. Black, Buchanan, Mich.
114,520.—PIANO VIOLIN.—E. D. Blakeman, Mount Lebanon N. Y.
114,521.—BELL.—S. C. Bond, Hainesville, Ill.
114,522.—RADIATOR.—E. M. Bosley, Baltimore, Md.
114,523.—SASH WEIGHT.—F. Brady, Jr., Washington, Pa.
114,424.—FLIER.—J. S. Brown, Pawtucket, R. I.
114,525.—WATER WHEEL.—N. P. Burnham, York, Pa.
114,526.—STALK PULLER.—H. Buttenberg and J. L. Strong Memphis, Tenn.
114,527.—DRIER.—T. H. Chubb and W. G. Marston, Post Mills, Vt.

114,528.—FURNACE.—Edwin Clark, Lancaster, Pa.
114,529.—BRAKE.—J. A. Cody, Cleveland, Ohio.
114,530.—BUCKLE.—A. H. Cole, Adrian, Mich.
114,531.—DIGGER.—Clark Cooney, Columbus, Neb.
114,532.—CHAIR.—S. W. Cozzens, Sheboygan, Wis.
114,533.—STOVE.—Robert Diven, Williamsburgh, N. Y.
114,534.—CAR.—C. S. Dole, Chicago, Ill.
114,535.—STRAW ROPE.—C. E. Donnellan, Indianapolis, Ind.
114,536.—STEP.—George Draper, Hopedale, Mass.
114,537.—SPOOL STAND.—J. H. Drum, Bethel, Mass.
114,538.—SUPPORTER.—A. M. Dye, Elkhart City, Ill.
114,539.—FIFTH WHEEL.—P. S. Eastman, Washington Mills, N. Y.
114,540.—FIREARM.—W. H. Elliot, New York city.
114,541.—SASH HOLDER.—W. R. Elliott, Troy, Kansas.
114,542.—JOURNAL BOX.—S. C. Ellis, Jersey City, N. J.
114,543.—FENCE.—Ellsworth Ely, Lockport, N. Y.
114,544.—MEDICAL COMPOUND.—John Fay, Lacon, Ill.
114,545.—DRILL.—William Frankel, Springfield, Ohio.
114,546.—SEPARATOR.—Daniel Garver, Ringgold, Md.
114,547.—REGULATOR.—Daniel Garver, Ringgold, Md.
114,548.—SCREEN.—Benjamin Giroux, Chicago, Ill.
114,549.—HORSE POWER.—Homer Glass, Racine, Wis.
114,550.—LAMP RESERVOIR.—L. A. Gouch, Yonkers, N. Y.
114,551.—BLOW-OFF.—J. S. Griffith, St. Louis, Mo.
114,552.—WHISKEY.—S. Gross, Dover Township, Pa.
114,553.—HORSE DETACHER.—J. L. Hamilton, St. Joseph, Mo.
114,554.—SAW FRAME.—Leonard Hancock, Alton, Ill.
114,555.—HORSE POWER.—T. Harrison and W. C. Buchanan, Belleville, Ill.
114,556.—MOSQUITO BAR.—R. F. S. Heath, Philadelphia, Pa.
114,557.—PRINTING PRESS.—J. H. Millburn, Summit, N. J.
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114,559.—GAS.—Samuel Hevner, San Francisco, Cal.
114,560.—CORD RETAINER.—Henry Holcroft, Media, Pa.
114,561.—CANAL BOAT.—J. L. Hornig, Chicago, Ill.
114,562.—TWISTER.—Hiland Howard, Leeds, N. Y.
114,563.—GAGE.—W. S. Huntington, Byron, Mich.
114,564.—CHAIR.—P. C. Ingersoll, Greenpoint, N. Y.
114,565.—WHEEL RIM.—D. A. Johnson, Boston, Mass.
114,566.—COUPLING.—William Johnston, Decatur, Mich.
114,567.—TACKLE BLOCK.—J. E. Jones, Waretown, N. J.
114,568.—SAW MILL.—Simon Kemper, Berger, Mo.
114,569.—GLASS MOLD.—W. C. King, Pittsburgh, Pa.
114,570.—SPINDLE STEP.—G. W. Knight and George Draper, Hopedale, Mass.
114,571.—WATER WHEEL.—Thomas Leffel, Springfield, Ohio.
114,572.—VALVE.—Joseph Lewis, Manchester, England.
114,573.—SEWING MACHINE.—H. W. Little, Muncie, Ind.
114,574.—CUT-OFF.—K. H. Loomis, New York city.
114,575.—COUPLING.—J. J. Lovell, New York city.
114,576.—REDUCING RUBBER.—W. N. MacCartney, Glasgow, Scotland.
114,577.—STONE.—T. Madeley, Rochester, N. Y.
114,578.—SCOURER.—E. J. Marsh, Leominster, Mass.
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114,692.—TELEGRAPH.—M. Lefferts, New York city.
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114,694.—WATER METER.—J. P. Lindsay, New York city.
114,695.—CLEANING TUBES, ETC.—C. Lungley, Greenwich, Eng.
114,696.—FURNACE.—T. W. Lyon, Bennett, Pa.
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114,714.—BUTTER PAIL, ETC.—A. Robertson, East Rupert, Vt.
114,715.—WASHING MACHINE.—J. Robinson, Lawrence, Kan.
114,716.—LUBRICATOR.—M. G. Ryan, Frostburg, Md.
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114,718.—FOUNTAIN.—L. Schoeney, New York city.
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114,720.—SPOKE MACHINE.—A. Sherman, Poughkeepsie, N.Y.
114,721.—MEASURING MACHINE.—S. K. Smith, Newark, N.J.
114,722.—TABLE.—Felix Souweine, New York city.
114,723.—REGISTER.—W. H. Stinson, Newbern, Iowa.
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114,726.—PLOW.—L. S. Tewell, Elbinsville, Pa.
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114,729.—SASH BALANCE.—C. Van Hoosen, Catskill, N. Y.
114,730.—TRUCK.—D. Wagner and Wm. K. Bushnell, Titusville, Pa.
114,731.—SLIDING DOOR.—G. L. Waitt, Philadelphia, Pa.
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114,736.—CHURN DASHER.—H. L. Wells, Chillicothe, Mo.
114,737.—SCALE.—H. P. Wheeler, Rochester, N. Y.
114,738.—STOVE.—Alexander White, Rock Island, Ill.
114,739.—TWEER.—John Wood, Jr., Conshohocken, Pa.
114,740.—TICKET HOLDER.—E. M. Wright, Castile, N. Y.
114,741.—CAR SPRING.—Silas Yerkes, Jr., Philadelphia, Pa.
114,742.—FIREARM.—Jose Yglesias, New York city.

REISSUES.

4,370.—DETERGENT.—W. Berry, Boston, Mass.—Patent No. 100,814, dated March 15, 1870.
4,371.—SHINGLE MACHINE.—W. R. Close, Bangor, Me.—Patent No. 91,826, dated June 29, 1869.
4,372.—ARTESIAN WELL.—N. W. Green, Amherst, Mass.—Patent No. 73,425, dated January 14, 1868.
4,373.—WATER SUPPLY.—B. Holly, Lockport, N. Y.—Patent No. 94,746, dated Sept. 14, 1869.
4,374.—STEAM ENGINE.—John Houpt, Springtown, Pa.—Patent No. 90,265, dated May 18, 1870.
4,375.—DISTILLING PETROLEUM.—E. G. Kelly, New York city, and A. H. Tait, Jersey City, N. J.—Patent No. 32,568, dated June 18, 1861.
4,376.—SEWING MACHINE.—Wm. N. Martin, Boston, Mass.—Patent No. 109,366, dated Nov. 15, 1870.
4,377.—RAKE.—J. R. Parsons, Hoosick Falls, N. Y.—Patent No. 22,786, dated Feb. 1, 1859.
4,378.—CAR TRUCK.—C. D. Tinsdale, Boston, Mass.—Patent No. 44,694, dated Oct. 11, 1864.

DESIGNS.

4,867.—CARPET PATTERN.—J. Barrett, New York city.
4,868 to 4,873.—CARPET PATTERNS.—R. R. Campbell, Lowell, Mass., assignor to Lowell Manufacturing Co.
4,874.—SCALES.—Pietro Cinquini, Meriden, Conn.
4,875.—PACKAGE.—D. Dick, New York city.
4,877.—TOY.—John T. Duff, Pittsburgh, Pa.
4,878.—CARPET PATTERN.—John Fisher, Enfield, Conn.
4,879 to 4,883.—CARPET PATTERNS.—A. Heald, Phila., Pa.
4,884.—HAY RACK.—J. A. Herron, Talley Cavey, Pa.
4,885.—STOVE.—S. E. Hewes, Albany, N. Y.
4,886.—SCREEN.—C. L. Hubbard, New Haven, Conn.
4,887.—CARPET PATTERN.—H. S. Kerr, Philadelphia, Pa.
4,888.—PIANO FRONTS.—W. Leigh, Bridgeport, Conn.
4,889.—CARPET PATTERN.—Levi G. Malkin, New York city.
4,890 to 4,894.—CARPET PATTERNS.—C.T.Meyer, Newark, N.J.
4,895.—COOKING STOVE.—A. M. Mothershead, Indianapolis, Ind.
4,896.—CARPET PATTERN.—E. J. Ney, Dracut, Mass.
4,897 and 4,898.—CARPET PATTERNS.—E.J. Ney, Dracut, Mass.
4,899.—FRUIT BASKET.—S. D. Payne, Kasota, Minn.
4,900.—RANGE.—N. S. Vedder, Troy, and T. S. Heister, Lansinburgh, N. Y.
4,901.—THILL COUPLING.—H. Newby, Cincinnati, Ohio.
4,902.—STOVE.—J. R. Rose and E. L. Calely, Philadelphia, Pa.

TRADE MARKS.

249.—SHIRTING.—Fisk, Clark & Flagg, New York city.
250.—BOOT LAST.—Joel McComber, Chicago, Ill.
251.—PLOW.—"Moline Plow Co." Moline, Ill.
252.—DYEING COMPOUND.—W. H. Place & Co., Providence, R.I.
253.—SHIRTS, ETC.—L. and S. Sternberger, Philadelphia, Pa.

APPLICATIONS FOR EXTENSION OF PATENTS.

MACHINE FOR SMOOTHING PLANED WOODEN SURFACES.—Baxter D. Whitney, Winchendon, Mass., has petitioned for an extension of the above patent. Day of hearing, July 26, 1871.

MACHINE FOR HULLING COTTON SEED.—William R. Fee, Cincinnati, Ohio has petitioned for an extension of the above patent. Day of hearing, July 26, 1871.

MANUFACTURE OF SULPHURIC ACID.—Alfred Monnier, Philadelphia, Pa., has petitioned for an extension of the above patent. Day of hearing, July 26, 1871.

ARRANGEMENT OF FEED ROLLERS FOR PLANING MACHINES.—Benaiah Fitts, Worcester, Mass., has petitioned for an extension of the above patent. Day of hearing, July 26, 1871.

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