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## PORCELAIN MANUFACTURE IN NEW YORK.

Augustus II., Elector of Saxony, was of a scientific turn of mind. He loved Science, however, not for its own sake but for his own: in other words, for what he could make out of it. Consequently, when the staid citizens of Berlin drove from their city an unfortunate apothecary's assistant, whose mysterious operations with retort and crucible savored of the black art, he received the outcast with open arms, and shut him up in a laboratory with instructions to fill up the somewhat depleted electoral coffers with gold produced by the aid of the philosopher's stone, at his earliest possible convenience. John Frederic Bottcher, for that was the exile's name, had learned by experience the futility of such speculations; but, in obedience to the sovereign command, he undertook it, and began operations by making some new crucibles from the clay nearest at hand. When these vessels were fired, to his astonishment he recognized in them the appearance of oriental porcelain, and lost no time in communicating his discoveries to his patron. That business-like individual, promptly appreciating the fact that there was more gold to be made in selling the ware than in hunting the marvelous stone, at once locked up Herr Bottcher and his secret in the strong fortress of Albrechtsburg, and then and there embarked in the pottery trade. Now, like every other inventor, before or since, Bottcher was dissatisfied. He could produce red and white stoneware of great fineness, resembling porcelain, but true porcelain baffled his efforts, and such porcelain, he argued, he must produce or remain unhappy.

Fig. 3.—THE MAGNETS.

Fig. 1.—MOLDING THE WARE.

Meanwhile there lived in the neighborhood an ironmaster named Schnorr. Schnorr's horse one day, while his master was on his back, came to a standstill with all four feet stuck in the mud, causing Schnorr to dismount and, doubtless with sundry hearty Teutonic objurgations, to extricate him. Schnorr was not so angry, however, as to prevent his noticing that the mud was pure white, although astonishingly sticky, and it occurred to him that, if he could make the material into a powder, there was the stuff for the wigs of the gentry and, at the same time, the basis of a fortune for him. This idea he put in practice; the powder sold well, and in the course of time fell into the hands of Bottcher's valet, and thence upon the head of Bottcher himself. Bottcher one day, after an application of the substance, discovered that his wig was remarkably heavy, an annoyance, in fact, which interfered with his cogitations over his pet problem. So he removed the covering and, at the same time, whitened his fingers with the powder. He looked at the stuff for an instant, noticed its greasy feeling, and then the thought flashed through his mind: "Why not try this for porcelain?" The next paste that entered his kiln contained the ingredient, and that paste emerged white porcelain. The riddle was solved.

At once every workman was sworn to secrecy under penalty of death. "*Geheim bis ins Grab*" (be secret to the grave) appeared in large letters on the wall of every work room. Even the Elector took the oath, which the laborers repeated monthly, and the factory at Meissen became a fortress fully garrisoned and armed. This was in 1715. One man, however, escaped to Vienna, and betrayed the secret. At once other factories sprung up, and their numbers extended throughout German Europe. France looked on with undisguised jealousy, and set her chemists hard at work. It was reserved for a woman to do that in which the wise men failed. The wife of a surgeon, living near Limoges, ran short of soap for her week's washing. She was too poor to buy more, and hence attempted to use a white unctuous earth found in a ravine hard by. Her husband showed the strange clay to the village apothecary, and he in turn told the chemists, who recognized in it the kaolin of which they were in search. Thus sprang up the great factory at Limoges, and then that of Sevres, both famous to this day.

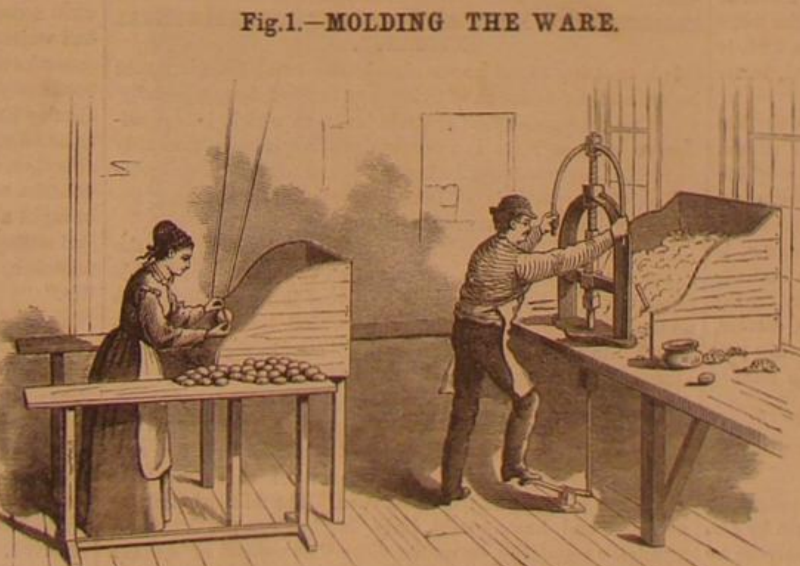

Fig. 2.—PRESSING AND TURNING SMALL WARE.

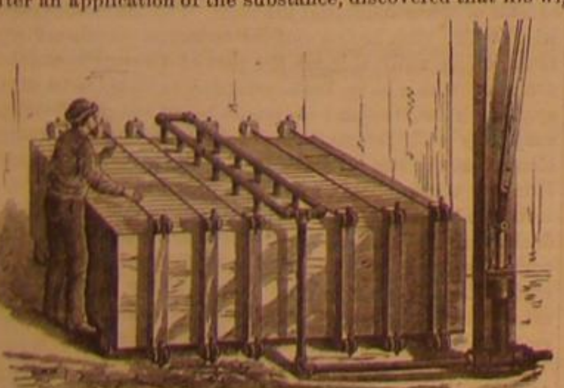

Fig. 4.—PRESSING THE WATER FROM THE SLIP.

To trace the course of the porcelain industry for the last hundred years would cause us far to transcend our present limits. Suffice it to say that it is now one of the first in the world, and that the earlier products have been made the subjects of manias which have run their value up to sums far exceeding the actual weights of the articles in gold. We eliminate a century's labor abroad, then, to come at once to the introduction of the manufacture into this country sixty-five years ago, when we find the first record of a company being chartered to manufacture the material from kaolin found in Vermont. Later still, in 1819, Dr. H. Mead began porcelain manufacture in New York, and in 1827 William Ellis Tucker had established a porcelain factory in Philadelphia; while another of considerable extent, employing one hundred persons, had sprung up in Jersey city. Since then the manufacture has been continued, and at the present time the porcelain produced in the neighborhood of this city is, in many respects, equal to the best imported ware.

We now proceed to describe the processes as carried out in one of the oldest and largest establishments in the United States, premising, however, with a few words as to

### THE MATERIAL OF WHICH PORCELAIN IS MADE.

Porcelain clay or kaolin (the word is derived from the name of a mountain in China where the substance abounds) is a silicate of alumina, and has an average composition of 47 per cent silica, 40 of alumina, and 13 of water. It comes from granite rock which, by natural causes, is decomposed, so that the felspar and quartz are separated. The potash extracted from the felspar leaves the kaolin in a soft unctuous condition, white and opaque, and with a characteristic odor when breathed upon. In this condition, it is exported hither from certain districts of England, and is combined in suitable proportions with felspar and quartz. It is unfortunate for the industry here that the necessity exists of obtaining the ingredient from foreign sources, as there is no reasonable doubt but that ample beds of the material exist within our own borders, which careful search and careful development might soon render available.

### THE FACTORY

which we recently visited is located in Greenpoint, Long Island, opposite this city, is known as the Union Porcelain Works, and is owned by Messrs. T. C. Smith & Sons.

Fig. 5.

### MIXING THE SLIP.

After the kaolin has been combined, as above noted, with felspar and quartz, it is thrown into a huge vat, and there mingled with water to the consistence of a thin paste. This operation we found in process in a lofty lower story. Inside the vat a vertical shaft, supporting a number of radial arms, kept the slip, as it is technically termed, in a state of constant agitation, as the liquid slowly escaped from an orifice beneath into a sieve held by a workman there stationed. The sieve was constantly shaken, and the slip continued its sluggish course down a short channel and between two sets of horseshoe magnets, some horizontal, others perpendicular. The object of these, we were told, is to remove every fine particle of iron which the mixture may contain, for, as we afterwards saw, each speck of the metal, however minute, appears as a black spot on the snowy surface of the finished china. From the magnets (Fig. 3) the liquid ran into a second sieve held by the same man, faucets suitably located enabling him to check the flow at pleasure, and thence into a second vat located on a lower level, where similar apparatus to that already noted kept it stirred. With the initial letter which heads this article, there is a small drawing which shows the arrangement of the vats, after escaping

Fig. 6.—THE SEGGARS.

from the last of which the slip is led into storage bins or tanks. The next operation is

SQUEEZING THE WATER FROM THE SLIP,

and to this end the paste is pumped from the bins and into a peculiar press which is represented in Fig. 4. This may be compared to a series of heavy wooden trays set up on end and held together by strong iron bands. Between each pair of trays is a cloth bag, and with each bag a supply pipe communicates. A powerful force pump drives the slip into the bags under a heavy pressure, and an ingenious valve, which may be weighted as required, regulates the backward tending force, and by lifting at the proper time prevents the bursting of the bags. The result is that a large quantity of water is expelled, and the material emerges a heavy dough. This is worked and kept for some time before using as ageing is said to improve it. The Chinese, by the way, have a tradition that the material for their old porcelain was stored away for a hundred years before use. The French missionaries, translating the words "for a hundred years" into their own language, "*pour cent années*," afterwards corrupted the latter phrase into the word "porcelain."

Passing from the press room to another apartment, we were shown an immense heap of smashed crockery. All this, we were told, is utilized, and in fact made over again. The fragments are ground to a coarse powder under two huge revolving burr stones, each weighing some two tuns. This powder is again ground in an ordinary mill, and in its fine state, is mixed with water to go through the regular process. The operation of

MAKING SEGGARS

next claimed our attention. A "seggar" (Fig. 6) is a tray of common baked Jersey red mud. It has no cover, and its depth varies according to the piece of ware it is to contain, during the baking of the same in the kiln. The clay is mixed to a thick plastic mass in a pug mill and subsequently pressed in molds to any desired form. Baking follows, and the finished seggar emerges looking like a piece of coarse red earthenware.

Leaving the lower stories, we ascended through large brilliantly lighted rooms and past tier on tier of crockery in all stages of manufacture. Scrupulous cleanliness pervaded everywhere, and, save the slight whizzing sound of machinery no noise was heard. The workmen—and, very singular to add, girls too—labored silently, obeying the placards commanding stillness, which, appearing on the walls, reminded us of the stern warning in the old German workshop a century ago.

MOLDING THE WARE.

"The potter's lathe," said our guide, "is obsolete here. We abolished that antique apparatus long since;" and leading us to a long table, he showed us a row of men, each one stationed before a horizontal revolving disk (Fig. 1). This, by a mere pressure of the knee on a lever, which threw friction gearing into operation, could be set spinning around. Beside each man was what appeared to be a number of short tubes (Fig. 5), irregularly shaped and made of the clay dough. The disk or rotating head being at rest, the workman placed thereon a mold, the interior of which was of the exact form of the exterior of a bowl. Into this he inserted one of his dough tubes, and set the disk in motion, pressing the plastic mass with his fingers, at the same time, out against the side of the cavity. Then he brought down into the latter a counterpoised metal blade, as shown in Fig. 1, which was so adjusted and shaped as to remove exactly enough material to leave the bowl of the requisite thickness, and at the same time to form its interior. The article, we were told, is subsequently put aside to dry, and, thus completed, is removed from the mold and is ready for baking.

There are very many objects which do not require the use of the revolving head, and are simply pressed into molds, some by machinery, others by hand alone. The machine used for door knobs, for example, is simply a screw press which forces the clay in the condition of moist powder into a properly shaped die. The knob, however, on emerging, is not everywhere round, and is therefore placed on a horizontal revolving spindle and turned. These operations on the knob are shown in Fig. 2. China heads for nails, casters, speaking tube mouths, and an immense variety of other porcelain goods for the hardware trade are made in similar manner.

(*To be concluded in our next.*)

**A New White Pigment.**

A Mr. Orr, of Glasgow, has recently taken out a patent for a white pigment, which he has endeavored to obtain by forming a compound of zinc and barium. For this purpose he takes crude barium sulphide, and lixiviates it. The supernatant liquid is then drawn off, and divided into two or more equal portions. To one, an equivalent of zinc chloride is added, and to this again zinc sulphate is added, and afterwards another portion of barium sulphide, the result being an intimate mixture of 1 equivalent barium sulphate and 2 of zinc sulphide. The precipitates, composed of zinc and barium, are collected and pressed to expedite drying, after which they are placed in retorts and brought to a red heat. While still hot, they are drawn into water, preferably cold, which, it seems, has the effect of increasing their density and imparting body to the paint to be made from them. They are subsequently washed and ground in water to a fine powder, or they may be first dried and then ground. The inventor states that, by increasing the number of additions of zinc sulphate, the quality may be varied. The pigment thus prepared is to be used in the ordinary way; and if it does but possess the covering power of white lead, and can be sold as cheaply, it will be undoubtedly a useful product, for zinc white retains its color better than any other white pigment in ordinary use.


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**Contents.**

(Illustrated articles are marked with an asterisk.)



## CROSSING THE BOUNDARY OF THE EXPERIMENTAL EVIDENCE.

It is amusing to see how zealously the non-scientific world insists on the restriction of Science to verified fact, especially when we remember that the sole basis on which its opposition to Science rests is a stupendous hypothesis, not only unverified, but confessedly beyond the reach of human verification, the hypothesis of Divine revelation—something supernatural, superhuman, miraculous.

Professor Tyndall speaks of crossing the boundary of the experimental evidence in pursuit of an explanation of visible phenomena, and straightway a great cry is raised that he is no true friend of Science, or, at best, that he has been betrayed into a false and "unscientific" step in the heat of oratory and by the sympathies of his audience. The speaker disclaims any such apology, assuring his volunteer defenders that he said nothing in heat or haste; that he crossed the boundary deliberately, and said just what he meant to say.

The reply all but breaks the heart of these would-be guardians of the integrity of Science. The admission of imprudence and haste would have simply damaged Professor Tyndall's reputation as a scientist. The avowal of deliberate intention, they fear, will utterly destroy the claims of Science in popular estimation! If years of scientific training and investigation, they say, can produce no better result than to make a professor of Science carry his scientific teachings straight to conclusions in the regions of the absolutely unknowable, what becomes of the boasted virtues of the scientific habit and its supposed effects upon the human judgment and intelligence?

A sufficient reply to this objection would be that one of the chief virtues of a scientific training is, not to keep the mind's action wholly within the bounds of experimental evidence, for that would block all progress, but to enable it to cross that boundary when occasion demands, properly restrained by a knowledge of what is known and a conviction that what is unknown is certain—so far as experience goes—to be in harmony with the known. For this reason the hypotheses of a true scientist are to those of the unscientific or anti-scientific as the speculations of a wise man are to those of a theologian. In the one case the hypothesis, unverifiable though it be, has a basis in reason and reality; in the other it is very apt to fly in the face of fact, and set faith above reason. He would be a curious disciple of Science who should say: "I cannot understand, therefore I believe!"

Fortunately the anti-scientist cannot be unreasonable in all things. In the common affairs of life his mind works like other men's. It is only when his religious prejudices are involved that he kicks at the scientific method. Thus if he should find on his doorstep some morning an infant, with no discoverable clue to its origin, he would be as ready as Darwin himself to pronounce it a human child, born of human parents in the ordinary way, and placed there by human hands, though, under the circumstances, not one of these assumptions would be other than an unverifiable hypothesis.

In no case could we think of a true scientist as deciding otherwise. It is quite possible, however, to suppose that an ecclesiastic might hold a different opinion. "What has happened may happen." If one child, as he devoutly believes, came into the world without a human father, it is possible that this might have had a similar origin. Still more, if his church decreed it, he could not deny that the child was, like the progenitors of the human race, according to his theory, a direct product of creative power, with no parent but the Almighty. Under the supposed circumstances, this would be no less possible of verification than the scientist's hypothesis of human parentage; the two differ simply in the fact that the one has all the verifiable facts we have to support it, while the other has all known facts against it. The great virtue of Science training is to keep men from such unsupported vagaries, not to chain them down to demonstrable fact.

In his late review of Haeckel's "Anthropoginie," Professor Huxley touches this point in defense of the hypothesis of development as applied to living creatures, man included, and shows how few scientific problems, even those which have been and are being most successfully solved, have been or can be approached in any other way than by speculations passing the bounds of positively verifiable fact. "Our views respecting the nature of the planets, of the sun, and stars are speculations which are not and cannot be directly verified; that great instrument of research, the atomic hypothesis, is a speculation which cannot be directly verified; the statement that an extinct animal, of which we know only the skeleton, and never can know any more, had a heart and lungs, and gave birth to young which were developed in such and such a fashion, may be one which admits of no reasonable doubt, but it is an unverifiable hypothesis. I may be as sure as I can be of anything that I had a thought yesterday morning which I took care neither to utter nor to write down, but my conviction is an unverifiable hypothesis. So that unverified and even unverifiable hypothesis may be great aids to the progress of knowledge—may have a right to be believed with a high degree of assurance. And therefore, if it is to be admitted that the evolution hypothesis is, in a great measure, beyond the reach of verification, it by no means follows that it is not true, still less that it is not of the utmost value and importance."

The like is true of other current hypotheses in Science. They may or may not be ultimately demonstrated; many of them may be, and in all probability will be, supplanted in time by new hypotheses having a wider basis in verified fact; nevertheless, they are to be accepted provisionally, as giving the best expression and interpretation of phenomena as we know them, and used as "instruments of research" until something better is found. If the world of thought had waited for absolute truth before going ahead, it would never have got even so far as the crude hypothesis of the books of Genesis. To wait is to go to waste. As Professor Huxley has well said: "Active error may advance knowledge in its efforts to establish itself; and nothing is more remarkable than the number of great things, from the discovery of America to that of the antiquity of man, which have been brought about by the attempt to establish erroneous views. But sitting still and being afraid to stir, for fear of making mistakes, is certain to end in ruin, in Science as in practical life."

## FOREIGN EXHIBITORS AT THE CENTENNIAL.

So far from there being a prospective lack of foreign exhibitors at the Centennial, it now appears that so many desire to avail themselves of the advantages offered that it will be impossible to accommodate all in the spaces allotted. The commissioners of several nations have already made requisition for greater areas than have been set aside for their respective countries, and applications, they state, are being constantly received. The German Empire, it is said, will make by far the finest display, both in kind and extent; Austria will follow closely, and her products, comprising the exquisite articles of *vertu* from Vienna, Moravian cloths, Bohemian glass, and Styrian and Carinthian iron, will together constitute an exhibit of great industrial interest. The marked eagerness with which each nation desires to secure prominent representation is noticeable on the part of the small countries, some of which have been assigned in couples to certain spaces. Thus, Holland objects to being assigned floor space conjointly with Denmark, and asserts through her commissioner that she can fill every inch of the space allowed, alone. Hungary will probably insist on a separate department, and refuse to be overshadowed by the Austrian display. Norway declines to be joined with Sweden, and both Scandinavian countries assure very interesting exhibits of iron, furs, and matches. Denmark offers a good display of Copenhagen manufactures, besides collections illustrating the manners, customs, and industries of Greenland and Iceland.

France will also crowd her space with silks, velvets, lace, jewelry, and the thousand productions in which her artisans are unrivaled. It is said that the French display will be the best organized and regulated in the Exposition. Italy has not yet appointed a commission, but it is understood that she will shortly do so. Her exhibit will be principally mosaics, cameos, corals, statuary, Venetian glass, Genoese silk, and other specimens of industrial art. Fine displays from Greece and Portugal are expected, and Switzerland has promised a complete exhibit of her watches, mathematical instruments, lace, and wood carvings.

Russia is holding off, and as yet her government has made no overtures toward participation. It is rumored that this position will be maintained, and that the country will be represented solely by voluntary contributions sent by individuals.

England and all her colonies are manifesting a largely increased interest in the enterprise, and leading manufacturers are well advanced in extended preparations. The Canadian government has appropriated $250,000 to pay expenses of the Dominion commission, and British India, Australia, New Zealand, and the Cape of Good Hope have promised full displays. All of the South American countries have applied for space, and the commissions of several are already organized. Brazil and Chili will take the lead in point of extent of exhibits, but from all contributions are expected, far larger than those sent by them to previous World's Fairs. Mexico, the Central American States, and Hawaii are likewise preparing. In the East, from Egypt and Japan magnificent displays have been promised; Turkey, Persia, Siam, and China are as yet unheard from.

Altogether, the prospects are that the Centennial will outshine all previous expositions in the completeness of the exhibits which each country will furnish. This is well evidenced by the ready response which all have made to the invitations sent them to participate, and the celerity with which they appointed commissions and set about the necessary preparations. The combined foreign exhibits will occupy 340,432 square feet out of the 485,000 feet available. The United States has 123,160 square feet, and there is an area of 21,408 square feet reserved for contingencies.

## AMERICAN PORCELAIN.

We commence on the front page of this issue an elaborate illustrated article detailing all the various processes of the manufacture of porcelain as practised in this country. There is no question but that this industry has become a very important American manufacturing interest, and one which, before many years, will enter into sharp rivalry with the work of European producers. It holds the unfortunate position now, however, of being practically unrecognized. That is to say, the popular prejudice is so strong in favor of foreign goods that American wares have to be and are largely sold as French or English products in order to induce people to buy them. This is alike destitute of sense or justice. The fact remains that porcelain from our own factories is bought and liked, and therefore no valid reason exists why it should not be put on the market for what it is. We are gratified to notice that a meeting of the pottery trade, held in Philadelphia a month or two ago, recognized this very plainly, and the convention voted, among other resolutions, to the effect "that we have sufficient talent in this country to originate new designs, more elegant and suitable to the wants of the American people, and that such procedure on our part will the sooner enable us to give our products the stamp of a national product and a distinct character."

We also wish to direct especial attention to the fact that we import kaolin from England, and that none, as we are informed, has as yet been discovered in this country suitable for the finer porcelain. There are beds, we believe, in Brandon, Vt., but the clay is put to base uses in adulterating paper, paint, and other products. We have no record of its being tested for porcelain. There is a tariff of $5 a tun on the imported material, from which our citizens reap no benefits, and which offers a further incentive to discover the kaolin. It seems to us that, unless some effort in this direction shortly appears, it would be good policy to encourage the industry by remitting the tariff altogether, and entering the kaolin free as a raw material.

In our inspection of the machinery, at the establishment described, we were impressed with its simplicity and efficiency everywhere except in one particular. That was in the means used for making the small articles, such as nail heads, castors, and other hardware trimmings, of which the factory produces an enormous quantity. The reader will find the apparatus illustrated in Fig. on page and it will be perceived to consist merely of a screw press, which forces the damp powder into a die, the latter being removed by hand and filled for each article. There is very clearly work for an inventor here; and it seems to us that a little ingenuity could speedily contrive an apparatus which would fill the die, hold it in place, and run down the screw, automatically. Now it requires one workman to each machine. With suitable apparatus, one man ought to control half a dozen if not more, and produce the articles far more quickly as well as of more uniform shape.

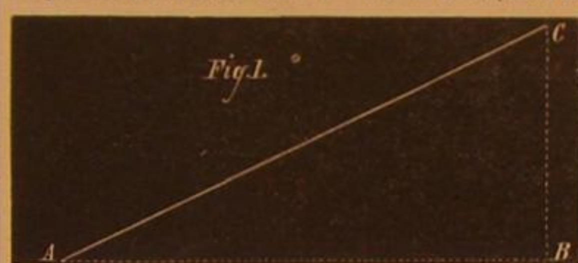
We notice that the Potters' Association offer three prizes of one hundred, fifty, and twenty-five dollars respectively, for the handsomest design of pottery ware to be exhibited at the Centennial. If we may judge from the efforts being made at the factory visited by us, our American potters are thoroughly imbued with a spirit of emulation, not of course to gain the small sums above mentioned, but to produce a display at the Centennial well calculated to arouse the world to a sense of the progress we have made in the ceramic art. We were shown some remarkably beautiful vessels, of unique shape, the exteriors of which were molded with national emblems and bas reliefs of events in American history, which when complete will, we think, compare favorably with some of the finest vases and other evidences of skill produced by European factories.

## A VARIABLE SCREW.

A correspondent asks how to lay out an increased twist on a wooden cylinder. We do not know that this information is published in a form that is generally accessible to our readers; and as the construction is also applicable to the guide plates for screw propulsion, we here present it in simple form.

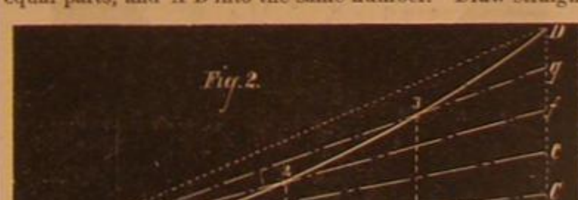
The line forming the intersection of any two faces of a screw thread is called a helix, and can be described, on a cylinder having the same diameter as the thread, by the motion of a point which goes around the cylinder, and, at the same time, advances in the direction parallel to the axis. If all the helices of the intersections of the faces of the screw are determined, we have the boundaries of the thread, and it is the method of making the determination that our correspondent desires to have explained. The pitch of a helix is the distance that the generating point moves along the cylinder in passing once around it. If this axial motion is the same for all parts of the revolution, the helix has a constant pitch; but if the motion varies at different parts of the revolution, the helix is said to have a variable pitch—increasing if the axial motion of the point is greater for each successive equal interval of the revolution, and decreasing if the axial motion continually grows smaller. The simplest manner of drawing either of these helices is by the aid of a graphical construction; and the methods employed in the three cases are represented in the accompanying sketches:

1. Helix with constant pitch, Fig. 1: Provide a cylinder of the same diameter as the required helix. Draw a horizontal line, A B, equal to the circumference of the cylinder; and at the point, B, erect a perpendicular, B C, equal to the pitch; connect the points, A and C, by a straight line; cut out the figure so constructed, and wrap it around the cylinder, with B C parallel to the axis. Then A C will be the required helix;




which can be traced on the cylinder by using the edge, A C, of the paper as a guide. If the helix is to be constructed for only a portion of a revolution, make A C equal to that fraction of the circumference, and B C equal to that fraction of the pitch. Similarly, if the helix is to make several revolutions, A B must be the length of the circumference of the cylinder multiplied by that number of revolutions, and B C, the pitch multiplied by the same number.

2. Helix with increasing pitch, Fig. 2: Provide a cylinder, as before, and make A B equal to the circumference. Erect a perpendicular at B, and make B C equal to the initial pitch of the helix, and B D equal to the sum of the initial and final pitch divided by two. Divide C D into any number of equal parts, and A B into the same number. Draw straight



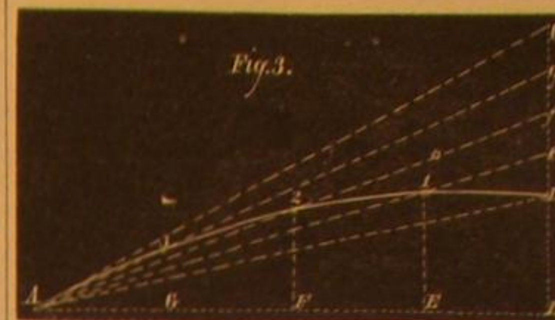

lines to A, from the points of division of C D, and perpendiculars to A B from the points of division of that line; mark the points in which these perpendiculars cut the corresponding lines drawn from the points of division of C D, and draw a curve, A 1 2 3 D, through these points and A and D, cut out the figure, and wrap it around the cylinder as before, when the required helix can be traced with A 1 2 3 D as a guide. If the helix make more or less than one revolution, A B must be made equal to the length of the same part of the circumference of the cylinder, B C to the same part of the initial pitch, and B D to the same part of the half sum of the initial and final pitch. In the figure, only a few points of the guide curve are constructed, as it is merely given for the sake of illustration; but in any practical case, it is well to construct as many points as convenient. Some examples are added to still further illustrate the construction

Example 1.—To construct the guide for one revolution of a helix, 4 inches in diameter, and with pitch increasing from 4 to 12 inches: A B is 12·566 inches, B C is 4 inches, and B D, $(4+12)\div2$, or 8 inches.

Example 2.—Guide for a helix making six revolutions, having a diameter of half an inch, starting with a pitch of 3 and ending with a pitch of 15 inches. In this case, A B is $6\times1{\cdot}5708$, or 9·425 inches, B C is $6\times3$, or 18 inches, and B C is $6\times(15+3)\div2$, or 54 inches.

Example 3.—Guide for the circumferential helix of one blade of a screw propeller, the diameter of the screw being 18 feet, one eighth of the pitch being used, and the pitch expanding from 24 feet at the forward edge of the blade to 32 feet at the after edge. A B is $\frac{1}{8}$ of 56·549, or 7·069 feet. B C is $\frac{1}{8}$ of 24, or 3 feet. B D is $\frac{1}{8}$ of $(24+32)\div2$, or $3\frac{1}{2}$ feet.

3. Helix with decreasing pitch, Fig. 3: The guide is constructed in a similar manner to that already described. A B is the circumference of the cylinder on which the helix is to be drawn; B C, perpendicular to A B, is the initial pitch, and




B D is equal to half the sum of the initial and final pitch. Divide C D and A B, each into the same number of equal parts, and mark the points of intersection of lines drawn from the divisions of C D, to A, with the perpendiculars erected at the corresponding points of A B. A curve, D 1 2 3 A, drawn through these points and D and A, will be the guide, by means of which the required helix can be traced upon the given cylinder.

## THE METALLURGY OF IRIDIUM.

When it was decided to make the standard meter, of which a description appeared in our issue of September 10, of an alloy of platinum and iridium, the preparation of the latter metal presented the greatest difficulty. Platinum resists the action of oxygen, and is only acted upon by aqua regia; for its fusion it requires the highest heat attainable by the oxyhydrogen blowpipe. The alloy of osmium and iridium, in which form the latter is only found in Nature, is unaffected either by aqua regia or the blowpipe. Small grains of iridosmine are found mixed with the sand in which platinum ore is found. This mixture of platinum, sand, and iridosmine was first treated with aqua regia, which, of course, dissolved the platinum, leaving the iridosmine in small grains and scales, mixed with sixty to seventy-five per cent of sand. By fusing this mixture with litharge, silica and a little charcoal, the same unites with the litharge and silica to form a glass; the iridosmine, being heavier, falls into the reduced lead below. It is isolated in metallic granules by dissolving the lead in nitric acid; next the iridium must be separated from the osmium.

Iridosmine can only be attacked and rendered soluble by treating it with alkalies combined with powerful oxidizing agents. For this purpose, it must be reduced to a fine powder, which cannot, however, be accomplished by pulverization in a mortar, for the iridosmine is very tough and hard. The object was accomplished by fusion with zinc, with which it forms an alloy. On distilling off the zinc, it is left in the state of a very fine powder. This powder is heated with nitrate of baryta as a flux, whereby it is converted into oxide of iridium and osmate of barium. The resulting mass is soluble in nitric acid; and when the solution is distilled the osmic acid, which is volatile at 212° Fah., is obtained in large, white crystals. This operation requires special caution, as the osmic acid is very poisonous, the most so of any known substance. It, therefore, has to be kept in tubes hermetically sealed.

The red liquid, which remains after distilling off the osmic acid, contains nitrate of baryta and oxide of iridium. The latter is precipitated by adding baryta. The precipitated oxide of iridium is dissolved in aqua regia and precipitated by the addition of sal ammoniac, in the form of a double chloride of iridium and ammonia, $NH_4Cl+IrCl_2$. When ignited, this yields the crude iridium sponge, which also contains some platinum, ruthenium, and a little rhodium. This is refined by fusion with saltpeter, which oxidizes the ruthenium and other metals. The resulting mass is treated with water, which dissolves the ruthenate of potash with a yellow color. The residue is fused with lead, which separates the metals. On cooling, pure iridium crystallizes from the lead. The lead is dissolved by nitric acid, and the platinum by aqua regia, which does not attack the iridium.

The invention of a method of working up iridosmine, although somewhat difficult and dangerous, so as to obtain the iridium in a metallic state for the preparation of very refractory alloys, will probably render valuable a hitherto waste product in the working of platinum ores.

The dangerous character of its companion, osmium, of which it is said that twenty pounds would kill all the inhabitants of the world, will prevent its finding a use in the arts.

## New Screw Propeller Experiments.

We have alluded to the experiments of the veteran screw propeller inventor, Mr. Griffiths, who has shown that in some cases there is a loss of 60 per cent of engine power in the use of screws. He now proposes, as an improvement, the use of small screws, one at the bow and the other at the stem. The British Admiralty have placed the Bruiser steamer at Mr. Griffith's disposal for trial of the new plans, and the results, which may soon be expected, will be studied with interest.

AT the New Albany (Ind.) Plate Glass Works, the other day, several men were standing on an elevator, steadying a very heavy load of plate glass, worth some $2,500, when the cog wheel which propelled the windlass broke suddenly, just as the elevator reached the topmost floor, and the men and their charge were precipitated together a distance of thirty feet. The glass was broken in fragments, which almost buried the men. Three of the latter were seriously wounded.

### THE FIREMAN'S RESPIRATOR.

In a paper read by Captain Shaw, of the Metropolitan Fire Brigade, at the Society of Arts, on January 19, an ingenious apparatus was described for enabling persons to breathe in dense smoke or poisonous vapors. It consists essentially of a close-fitting hood, with a respirator, holding a filter, the

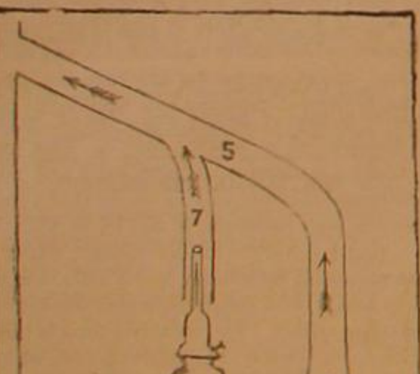
nvention of Professor Tyndall, which consists of a valve chamber and filter tube about 4 inches long screwed on outside, with access to it from the inside by a wooden mouthpiece. The charge for the filter consists of the following materials, which are put in with the tube turned upside down, and the lower valve removed: Half an inch deep of dry cotton wool, an inch deep of the same wool saturated with glycerin, a thin layer of dry wool, half an inch deep of fragments of charcoal, half an inch deep of dry wool, half an inch deep of fragments of lime, and about an inch of dry wool. The whole can be put on and adjusted in a few seconds by the wearer.—*Science Record.*

### A New Light.

We described, not long ago, the new light for photographic purposes, produced by the combustion of bisulphide of carbon and binoxide of nitrogen. The only drawback to the utility of the light was the danger of explosion. Further experiments in the same path have recently been made, and Messrs. Riche and Bardy communicate to the French Academy the details of the apparatus, by which a new light, having an actinic power superior to the oxyhydrogen light, is produced, with economy and safety. The light is made by melting sulphur in an open vessel; and when the sulphur is in flames, a jet of oxygen gas is directed upon it, producing a bluish light of great actinic power.

Another method, which produces a brilliant white light, but of less actinic power than the other, consists in filling the vessel with nitrate of potassium, and heating until the salt begins to decompose, then throwing small pieces of sulphur upon the surface of the salt.

The following is the apparatus for the sulpho-oxygen light:




No. 1, a glass tube connecting the gas bag with burners No. 2, an iron stand to hold the small crucible. No. 3, a crucible. No. 4, a small alcohol lamp to ignite the sulphur. No. 5, a funnel to receive the product of combustion. No. 6, a petroleum lamp employed to establish a current of air in the chimney. No. 7, a shaft connected with the chimney, in which the current of air is formed by means of gas or a lamp.

It is not necessary, says Professor E. Stebbing, in the *British Journal of Photography*, to employ the oxygen under much pressure, for with too much of that gas the flame is white instead of blue, and therefore less photogenic.

PROFESSOR FORSTER, of Berlin, discovered, on February 25, a new planet of the twelfth magnitude.

### THE NEW REVELATIONS OF A SNOW FLAKE.

It is difficult to believe that the pure white flake, which settles noiselessly upon the earth, and which seems, even when moderately magnified, but a mass of exquisite white ice crystals, is, after all, but a scavenger of the atmosphere. But such, nevertheless, is the fact, and henceforth we must regard the snow drops but as so many sponges which absorb into their porous substance the myriads of microscopic bodies which form that peculiar atmospheric dust, found near the surface of the earth, and most largely in the vicinity of cities. This dust is itself a queer mixture of heterogeneous substances. M. Gaston Tissandier, who has been making a

Fig. 1.—Corpuscles suspended in a drop of snow water.

number of very interesting investigations on the snow, states that, in a drop of water obtained from a single flake and magnified 500 times, he found pieces of coal, fragments of cloth, grains of starch, sandy matter, and an immense variety of other substances, not a fragment of which exceeded in diameter three ten-thousandths of an inch. Some idea of the numbers in which these infinitesimal particles must exist in the snow can be gained from Fig. 1, which represents a drop of snow water gathered at the summit of Notre Dame towers, in Paris, and magnified under the microscope 500 diameters. The fibers of fabrics and bits of coal are easily recognized.

Fig. 2.—Crystals obtained by evaporating a drop of snow water.

By examining large volumes of snow water, M. Tissandier has been able to determine the weights of these corpuscles. A quart of water collected in the ity and evaporated gave 3·2 grains of residue, and the same quantity obtained in the country yielded about half that weight. The residue is an impalpable pulverulent gray powder, composed, in round numbers, of 70 per cent mineral and 30 per cent organic substances. It is very rich in carbon, burns brilliantly, and con-

Fig. 3.—Crystals obtained by evaporating a drop of snow water.

tains certain chlorides and sulphates in appreciable quantities, besides carbonate of lime, alumina, silex, and sufficient iron to be readily recognized by reagents. Nitrate of ammonia is also detected in the proportion of about 0·015 grains per quart of water.

M. Tissandier states that, by evaporating a drop of snow water, in dry air on a glass slide, and examining subsequently with the microscope, crystals, some needle-like, some prismatic, and others star-shaped, as represented in Fig. 2, were observed to form. *During the course of one experiment,* however, he remarked a noticeable difference in the crystallization. The crystals appeared to ramify, throw off other needles, these last others again, until the slide under the lens presented the beautiful appearance represented in Fig. 3.

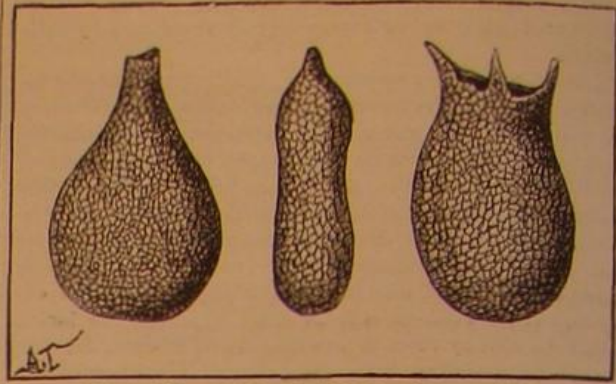


Fig. 4.—Microscopic aerolites (largely magnified).

Under the influence of a high temperature, these new crystals evaporated, but it was not difficult to prove them to be the nitrate of ammonia, the presence of which chemical analysis had previously indicated. Further investigation showed also that, among the nitrate of ammonia crystals, were scattered others of different form and totally unlike those of the rhomboidal system. Some were cubical, indicating them to be probably sea salt, others resembled the sulphate of soda crystals. The last probability was rendered quite certain by throwing a few flakes into a supersaturated solution of sulphate of soda, in which they immediately caused crystallization to take place. All the crystals, it appears, formed on the edges of the drop, while the corpuscles formed a dense group in the center.

As regards the particles of iron found, while it is very possible that they came from the surface of the soil, it is not improbable that they may have reached the atmosphere from without the same, and therefore be due to the disaggregation of aerolites, destroyed on entering the aerial ocean. Nordenskjold has collected, on the great snow fields of the arctic regions, a dust which contains iron, carbon, nickel, cobalt, and phosphorus, elements especially characteristic of extra-terrestrial bodies. Ehrenberg, the celebrated German microscopist, has examined the ferruginous dust, which, to the naked eye, appears to be but an agglomeration of minute grains, as represented in Fig. 5. When very highly magnified, however, the curious shape of the particles becomes clearly apparent (Fig. 4), showing that, at some time, they must have been in a state of fusion, and hence very probably due to some mass of meteoric iron rendered incandescent and melted by friction with our atmosphere.

Fig. 5.—Microscopic aerolites (natural size).

The iron and other particles in the snow probably are not without some effect upon vegetation, the exact nature of which future investigation will determine. Certainly, however, it appears that heavy snow falls, besides protecting the ground against excessive cold, serve to fertilize the same through the nitrate of ammonia, conveyed to the soil by the melting of the snow.

### New and Valuable Printing Press.

A new printing press made in Liverpool, Eng., by Duncan and Wilson, for the *Christian Union* newspaper of this city, is a remarkable novelty in this class of mechanism. It prints, folds, pastes, and binds the paper inside of a cover, which it also prints; and delivers the numbers, thus completed, at the rate of 5,000 copies per hour, and may be worked up to 6,000 per hour. The paper is drawn from a roll. The whole machine is 27 feet long, 7 feet high, and the cost is $20,000. The folding apparatus may be disconnected whenever necessary, and the machine used to print without folding. Various attempts have been heretofore made to attach folding machines to printing presses; but this, we believe, is the first successful example of the kind.

### Rather Cold.

A correspondent of the Toronto *Globe* wrote from Bridge Creek, British Columbia, on February 19: "The thermometer at this place was frozen up, so we could not tell how cold it was. A bottle of good brandy and a bottle containing two pounds of mercury were put out as a test on February 14. In the morning both were frozen solid. This cold snap has lasted for more than two weeks, with no signs of mild weather. The mercury in the thermometer has been frozen every night."

### German Locomotives.

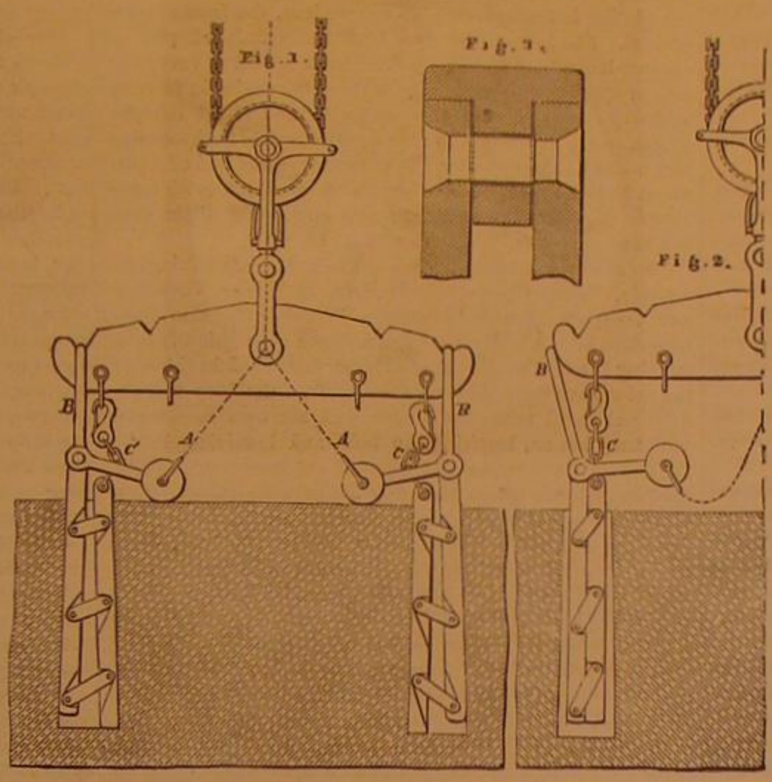
The sixth annual report of the artisans of the German railway administration states that locomotive boilers made of sheets of cast steel have not fulfilled the expectations entertained for them, although it is hoped that more favorable results will be obtained when improvements have been made in the manufacture of steel plates. Copper bolts are recommended for the first row; steel ones are only to be employed when the feed water and fuel are both good.

## IMPROVED LEWIS.

At the present time it is no uncommon thing to use, in the formation of breakwaters, piers, and other similar structures, blocks weighing from twenty to thirty tuns each, and it is found that, with suitable plant and machinery, masses of this weight can be moved readily and safely.

The ordinary lewises, by which large concrete and artificial blocks have hitherto been lifted and deposited, consist of a pair of round bars with a T end on each, and a ring at the top to receive the hook or shackle of the setting crane or traveler, suitable holes, with boxes and pieces of hard wood at the lower ends, being formed in the blocks for the reception of the bars. When a block has been lowered, say for subaqueous work, divers are required to turn these T bars around, and to draw them out of the holes preparatory to their being lifted up with the slack chain of the crane or traveler. For heavy blocks the weights of these bars must of necessity be great, and the process of turning and lifting them by divers consequently expensive. It is the object of the lewis which we herewith illustrate, and which has been invented by William Matthews, of England, to provide for disengaging from above water, so that, when no longer required, the lewises shall free themselves and be drawn out of the holes in the blocks by means of the setting machine, and lifted with the slack chain to the surface.

The holes, instead of being parallel as in the ordinary cases, are made dovetailed; they are formed in the blocks by means of core pieces. The apparatus consists of two lewises, each formed of two wrought iron square bars linked so as to open in a dovetail shape. At the top of one bar of each lewis there is a shackle which is passed over the hook of the beam, the other bar being attached to the underside of the beam by means of a short piece of chain and a spring hook. Fig. 1 shows the lewis in the act of lowering a block; when the block has been set and adjusted, the beam is lowered from three to six inches, and the bridle rope, A A, drawn up from the top upon which the shackles, B B, are thrown over so as to clear the ends of the beam; the apparatus is then lifted by means of the setting machine, and, as the chains, C C, are tightened, the lewises fold and come clear out of the holes in the block.



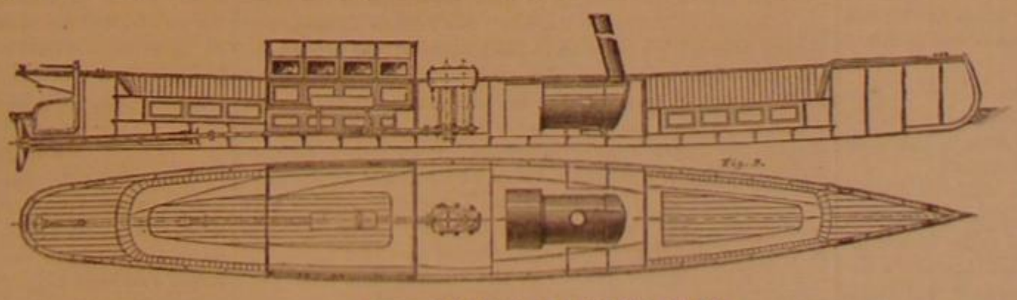
MATTHEWS' DISENGAGING LEWIS.

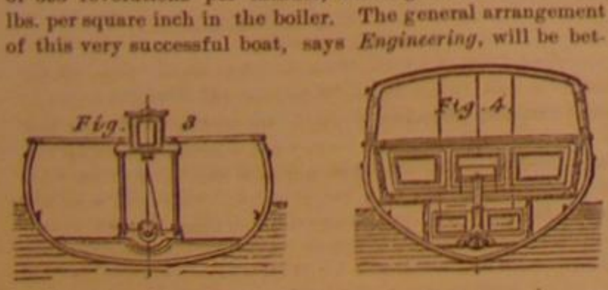
Fig. 2 shows the lewises when disengaged and in the act of being lifted. Fig. 3 shows the construction of the bars and links, from which it will be seen that the bars of the ends of the latter have a solid bearing against rounded recesses in the former, so as to avoid strain on the pins. If considered desirable, the disengaging levers might be omitted, in which case the shackles, B B, would be thrown back by the divers employed in setting the work, and the lewises would then disengage and free themselves as before. It will be seen from the illustration that provision has been made for dealing with blocks of different sizes.

The apparatus has been in successful operation for some months on the new harbor of St. Heliers, Jersey, and is about to be introduced on many other important works. It is claimed for the invention that it effects a saving of an expensive description of labor, namely, divers' work.

## A NEW STEAM LAUNCH.

Mr. George Baird, an engineer residing at St. Petersburgh, Russia, has recently constructed a high speed boat, which has proved a remarkable success. Her outer shell is entirely constructed of Muntz metal, an alloy of great durability, much used in Europe for sheathing wooden vessels and for axle bearings, etc. At a recent trial, against one of Messrs. Thornycroft's fast boats, the Mab was victorious, accomplishing 19 miles per hour. The Mab is 48 feet long at the load line, and has 6 feet 6 inches beam and 3 feet 6 inches depth of hold, while her mean draft is 1 foot 9 inches. She is fitted with a beautifully made pair of compound engines, driving a screw 2 feet 9 inches in diameter and 3 feet 4 inches in pitch. During the trials the engines made an average speed of 593 revolutions per minute, working with steam at 100 lbs. per square inch in the boiler. The general arrangement of this very successful boat, says *Engineering*, will be better explained by reference to our engravings than by any verbal description.


THE STEAM LAUNCH MAB.




## St. Gothard Tunnel Air Compressors.

In the case of the St. Gothard Tunnel, dry compressors are employed for furnishing the necessary supply of compressed air, these compressors being constructed on the system of M. Colladon, of Geneva. The sets of compressors employed at the two ends of the tunnel are alike in general construction, but differ somewhat in dimensions and in some points of detail, as well as in the arrangement of the driving machinery. The compressors at Airolo have been constructed in three groups, each consisting of three compressors.

The three compressors in each group have each a cylinder 18·11 inches in diameter and 17·72 inches stroke, and they are driven so as to have a mean piston speed of about 265 feet per minute. The pistons are coupled by connecting rods to a three-throw crankshaft, this shaft having its three cranks set at an angle of 120° with each other. The arrangement of bedplate, main bearings, crosshead guides, etc., is neat and substantial.

The leading feature in the Colladon system of air compressors consists in the arrangements made for the efficient cooling not only of the barrel of the cylinder, but also of the piston and piston rod. The cylinder is enveloped in a jacket through which water is made to circulate. The piston and piston rods are made hollow and water is caused to circulate through them.

In addition to the cooling action of the currents of water already mentioned, the air, during compression, is further cooled by the injection into the cylinder of a small quantity of "pulverized" water admitted through suitable injection nozzles in the cylinder covers. The compressors are driven by turbines.

## New Life-Preserving Dress.

For some time past Captain Boyton has used this dress with wonderful success at Atlantic City, N. J., where he held the post of Captain of the Camden and Atlantic Life Guards, a corps of gallant men whose business it is to save life at dangerous sea-bathing places.

It is simply a dress composed of the best india rubber, made in five distinct airtight compartments, namely, one for each leg, one at the back, another in front, and the fifth for the head. Each of these is inflated by means of a tube long enough to reach to the wearer's mouth when the dress is on. The dress is made in two pieces, the lower part being like a loose pair of trowsers ending in a pair of waterproof socks. At the waist is a broad steel hoop or band, which has a groove cut in it into which the other part of the dress exactly fits, rendering the whole suit perfectly watertight. Strong suspenders fixed to this hoop pass over the shoulders and retain the lower portion of the dress in its proper place.

The upper part of the dress is made similar to a jacket with a head piece attached. In order to allow of the face being uncovered and yet to be quite watertight, an elastic padding of india rubber fits round the face, which presses (closely enough to keep out the water, but not unpleasantly) round the face and head, when the chamber at the back is inflated. When this part of the dress is put on, it is fitted round the waist hoop, and, being strained tightly, the whole dress is quite impervious to water or even damp, not by any means the least important of its advantages, as many, perhaps more people are drowned owing to the benumbing effects of cold as from the actual incapacity of swimming. So simple is the adjustment that the entire dress can be put on and thoroughly inflated in a few minutes by any one who has had a little previous practice. Being made in so many different air chambers, there is no danger should one or more parts get injured, as the chamber at the back of the head alone is sufficient to float the heaviest man. The total weight of the dress is about 15 lbs.

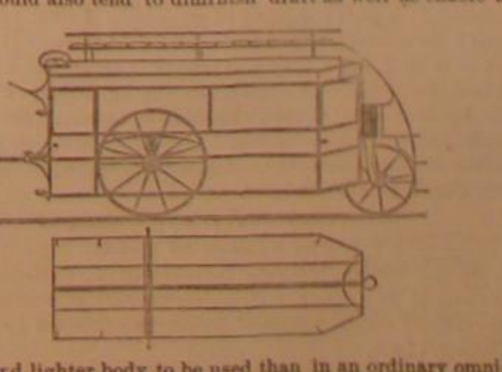
On the 10th of October, 1874, in accordance with his previous public announcements in our city papers, Captain Boyton left New York in the National steamship Queen, intending to go overboard when about 250 miles distant from America and return to the coast at the nearest point he could reach. However, when he came on deck in his curious dress and told Captain Bragg that he was going back to America, asking him at the same time to "slow" the ship so as to let him get into the ocean comfortably, he was very properly ordered to go below, and was told that if he would be put in irons. Greatly disappointed, he was compelled to remove his dress and remain on board content. But on the night of the 20th of October, at half past nine o'clock, when about two and a half miles distant from Cape Clear, the southern extremity of Ireland, he left the steamer, having obtained the reluctant consent of Captain Bragg. His departure is thus described in the London *Examiner* by a passenger: "A loud cheer greeted him as he plunged into the waves, which were then heavy, as the breeze at the time amounted to half a gale. 'All right, captain,' he shouted, 'go on!' as the ship left him behind. The captain gave orders to go ahead, full speed, and in a moment the daring adventurer was lost to sight."

He had taken with him, in his waterproof and airtight sack or traveling bag, food and water sufficient for three days, besides other articles, such as a compass, lantern, signal rockets, bowie knife, axe, American flag, and his indispensable paddle. His intention was to make for Baltimore, distant about seven miles, but owing to the roughness of the weather he was driven as far as Frefaska Bight, some miles east and south of Baltimore, after having been seven hours on the water and having traveled about thirty miles. His trials on that night—a night which will be long remembered on account of the numerous shipwrecks which took place during it, and the heavy gale blowing—must have been most severe, and no other form of life buoy could possibly have saved his life. So tremendous was the sea and violent the storm that, notwithstanding his confidence in his dress, Boyton's heart nearly failed him when the steamer disappeared from his sight and he was left a solitary waif on the ocean.

For hours through that wild dark night, so stormy that no mail steamers crossed the Irish Channel, Boyton lay on his back tossed about, unable to use his paddle, and quite at the mercy of the sea and wind, but, thanks to his dress, dry and warm. About one o'clock the wind changed, blowing on to the land, and about three he saw land "under his lee." With such a sea his danger was greater than before, and he narrowly escaped death. More by luck than anything else, however, he got ashore safely and made his way to the coast-guard station. Since then he has exhibited his apparatus in many places in England, proving how thoroughly adapted it is to its purpose.—*Hunt's Yachting Magazine.*

## A THREE-WHEELED OMNIBUS.

The upper figure in our illustration shows the elevation, and the lower figure the plan, of a three-wheeled omnibus which is claimed to secure economy in cost and draft, as well as comfort for riders, by reason of the four side entrances, and one step in from the road, and a staircase behind on to the roof seats. On some routes such vehicles might supplement the present rolling traffic of our public streets. Dispensing with an under carriage and one wheel must prove a material economy; the triadic bearing of the wheels on the ground would favor the draft. The bulk of the weight, being on the large wheels and partly suspended beneath the axle, would also tend to diminish draft as well as enable a



wider and lighter body to be used than in an ordinary omnibus, the total weight of which ranges from 20 to 24 cwt. for 26 passengers; for the same number of passengers, a three-wheeled omnibus might be made to weigh from 14 to 16 cwt.

The obvious simplicity of construction makes any technical detailed statement unnecessary, beyond saying that the hind wheel turns round freely in an upright axle box, fitted with a coil spring round the spindle.—*Carriage Builders' Gazette.*

### Useful Recipes for the Shop, the Household, and the Farm.

An old gun loaded with a heavy charge of powder and hung near the rafters, in a barn or in any dangerous locality about the house, makes an excellent fire alarm The explosion is caused by the heat.

The following alloy of copper will attach itself firmly to surfaces of metal, glass, or porcelain: 20 to 30 parts finely blended copper (made by reduction of oxide of copper with hydrogen or precipitation from solution of its sulphate with zinc) are made into a paste with oil of vitriol. To this add 70 parts mercury and triturate well; then wash out the acid with boiling water and allow the compound to cool. In ten or twelve hours, it becomes sufficiently hard to receive a brilliant polish and to scratch the surface of tin or gold. When heated it becomes plastic, but does not contract on cooling.

To preserve anatomical specimens, immerse in a saturated solution of 100 parts alum with 2 parts saltpeter. The article at first loses color, but regains it again in a few days, when it is removed from the liquid and kept in a saturated solution of alum and water only.

An excellent, well recommended pickle for curing hams, is made of 1½ lbs. of salt, ½ lb. of sugar, ½ oz. of saltpeter, and ½ oz of potash. Boil all together till the dirt from the sugar has risen to the top and is skimmed. Pour it over the meat and leave the latter in the solution for four or five weeks.

Save the soot that falls from the chimneys, when the latter are cleaned. Twelve quarts of soot to a hogshead of water makes a good liquid manure, to be applied to the roots of plants.

A folded newspaper placed over the chest inside the vest, on going out during the present raw spring weather, constitutes an excellent protector for the lungs.

There is no rule of health more important than "keep the feet dry and warm and the head cool."

Do not allow a grindstone to stand in water when not in use. Clean off all grease from tools before sharpening, as grease or oil destroys the grit. When you get a stone that suits your purpose, send a sample to the dealer to select by; a half ounce sample is enough, and can be sent by mail.

To clean a watch, even if it be of the lowest grade, the barrel or mainspring box should always be taken apart and cleaned, fresh oil being applied before the cover is replaced Naphtha is the best stuff to clean with.

The simplest, and perhaps best, paint to prevent buried wood from decaying is made of boiled linseed oil, into which charcoal is stirred until the whole is of proper consistence. Apply with an ordinary paint brush.

To silver the inside of hollow glass vessels, globes, convex mirrors, etc., the following amalgam, which becomes fluid at a low heat and adheres to glass, may be used: Lead and tin, of each 2 ozs.; bismuth 2 ozs.; mercury 4 ozs. Add the mercury to the rest in a melted state, and remove from the fire; mix with an iron rod.

The elevation of temperature produced by the friction of a journal is sometimes used as an experimental test of the quality of unguents. When the velocity of rubbing is about four or five feet per second, the elevation of temperature with good fatty and soapy unguents is 40° to 50° Fah., with good mineral unguents 30°.

A tablespoonful of niter (per gallon of milk) dissolved in as much water as it will take and put in the pail before milking will lessen the taste of turnips or other vegetables in the milk.

Carbolic acid, combined with glycerin or linseed oil in the proportion of 1 to 20, is a good application to wounds of horses.

The germination of seeds can be watched at every stage of its progress by laying the seeds between moist towels and placing the latter between plates. The towels can be lifted without damage to the tender sprouts.

To remove clinkers from stoves and ranges, mix a few oyster shells with the coal or put them upon the coals while the fire is burning freely. An occasional application of this kind will keep the grate free and the cook good-natured.

Two thicknesses of paper are better than a pair of blankets, and much lighter for those who dislike heavy bedclothes. A spread made of double layers of paper tacked together, between a covering of chintz or calico, is really a desirable household article. Soft paper is the best, but newspapers will answer.

Owing to irregularities of surface, it often happens that considerable difficulty is encountered in putting a good polish on articles of brass or copper. If, however, they be immersed in a bath composed of aquafortis 1 part, spirits of salt 6 parts, and water 2 parts, for a few minutes if small, or 20 or 30 if large, they will become covered with a kind of black mud, which, on removal by rinsing, displays a beautiful lustrous undersurface. Should the luster be deemed insufficient, the immersion may be repeated, care always being taken to rinse thoroughly. All articles cleaned in this manner should be dried in hot dry sawdust.

### The Transit of Venus.

At the Stevens Institute, Hoboken, N. J., Professor C. A. Young, of Dartmouth University, recently gave an interesting lecture on the transit of Venus, as witnessed by him at Peking, China.

"In obtaining photographs, instead of a telescope opening upon the sun, we had," said the lecturer, "the object glass of the telescope fixed with a focal distance of forty feet. By means of mechanism we were enabled to throw the sun's rays through the lens. The manipulation of the instrument was very simple; it only required that a person standing near the post of the instrument should throw the light up the post upon a screen, and, as the image was formed, by turning a spring to one side, he caused a slit to open, making an exposure of about one quarter of a second.

We obtained one hundred pictures, of which a dozen or fifteen are good for nothing, a few are tolerable, and the rest are very good, so that we are very well satisfied. *I imagine* that the results will not be worked up as fully as they ought to be until eight years from now, when the next transit of Venus takes place. That is a very important transit, as it is to be visible all along the Atlantic coast."

### High Speed Torpedo Launches.

A trial was lately made of a new steam launch, built by Messrs. Yarrow & Hedley, Isle of Dogs, Eng., for the Argentine Republic. The little vessel is 55 feet long, and 7 feet beam; the plating is throughout of Lowmoor iron, the frame being of steel. She is propelled by a beautifully finished pair of engines indicating 60 horse power, with which a very high rate of speed is obtained. The torpedo resembles in form an ordinary elongated projectile, and will hold about 100 lbs. of gun cotton, estimated to give an effect equal to three times that weight of gunpowder. It is carried at the end of a pole about 25 feet long, and the launch is provided with steel shields to protect the crew from rifle shot. The little craft is a most successful specimen of boat building.

The most remarkable feature is the system of igniting the torpedo, designed by Captain McEvoy, of Messrs. Vavasseur and Company, London Ordnance Works. Hitherto these torpedoes have usually been ignited by a concussion fuze on striking the ship's side. It is evident that, used in this way, the crew have little chance of escape, as the boat must be driven at speed against the ship, and her own momentum will carry her on, breaking the hole, and involving her in the results of the explosion; while if she does not go right, head on, the concussion fuse may not explode at all. Captain McEvoy gets over this objection by carrying three wires down the pole and into the torpedo, within which is placed a very simple detonating fuze. A brass cap is fitted to the torpedo, and a suitable battery is placed in the launch. A very slight blow will drive home the brass cap and "make contact," when the charge explodes. Besides this, the third wire is so arranged that contact can be made in the boat and the charge exploded at any time. Thus a launch might steal alongside a ship, and, by just touching her, explode the torpedo at the instant that her engines are turned full speed astern to back the launch off; and if she does not come square on and so make contact, the torpedo can be exploded by the auxiliary gear without trouble. We may add that Messrs. Yarrow and Hedley propose to build torpedo launches 100 feet long with a speed of twenty-five miles an hour. No ironclad afloat could run away from such craft, and two or three of them would constitute a most dangerous force.

### The Electric Telegraph.

Mr. Latimer Clark, in a recent address before the Society of Telegraph Engineers, states that, on the 1st of February, 1758, a Scotchman, Charles Marshall, of Paisley, published in the "Scots Magazine" a full and clear description of a practicable electric telegraph, and suggested the coating of his wires with an insulating material. Mr. Clark thinks that Marshall may therefore be considered, in a sense, the inventor of the telegraph.

"In 1816 our late lamented member Sir Francis Ronalds produced his electric telegraph, and at great expense and trouble erected a considerable length in his garden at Hammersmith. He employed frictional electricity and only one wire, and exhibited his signals by the divergence of pith balls, combined with rotating dials working synchronously, a system afterwards brought to great perfection in the printing telegraph of Professor Hughes. Sir Francis Ronalds will always take a high position in the history of the telegraph, not so much on account of the excellence or originality of his invention, as on account of the confidence and ardor with which he pursued his experiments and endeavored to bring them to the notice of his countrymen. With wonderful prevision he fully perceived its value and foretold its destiny. His "Description of an Electrical Telegraph," which was published in 1823, the first book ever published on the subject of electric telegraphy, might almost serve for a description of a telegraphic system at the present day. He proposed the establishment of telegraph offices throughout the kingdom, and pointed out the benefits which the government would derive from their existence. He described methods of insulating the wires, either on poles or underground, with all the details of tubes, joints, and testing boxes, testing stations, line men, and inspectors, as at the present day. But the most interesting and singular point, to my mind, is the clearness with which he foresaw and explained the phenomenon of retardation of the electric current by induction in underground wires, a phenomenon which has so greatly engaged the attention of electricians in the present day.

The influence of this is so great that on our Atlantic cables we do not transmit messages at a greater rate than fifteen or twenty words per minute, whereas, if the effects of induction could be removed, we might transmit three or four hundred words per minute.

There can be no doubt that if Ronalds had worked in the days of railways and joint stock enterprise, his energy and skill would have triumphed over every difficulty, and he would have stood forth as the practical introducer of the telegraph. But he was thirty years before his age, and the world was not ready for him.

Having completed his arrangements, he modestly invited Lord Melville on July 11, 1816, to witness his experiments, in order that he might demonstrate the nature and merits of his invention.

The reply he eventually received was eminently characteristic of the neglect and even contempt with which Science and scientific men were, and to some extent still are, regarded by statesmen.

'Mr. Barrow presents his compliments to Mr. Ronalds, and acquaints him, with reference to his note of the 3d instant, that telegraphs of any kind are now wholly unnecessary, and that no other than the one now in use will be adopted.—Colonial Office, August 5, 1816.'"

### Phosphor Bronze.

The latest and most succinct information on this new and valuable compound we find in a letter of Mr. Stanislas Delalot, chemist, of Sheffield, England, to the *Moniteur Industriel Belge*. M. Delalot embodies a great many useful facts in very terse phrases, which we translate literally.

True phosphor bronze is not an alloy. It is a combination, without intermediaries, of copper with phosphorus. It is simply a phosphide of copper in definite proportions. The metal unites with the metalloid by either a cold or hot process. For certain applications of phosphor bronze the cold suffices. M. Delalot prefers it to combinations produced by heat. Phosphor bronze by the hot process excludes all introduction of simple bodies other than the metal and the metalloid. Copper exempt from arsenic, antimony, iron of zinc, is required; it must be commercially pure. The manufacturer can take his choice from three kinds of phosohorus, ordinary, amorphous, and all the earthy bisulphates. Amorphous phosphorus is the most expensive, but the best. The secret of good phosphor bronze lies in the furnace and in practice. The following are the best combinations in definite proportions. The minimum and maximum percentages of phosphorus in phosphor bronze are 2 and 4. Between these there is an infinity of degrees. Five sorts of phosphor bronze, however, answer all requirements of industrial application:

0. Ordinary phosphor bronze. 2 per cent of phosphorus.
1. Good " " 2½ " "

These two numbers are superior to ordinary bronze and steel in all cases.

2. Superior phosphor bronze, 3 per cent of phosphorus.
3. Extra " " 3½ " "
4. Maximum " " 4 " "

These three, according to M. Delalot, are superior to any other metal or alloy. Above No. 4, phosphor bronze is useless; below 0, it is inferior to common bronze and steel. The price of phosphor bronze unworked, for all numbers, should not exceed that of copper plus ten per cent. Nos. 3 and 4 are to a certain degree unoxidizable.

### An Ingenious Device.

A capillary correspondence was recently attempted between a notorious Parisian thief in durance vile and his comrades outside. The prisoner was sent a letter from his *fiancée*, containing merely a lock of hair wrapped in the leaf of a book. The jailor did not consider the souvenir important enough to be delivered, but a few days came a similar enclosure, and yet another. This aroused suspicion, and the governor took the matter in hand. He examined the leaf of the book; it was that of a common novel, twenty-six lines on a page. Then he studied the hair, and noticed the small quantity of the gift. Counting the hairs he found them of unequal length, and twenty-six in number, the same as the lines of the page. Struck with the coincidence, he laid the hairs along the line of the page which they respectively reached, beginning at the top with the smallest hair. After some trouble he found that the end of each hair pointed to a different letter, and that these letters combined formed a slang sentence, which informed the prisoner that his friends were on the watch, and the next time he left the prison, to be examined, an attempt would be made to rescue him. The governor laid his plans accordingly; the attempt was made, but the rescuers fell into their own trap.

### Fumigating Greenhouses.

Some years ago, while in charge of the Botanical Gardens here, I experienced considerable difficulty with the oldfashioned iron pot in producing smoke of sufficient volume to destroy the common aphis or green fly. The houses being roomy and very high, the smoking of them was a slow and tedious process, and something more effectual was needed; so I ordered another pot to be made, similar to a cylinder stove, of sheet iron, about two and a half feet high and ten inches in diameter, with a small sliding door at the base for a draft. To use it, put a handful of shavings at the bottom, then fill it nearly full of tobacco (we use stems), rather loose at first, and set fire to the shavings through the door. Should the tobacco burn too rapidly, the door may be partially closed, and the tobacco pressed down with a stick of wood. A few minutes will suffice to fill up the largest greenhouse with a dense smoke, when the furnace may be taken out to smoke other houses if needed. That little apparatus is now generally used by gardeners around Boston; all agree in calling it superior to any other in use, being so very prompt, simple, and effectual.—*Denys Zirngiebel, Cambridge, Mass.*

### Food by Railway.

The degree to which large cities are dependent upon rail roads for the supply of food is exhibited by some startling statistics; and Mr. Smiles observes that London may be said to be fed by the railways from day to day, having never more than a few days' food in stock. He adds that in these days of strikes the stoppage of supplies is quite within the limits of possibility; and that, were it possible to land an enemy of overpowering force on the Essex coast, it would be sufficient for them to occupy or cut the railways leading from the north to starve London into submission in less than a fortnight

## SCIENTIFIC AND PRACTICAL INFORMATION.

### FACTS ABOUT FIRE ARMS.

An expert will load and fire a muzzle-loading arm once every six seconds, and a good breech-loader once every four seconds. Henry C. Bull, of New Orleans, who is one of the best marksmen in the world, has invented a new breech-loader, which is charged and fired with three motions, and which he claims can be discharged once every two seconds. During the late rebellion, a large proportion of the wounds, on both sides, were in the right arms of the combatants. This was due to the fact that, in the act of loading the gun, the right arm is lifted to work the ramrod. Those carrying breech-loaders were saved from such wounds, as the loading was done without lifting the right arm. In action, the value of a breech-loader or any kind of gun depends upon the rapidity with which the second shot can be fired after the first volley is delivered.

### ADULTERATED SILK.

Ladies who admire the rich, heavy, stiff black silks which are sold at some shops, at apparently low prices, may be interested to know that a large portion of this richness is composed of salts of iron and astringents, with salts of tin and cyanides. The silk is merely a thin skeleton which supports the adulteration until the goods are sold.

### FAILURE OF COPPER SULPHATE.

Railway sleepers injected with sulphate of copper will be preserved indefinitely, provided the copper remains in its original combination with the ligneous tissue. But M. Max Paulet shows that,on railways where carbonate of lime exists in the stone ballasting of the track or in the soil,the carbonate gradually penetrates the wood and substitutes the copper. Decay then follows, for carbonate of lime is not a septic agent.

### COTTON SAMPLING BY HAND.

During the late civil war, when the supply of American cotton was cut off, a great stimulus was given to the cultivation of the fiber in India, and the price of Indian cotton, although rated of poor quality, rose to a high figure. But as soon as the war terminated, the American staple at once assumed its wonted preference, and the Indian article shrank to zero. The British authorities have always desired to encourage the Indian product,and it has been claimed that, if proper gins could be produced, the staple might be cleaned and separated from the seeds without the injury heretofore experienced. Dr. Forbes Watson, of Manchester,has for some time past been engaged in this work, and a trial of a number of different gins upon various samples of Indian cotton has recently been made. The cleaned specimens were then sampled by the fingers of experienced brokers, with the queer result that different samplers placed different values upon similar specimens, while, in some cases, a broker in sampling different packages of the same cotton would assign different values to each package. So unreliable were the general results thus obtained that it became necessary to cause the various specimens, in lots of 20 lbs. each, to be made up into yarn. The yarn is to be subjected to definite trials of quality and strength. This will effectively settle the question of commercial value, which the brokers are unable to do.

### THE ECLIPSES OF 1875.

There are but two eclipses to appear during the present year, both of the sun. That of the 15th of April, however, will be quite remarkable,in point of length, as it is predicted that the duration of totality will be greater than during any of the succeeding eclipses due in 1878, 1886, 1892, 1893, etc. Mr. Hind, by new calculations, finds that on Bentinck Island the period of total obscurity will last over 257 seconds. The central line will pass to the north of Kaikal on Camorta Island, in the Nicobar Archipelago, at which point the duration of totality will be ten seconds longer.

The phenomenon will be visible at Bangkok, and hither the King of Siam has already invited observers. M. Janssen will, it is stated, proceed to that city, and the Royal Society has already organized an expedition, to be superintended by Mr. Lockyer.

### THE DEBTS OF THE WORLD.

The *Pall Mall Gazette* carefully summarizes the debts of the nations of the world, and calculates the aggregate sum to be $23,750,000,000. France owes the most, then Great Britain, and then the United States. Canada is the least in debt of any civilized country. Egypt pays the highest rate of interest, or ten per cent, and Holland the least, two and three quarters per cent. England can borrow at the least rate, three and one quarter per cent, and Mexico is charged the most, or eighteen per cent.

## Geographical Progress in 1874.

Chief Justice Daly, President of the American Geographical Society, recently delivered his annual address before that association, and in so doing gave a most interesting account of the world's progress in geographical knowledge during the year lately closed. He began by remarking upon the physical occurrences, in the shape of great rainfalls, floods, earthquakes, extreme cold, etc., all of which he stated were remarkable for their violence and destructive effect; and after a brief reference to the transit of Venus, and Howarth's theory that the earth is gradually shrinking at the equator, he reviewed the general theories of oceanic circulation. Dr. Carpenter still advocates the view that there is a constant flow of cold water from the polar regions to the equator, which,reducing the ocean level at the poles,causes an indraft of the warm surface water of the Atlantic to flow toward the poles from the equator, thus producing a horizontal circulation which completes itself,and accounts for the Gulf Stream and other phenomena connected with the currents and the course of the trade winds. Mr. Croll, on the other hand maintains that all the movements of the water of the ocean, the deep as well as the surface waters, are produced by the action of the winds upon the surface, in connection with the motion of the earth.

Commander G. E. Belknap, charged with ascertaining a practicable route for a telegraph cable between Japan and Puget Sound, carried on a series of deep sea soundings in that part of the Pacific Ocean, which are of the highest interest, as they confirm the great depth of the Pacific and the powerful action of submarine currents. The soundings of the Tuscarora have been continued by Commander Erben, to ascertain the suitability of the ocean bottom for a telegraph cable from San Francisco to Honolulu, in the Hawaiian Islands, and the result is that it is suitable over the whole distance, from its almost unvarying soft oozy bottom.

In Europe the governmental surveys heretofore commenced have been continued. That the remains of the ancient city unearthed by Dr. Schliemann are those of Troy is still contested. Those who dispute it, however, are scholars who have never examined the locality.

The recent excavations in Pompeii show that what has been revealed after the course of so many years is, after all, only a small part of the city, and every extension adds new objects, and some are of the deepest interest.

The excavations that are now going on in Rome are bringing to light numerous quantities of objects, especially on the Esquiline, relating to nearly everything connected with both the public and private life of the Romans.

An ancient Egyptian medical treatise has been discovered by Professor Ebers, of Leipsic, which was written 1,600 years before Christ. It is a handbook of Egyptian medical science at that time, and the description of the drugs mentioned in it shows that, at that period, Egypt had extensive commercial relations with Western Asia, and that there existed then an interchange of thought and knowledge.

Lieutenant Cameron has made a most important geographical discovery, which fixes the furthest source of the Nile within known limits, and which there is every reason to think will connect the network of lakes and rivers, of the water system that Livingstone was investigating, with the great rivers that flow to the western coast of Africa and probably with the Congo. Lieutenant Cameron surveyed Lake Tanganyika, and ascertained the elevation of the lake to be 2,710 feet.

The expedition of Rolfe for the exploration of the Lybian desert has returned. It was found to be the most sterile part of the Sahara. It is the dried-up basin of a shallow sea, below the level of the Mediterranean.

Colonel P. F. Warburton has made a remarkable journey across Australia, from Adelaide to the west coast,which was achieved under the most extraordinary difficulties. After the first 200 miles,the whole region traversed was a dreary and scarcely habitable waste, the country,with but few exceptional places, consisting of ridges of sand, with intervening flats which are without water and uninhabitable. The natives found are on the very lowest scale of humanity. They had no huts nor places of shelter, except the shady side of a bush.

## The English and American Transit Campaigns Compared.

"It seems to me," says Professor Richard A. Proctor, "that a useful lesson may be learned by comparing the methods in which the two great English-speaking nations dealt with the late transit of Venus. We English, unless stirred by emulation, are slow to move; and though we do things in a thorough way, we seldom select the most effective methods for achieving our ends. Our American cousin is less ponderous in his movements, and, though to the orthodox British mind his methods may sometimes seem "rough and ready," yet he generally manages to accomplish his object, which after all is the important point. Not unfrequently the ingenuity and fertility of resource of Americans enables them to go easily ahead of us--not indeed that Englishmen are wanting in these qualities, but that either we are slow to exercise them or else find their exercise not appreciated. I was repeatedly struck by this during my stay in America,not only or even chiefly in scientific matters, but in contrivances relating to the conveniences and luxuries of life. To take a few out of many examples: With an enormous country, relatively thinly peopled, their system of railway traveling is altogether superior to ours: railways on our system would not pay their expenses in America; and yet notwithstanding a far higher cost per mile, our railway traveling would be simply unendurable there. With winter weather so bitter, in the greater part of the States, that by comparison the cold we thought so much of last December seems trifling, they have warm rooms and warm houses at a tenth part of the expenditure of fuel by which we manage to roast half the body while the other is chilled by cold drafts. They have only recently (by comparison) established meteorological observatories, yet already they have morning and afternoon weather announcements, nine times out of ten correct,for the whole area of the States west of the Mississippi; while we are laboriously, and at great expense, publishing each day announcements of the weather of the day before, as if that could be of any real use. In scientific matters they have a quiet way of taking up and settling matters which we in Europe have most ingeniously and elaborately failed to solve. I incline to think that this circumstance appeals rather strongly to their sense of humor; for we publish our failures rather too ostentatiously. We got the start of them, indeed, in the matter of the solar prominences, though only by departing from old usage and giving our younger men a chance. But they showed us how to settle the question of the corona, which we had been pottering over ineffectually; and it must never be forgotten that our eclipse successes in 1870 and 1871 were due to their example. Professor Young in America has gone far ahead of us in the analysis of solar surroundings. Professor Langley's investigation of the details of the sun's surface is far better than any yet made by European astronomers. They first photographed the moon, though some of our writers conveniently forget the Drapers, as well as later successes of Rutherfurd. Every European attempt to measure the duration of the lightning flash, or of the electric spark,failed; but Professor Rood (of Columbia College, New York) has not only measured the duration of the electric spark, but has actually succeeded in determining the relative duration of different portions of the flash. And this is only one instance, out of several, in which Professor Rood has accomplished a feat of this sort—I mean the mastery of an experimental problem of exceeding delicacy. Professor Mayer (of the Stevens Institute, Hoboken) has successfully dealt with acoustical problems, which had been practically abandoned as too difficult by European experimenters. But these are only typical instances, selected almost at random. In passing from them let me remark that I am far from thinking that our American cousins really surpass us in scientific acumen or ingenuity, though I think they are much more fortunate in their methods and in their opportunities for exercising these qualities.

Their action in the matter of the recent transit affords an excellent illustration of their method of dealing with scientific subjects—a method characterized by the combination of scientific exactness with readiness of resource and practical common sense.

Having selected eight stations, three in the northern and five in the southern hemisphere, where the whole tran would be visible, the Americans started with a chance of success far greater than we possessed. For we had but one station in the northern hemisphere (in North India) where the whole transit could be observed.

In the more important question of the method for applying photography, the American and English astronomers took different courses. I set on one side,as peculiar to our plans the use of the Janssen turning arrangement for securing internal contacts, and speak only of the methods for photographing the progress of the transit. The English and European astronomers set themselves the task of securing neat and well defined sun pictures, trusting to these pictures to indicate the true position of Venus on the sun. The Americans (and the astronomers of Lord Lindsay's party, be it noticed) set themselves the task of securing pictures which would indicate the true distance between the centers of the sun and Venus,independently of any special exactness in the definition of the limbs of the two orbs. It seems to me,viewing the matter in its mathematical aspect, that the American astronomers prove to demonstration (using the estimates of photographic work given by De la Rue and other advocates of the European arrangement) that the result of the best possible photographic successes by the European method cannot give the parallax with even as small a probable error as that affecting the determinations already obtained.

Whether we consider their general plan, or their arrangements as to details, Americans showed themselves well advised and skillful. Instead of trusting (in the main) to a single method, they had at every one of their stations four methods available. Having ascertained the untrustworthy nature of contact observations, they took measures for determining the chord of transit by photography; and having decided on this course,they adopted a mode of photographing the sun which insured measurable pictures."—*English Mechanic.*

## The St. Gothard Tunnel.

The works of the St. Gothard Tunnel continued to progress satisfactorily during the past year. The length of this immense work will be 14,920 meters, or nearly nine and a-half miles. The altitude of the northern entrance at Goeschenen will be 3,608 feet above the level of the sea, and that of the southern entrance 3,756 feet. The highest point in the interior of the tunnel will be 3,780 feet above the sea level, and it will be reached from the Goeschenen end by a rising gradient of 7 per 1,000. From the summit there will be a falling gradient of 1 per 1,000 to Airolo. The rock to be traversed is for the most part mica gneiss and mica schist. The most recent reports received in England respecting the progress of this important undertaking state that at the date of the report—October 21,1874—the work done,and that remaining to be done, was as follows: Total length of tunnel, 48,651 feet; total length driven up to October 31, 8,661 feet; of tunnel remaining to be driven, 39,990 feet.

## Boracic Acid.

At a recent meeting of the Chemical Society, Mr. Howard said boracic acid destroyed vegetable growth—grass, for instance—with a vigor and permanence which, if it were a fertilizer,would render it invaluable.

Mr. A. Smee, Jr., had found that, if 1 part of a 10 per cent solution of boracic acid were added to 8 of milk,it would keep it sweet for a week.

Dr. J. Edmunds,in a complicated case of amputation of the thigh, had employed dressing of lint, steeped in a hot saturated solution of boracic acid, with most satisfactory results in preventing putrefactive discharge. The bandage could remain for tl ty-six or forty-eight hours without the slightest putrefactive odour.

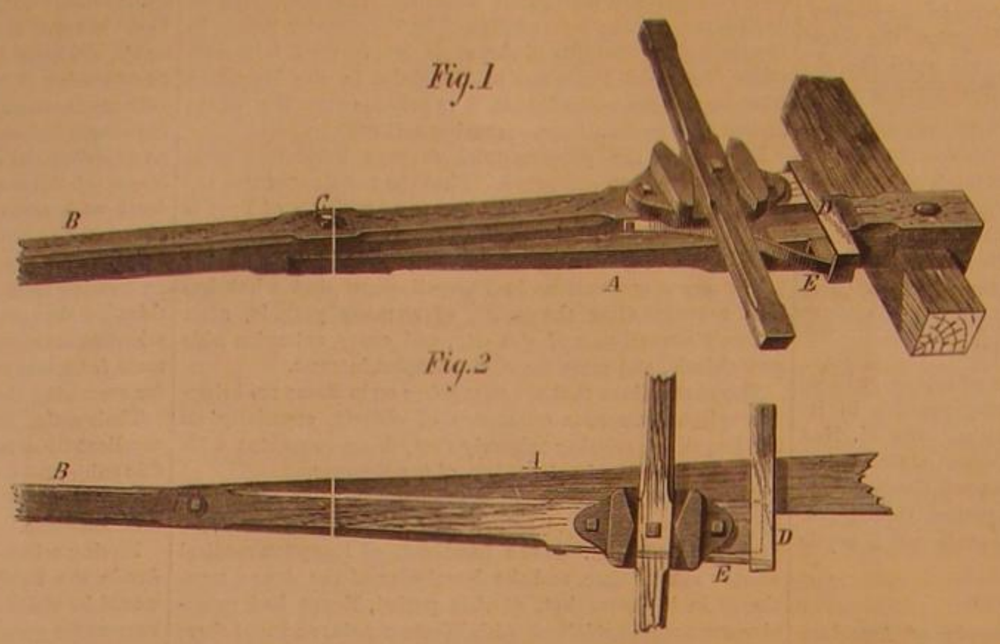
Pipe clay rubbed on the hands will remove the unpleasant odor of chloride of lime.

### IMPROVED CENTER DRAFT TONGUE FOR REAPERS AND MOWERS.

The invention represented in the annexed engraving is a device for equalizing the side draft of side-draft reaping or mowing machines. It consists in a tongue, constructed in sections and so arranged that the point of draft is transferred from the whiffletree to the pivot of the sections, enabling the horses to be kept clear of the standing grain, and, at the same time, preserving the proper position of the apparatus. The construction is also such as to allow of turning the machine with much greater facility.

Fig. 1 shows the tongue with its draft section in position, to equalize the draft. Fig. 2 shows the same in position for turning the machine. A is the fixed tongue, to prevent which from exercising a side draft on the carrying wheels, the section, B, is pivoted thereto at C. The inner end of the draft pole, B, is confined in an open cross strap, D, and the former carries the whiffletree, which has a swiveling movement thereon. A spring, E, is secured to the side of the draft pole, B, and extends into and bears against the guide strap, D, thus serving to hold the end of the draft pole outward, and out of line with the fixed tongue.

It will be seen that, as the horses pull in an oblique direction away from the standing grain, and by reason of the pivot heretofore described, the side draft is necessarily equalized because the direct draft is not at the whiffletree but at the pivot, C. This counteracts the side-dragging effect of the cutting apparatus, the off horse is relieved from the strain on his shoulder, and the machine moves forward in a straight line.




CENTER DRAFT TONGUE FOR REAPERS AND MOWERS.

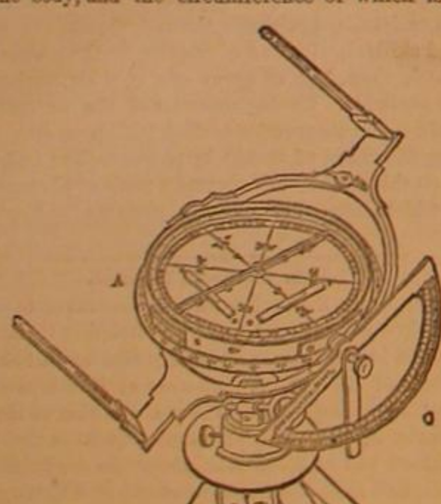
The action of the spring, E, is to keep the rear end of the pivoted pole about four or five inches out of a right line with the tongue and toward the machine. The strap, D, also acts as a purchase and lock to the inner end of the draft pole, in turning corners, thus avoiding the necessity of stopping the apparatus in so doing.

Patented October 15, 1872, and now owned by Mr. Jacob Kready, of New Pittsburgh, Wayne county, Ohio, who may be addressed for further particulars regarding sale of shop rights, etc.

### IMPROVED MINING DIAL.

We publish an illustration of an instrument which is claimed to possess many advantages over the ordinary dial. In this latter the vernier cannot be used in conjunction with the needle, without first clamping the body of the dial, which involves a loss of time, while the repeated operations of clamping and unclamping induce wear, and throw the instrument out of adjustment.

The improvement in this dial consists in the addition of a plate under the body of the instrument, which projects beyond the body, and the circumference of which is divided




into 360°. This plate is clamped to the ball and socket joint, and remains rigid. The swing sights move on axes fixed to the body, on the outside ring of which is attached a vernier, which reads upon the plate, A, to three minutes. By this arrangement, on taking a sight the angle can either be read from the vernier or the needle. The figuring of the needle ring is reversed, that is, the east and west points change places, so that the angles are read off correctly, and the figures on the vernier ring are so arranged that the reading of the needle and the vernier ring coincide. An effective mutual check is thus established, and any error arising from incorrect reading, or from any local attraction, is readily detected. Accurate surveying with this instrument can thus be relied upon, so far as the magnetic bearings are concerned.

The arc shown at C works as in the ordinary dial, being fixed at the side of the instrument, so that it can be easily read at any time, and is not in the way. One great advantage possessed by this arrangement is that, if the instrument be out of adjustment, the error is at once detected by comparing the needle and the vernier readings. Messrs. Davis & Son, of Derby, England, are the inventors of the improvement.

### Influence of Temperature on Magnetization.

M. Gaugain states that, in investigating the above subject, he first magnetized several small bars of steel varying from 0·12 to 0·24 inch in diameter by placing one of the extremities of each for a few moments in contact with one of the poles of a permanent magnet. He then noted their magnetic condition by determining some points of their curves of demagnetization.

Placing the bars a second time in contact with the magnet, he heated them with an alcohol lamp, and when they had cooled detached them, and once more determined their condition. In the second case the magnetization was found to be greatly the stronger, and in certain experiments the heat doubled the value of the currents of demagnetization.

This increase, however, it was found, was produced only when the bars were permitted to cool while attached to the permanent magnet. If separated before that time, instead of their magnetic properties being augmented, the same were decreased.

### REID'S AUTOMATIC HATCHWAY.

We illustrate herewith a new and simple arrangement for hatchways, which is so constructed that the ascending or descending carriage automatically opens the hatch covers and subsequently gently closes the same. The device is one which might be readily applied to any building, as it requires the addition of but a few inexpensive pieces and a slight alteration of the top of the ordinary carriage


The hatch covers are separated diagonally and are lifted as the car ascends by the curved upper portion, A, of the latter. As the car continues its upward course, the covers are kept raised by means of the bell crank levers, B, connected thereto by rods, C, which levers press against the sides of the car and ease the fall of the doors. In descending the bottom of the car strikes the ends of the levers, and thus, as indicated in the engraving, opens the hatch below.

Patented July 22, 1873. For further particulars address William Reid, 126 Eleventh street, Brooklyn, N. Y.

### New Process of Manufacture of Fatty Acids.

M. Bock has demonstrated that the greater part of the neutral fatty bodies are composed of small fat globules contained in albuminous envelopes of from 1 to 50 per cent of the weight of the bodies. The excesses of alkali, of pressure, or of heat necessary to decompose these bodies are in reality applied in order to destroy or eliminate the albuminous envelopes.

The coloring matter of the fatty bodies, or that which forms during their decomposition, is attributed to the envelopes, and for this reason M. Bock proposes to break or partially destroy the latter by the action of a small quantity of sulphuric acid at a determinate temperature and during a limited time. The fatty matter is then boiled with water, for several hours, in open vessels. The water charged with glycerin is then decanted, and the glycerin separated and pumped.

It remains then to remove the albuminous envelopes and the coloring matter, which is done by submitting the material in the vessels to the action of weak solutions of oxidizing agents. When the reaction has continued for a sufficient period, the substance is left quiet, and subsequently decanted, washed, and pressed.

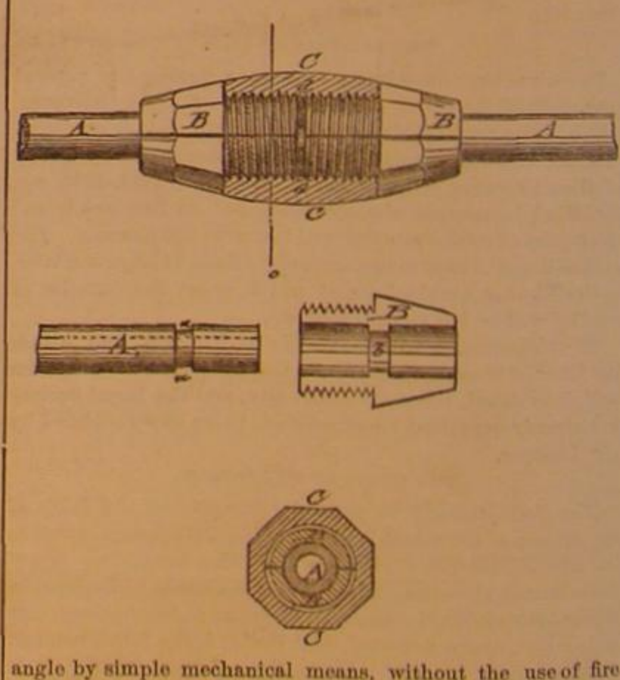
One of the advantages of this process, according to the inventor, is that all the operations are performed in open vessels, the contents of which are raised to ebullition by steam, not exceeding in pressure 37 lbs. per square inch.

### Models by Mail.

By provisions of the new postal law, now in vogue, models and merchandize of various descriptions, in packages not exceeding four pounds in weight, can be sent by mail at the rate of 8 cents per pound, or half a cent an ounce. This is a wonderful convenience for the public, especially for residents in distant places inaccessible by rail. But in sending models by mail, our correspondents should remember that the box or package must have openings in it, so that the contents may be observed by the postmaster; otherwise, or if the package is sealed, letter postage, or six cents an ounce, is chargeable on delivery. A little care will, therefore, save the sender considerable money.

### IMPROVED PIPE JOINT.

Mr. W. P. Valentine, of New York city, whose invention we herewith illustrate, informs us that, by the use of this device, water, steam, and other pipes may be joined at any




angle by simple mechanical means, without the use of fire and solder. He employs sockets made of two half shells, B, fitted by means of a projecting shoulder to the recessed ends of the adjoining pipes, A. The sockets are cut with an outer screw thread, and firmly connected, when placed on the pipes, by a sleeve, C, with right and left hand thread, which is arranged to be screwed over it without altering the position of the pipes. A leather or rubber washer, *d*, in the sleeve, C, secures the tightness of the communication.

Patented through the Scientific American Patent Agency, January 20, 1875. For further particulars address the inventor, at 4 Amity street, New York city.

### Comfortable Fishing.

A Western paper thus speaks of an improved method of fishing at the lakes in its district: It consists of a small house, built on runners like those of a sled, in which is placed a small stove, while in the floor a small aperture is left through which to drop the lines. Holes are cut in the ice, the houses are moved over them, and the fishermen sit by a warm stove while drawing in the fish.

### THE CRANE.

The crane, of which our engraving represents a fine sample, is a large wading bird of the order *grallatores*, and different genera of the species are found in Europe and America. The American crane (*grus Americanus*) furnishes a good typical example of the whole class. Its long bill is dusky, turning yellow towards its base; the top and sides of the head are of a brilliant red; the feet are black, and the plumage is white, except the primary and adjacent feathers, which are brownish black. The length of the full grown bird, from the bill to the tip of the tail, is often thirty-four inches, and to the end of the claws sixty-five inches; the wings extend to ninety-two inches. The young birds are of a bluish gray color, with the feathers tipped with yellowish brown.

Cranes are common in our Southern and Western States, from October till April, when they retire to the north. Their hearing and vision are very acute, hence they are difficult to approach. They roost either on the ground or on high trees. Their nests are usually built of coarse materials, and are placed in high grass; the eggs are two in number, and are hatched by the alternate attentions of both birds. They are easily tamed when captured, and may be kept on vegetable food.

THE AMERICAN CRANE.

### A New Enameling Process.

Mr. J. H. Robinson, of Liverpool, England, has recently invented a process which, he claims, is not only cheaper, but in which the resulting product is free from those specks of dirt which seem inseparable from the present methods of manufacture. The new process yields enamels of sufficient purity for dials and similar work, and is not so expensive as to virtually prohibit its use for ordinary purposes, such as name plates, notice boards, and wall advertisements. Thin sheet iron is first cut and stamped to the desired shape, the edges of the plate being turned up slightly in the usual way, so as to form a shallow tray, the edge serving to hold the enamel in position during the preliminary stages of the process. The plate is then to be made chemically clean by any of the ordinary processes of pickling and scouring. The ingredients of the enamel should be taken in the following proportions, but, in some cases or for certain purposes, they might be slightly varied: White lead 12 ozs., arsenic 2½ ozs., flint glass 8 ozs., saltpeter 3 ozs., borax 6¾ ozs., and ground flint 2 ozs. These are to be powdered and mixed thoroughly, placed in the crucible, and fused; but before they are cooled they must be plunged into cold water, which has the effect of rendering the mass very brittle. The cakes of fused enamel are then pounded to about the fineness of coarse sand, washed, and dried. The powder is then ready for use. The plates of sheet iron, having been well cleansed and thoroughly dried, are sprinkled over with sufficient enamel powder to make the coating of the desired thickness, and are then placed in a muffle, the turned-up edges retaining the swelling enamel in position. Lettering or designs can be produced on the surface by the ordinary means; but if it is desired to put them on when the enameled plate is cold, they are first received on paper, an impression being taken in soft black enamel from the engraved plate, and subsequently transferred, the article being again placed in the muffle to fuse the enamel of the design or letters. The inventor claims that the iron back is more durable than copper, and it certainly is cheaper. Variations in the color of the enamel can of course be obtained by the addition of various salts and earths, such as those of cobalt, peroxide of manganese, protoxide of iron, etc., and similar diversity of color can be introduced into the design or the letters.

### Cotton Gunpowder.

This explosive is of the gun cotton class, although it differs greatly from gun cotton proper, both in appearance and character, inasmuch as it is a fine powder of pale yellow color, and, it is stated, can be exploded with a cap direct after having been saturated with 20 per cent of water. This powder is now manufactured on a commercial scale at Oare, near Faversham, Eng., where a large number of military and naval officers, and scientific and mining gentlemen lately assembled to inspect the process of manufacture, and to witness some experiments to test its power and safety.

The initial process, as shown to the visitors, consisted in mixing together nitric and sulphuric acid, in which the cotton is steeped, 1 lb. at a time, after having been hand picked and further cleaned by being passed through a scutching machine, and afterwards washed and dried. After remaining in the acid for about four minutes, the cotton is withdrawn, and the surplus acid squeezed from it under hydraulic pressure. It is said to bring with it 20 lbs. of acid from the tank, 12 lbs. of which are pressed out, the remaining 8 lbs. being abstracted from it in a centrifugal machine, in which 6 lbs. form a charge. From the centrifugal machine the cotton is sent alternately to two steeping tanks and centrifugal machines, and after the second washing and drying it is passed through a pair of coarsely set rolls, and subsequently through a pair set more finely. The fibers have now become finely divided into particles of gun cotton, and in this condition are subjected to a lengthened washing in a tank of aerated water, the air being forced through the mass of liquid pulp by a fan blast. From the aerating washer the gun cotton—for such it now is—is run into settling tanks and afterwards partially dried, when it is taken to an incorporating mill, consisting of a pan and pair of edge runners, in which it is triturated in company with one or two other chemical substances, which complete the combination termed cotton gunpowder. It now only has to be dried, and this is effected in wire-gauze-bottomed trays placed over a channel through which a current of warm air is driven. From the drying house the powder is taken to the cartridge-filling sheds, and is made into cartridges, which are packed in cases and conveyed to the magazine. The magazine is situated some distance from the works, and is zinc-roofed and surrounded by a broad moat; zinc was preferred for the roof under the belief that, if an explosion were to occur, the zinc would volatilize instead of being blown about in fragments.

The first series of experiments were intended to illustrate the safety in transport and storage of the cotton gunpowder, and included the lighting of cartridges by ordinary means, when they simply burned quietly away, and the ignition of others by a capped fuse, when they exploded violently. In order to show that explosion would not follow upon conflagration, two barrels of the new powder were placed each in a roaring bonfire, and after a time the barrels were burned through and the contents blazed harmlessly away. An iron pile driver weighing half a tun was then allowed to fall 15 feet on to a box containing 10 lbs. of the powder, in order to illustrate immunity from danger in such cases as railway collisions, which, so far, it did, as the box was smashed and the powder scattered around.

The second series of experiments illustrated the strength of the powder, and consisted first in placing a charge of 2 ounces of the substance in a bore hole made in a block of Kentish rag stone measuring 5 feet by 3 feet by 18 inches, the explosion of the charge cracking the stone in all directions. Four steel ingots weighing 8 cwt. each were next laid in a pile, with 2 lbs. of the powder placed centrally between them. The explosion of the charge broke the ingots up and hurled the pieces to long distances. Other four ingots weighing 11 cwt. each were similarly treated with 2½ lbs. of the powder with similar results. A cylinder of cast iron, 2 feet in diameter and 18 inches deep, was charged in a central bore hole with 6 ounces of cotton gunpowder and fired, but the explosion only blew the hole through, driving a conical shaped piece out of the bottom. A 6 feet length of 70 lbs. steel rail was then laid on its side on bearings 4 feet 6 inches apart, and in its groove ½ lb. of the powder was placed and tamped with clay. The explosion broke the rail into four pieces, throwing the two ends far apart. In military work, the first illustration given was the cutting off a post of 12 inches by 12 inches timber—assumed to be a stockade post—with 12 lbs. of the powder placed against its side. The application of the compound to land mines was shown by placing two boxes each containing 30 lbs. of the powder in holes in the foreshore of the Swale—which flows by the company's works—covering them with 6 inches of soda, and exploding them. The result in each case was the formation of a crater 22 feet in diameter and 8 feet deep, besides the demolition of some of the factory windows, a result, we need hardly say, which was more unexpected than the other. To illustrate the statement that the powder could be exploded even when saturated with 20 per cent of moisture, a box of the powder stated to be so saturated was placed on the beach and successfully exploded. The concluding experiment was the explosion of 50 lbs. of cotton gunpowder suspended in the Swale in a case 10 feet below water level. The explosion threw up a fine column of water some 200 feet into the air, much to the satisfaction of the visitors, a satisfaction, however, not inferior to that afforded by the previous experiments, which demonstrated that a safe, handy and powerful explosive was ready to be placed on the market.—*Engineering.*

### The Momentum of Heat.

Heat is one of the modes of motion. The sun is its source. Vegetation springs up, matures, and decays as the continued round of change goes on. Old forms are buried beneath the new which rise upon their ruins. Thus have immense beds of fuel been hidden for centuries beneath the earth's surface. Born of motion from the sun acting upon matter, these deposits represent stored-up inertia, to be changed into momentum.

All matter is ponderable, or has weight, whether it be gaseous, or fluid, or solid, and of course possesses momentum when under motion.

In speaking of the motion of particles, their weights are to be considered: those which have the highest motion have the least weight.

The carbonaceous deposits, called coal, are simply combined elementary particles of different natures, and, when set free, give out their force to whatever they may come in contact with. Phosphorus and sulphur have their particles easily disturbed; for this reason they are put upon matches. The motion of the hand easily sets their momentum free; the wood of the match is next acted upon, then light kindling matter, then the coal. On and on this process goes, increasing in force as fresh fuel is added.

It is momentum from first to last, originally stored in the coal, and set free to be used for the benefit of man. To apply it in a manner that will utilize it best is his province. When water receives this transferred momentum, or heat force, among its own particles, it becomes steam. Steam is simply water in molecular motion. When the water has received its molecular motion, or when the steam is formed, by its momentum applied to the piston of the engine, the wheels are turned, the train is set in motion, and continues until the momentum is restrained by outside resistance or the supply of fuel is stopped. Thus did momentum begin and end its work, merely set free by human power, man acting only as the agent.—*J. M. Hicks.*

### Sound.

Professor Tyndall lectured recently on this subject at the Royal Institution. He began by saying that in the philosophy of Locke an idea was defined as a mental picture; and in all his (Professor Tyndall's) teaching of Science, he always attempted to give clear ideas—resting upon a physical basis—of the phenomena presented, avoiding all vagueness of phraseology, and in pursuance of this plan he would show a few experimental facts as a basis from which to start. He then took a large glass vessel filled with perfectly invisible carbonic acid gas, and held it between the electric lamp and the brilliantly illuminated screen, so that the large shadow of the glass vessel was seen upon the screen. Upon tilting the vessel the heavy carbonic acid gas began to pour out of it; and as it refracted light more than air, it became visible upon the screen as a falling stream full of waves. His assistant next began to blow through some invisible vapor of sulphuric ether placed between the screen and the lamp; and as the invisible mixed breath and vapor issued from the tube, the stream was rendered visible by its unequal refraction of the rays of light. The same effect was produced by means of the hot gases from a burning candle placed between the electric lamp and the screen. These acts, he said, would serve to give a physical basis for their ideas, by showing that, in a perfectly transparent atmosphere, there might be invisible layers, having an influence of their own.

If a wave of sound entered an invisible cloud of carbonic acid gas then the velocity of the wave would be reduced from 1,120 feet to 900 feet per second; but on leaving the gas and re-entering the common air, it would move with its original speed. At every change of velocity a certain portion of the sound would be sent back as an echo; thus on first reaching a layer of carbonic acid, a part of the sound would be reflected, and, after passing through the layer and reaching the other side, a further portion would be sent back as another echo; if there were many alternate layers of air and carbonic acid gas, this action might take place so often as to quench an entire wave of sound and to dissipate it in echoes. Professor Tyndall here called attention to a small square wooden tube, into the air of which, he said, he could introduce at will seven vertical sheets of carbonic gas through pipes. One of the sensitive flames, which contracted at a shrill sound, was placed at one end of the tube, and a whistle continuously blown by a bellows was placed at the other. When the tube contained air only, the sound passed freely and contracted the flame; when he let seven sheets of carbonic acid gas enter the tube, they broke up the sound into echoes so that its action upon the flame was cut off, being intercepted by layers of invisible gas. He then showed that heated air would have the same effect, by doing away with the carbonic acid, and placing four gas flames below the tube, so as to heat it in four places, and produce four layers of heated air inside. Layers of unequally heated air prevented the sound from passing through the tube, and broke it up into echoes. The lecturer here remarked: "How could it be proved these layers produced echoes?" If they did so, of course he ought to be able to prove it experimentally, so some time since he asked his assistant to solve the problem practically, and Mr. Cotterill had done so. His plan was to take a large hot flame from a batswing burner, which had the power of reflecting sound, for the hotter the flame the greater was the reflection; and he placed this flame in a position to throw back the sound, which it actually did, as proved by the contraction of the sensitive flame.

Strange to say, the flame could reflect sound much better than calico, muslin, and other woven fabrics. Professor Tyndall here borrowed a little boy's handkerchief, and showed that it would not cut off the sound even when folded four times; neither would green baize, nor felt ¼ inch thick—so thick that it would entirely cut off the light of the noonday sun. Two hundred layers of muslin in a square pad had but a feeble power in cutting off sound. The lecturer remarked that this was because the air was continuous inside the fabrics. On wetting the handkerchief with water so as to prevent continuity of the air, a single layer of the wet handkerchief cut off the sound. He remarked that, after seeing these facts, the listeners would be quite prepared to understand that a heavy snow storm would have little power in intercepting sound, whereas loud noises might be quickly quenched on a clear day, supposing the air to be heated unequally in different places.

Professor Tyndall narrated how in one of his laboratory experiments he had placed fifteen layers of calico, each an inch or two behind the other and in front of one of his sensitive flames. He discovered that the sound from the whistle would pass through the whole of the fifteen layers, and that each layer would reflect a portion of it so as to act upon the sensitive flame; thus in passing and returning through the fifteen layers, the sound passed through thirty layers in all.

Professor Tyndall here took a large glass cabinet, about the size of a watchman's box, and he caused the sound from the whistle to enter it on one side, and to depress the sensitive flames when it escaped on the other. In the lower part of the cabinet inside he lit two large gas flames, and the hot air from these, rising in the cabinet, intercepted the sound, so that the flame ceased to be shortened. He thus proved that invisible columns of heated air would cut off sound. He then put out the burners and lit a piece of phosphorus placed in a saucer at the bottom of the cabinet; the latter of course was soon filled with a thick smoke of phosphoric acid—so thick was it, that it cut off from view a lighted candle which was placed at the back of the cabinet; yet this cloud, which was so powerful in cutting off the rays of light, did not interrupt the waves of sound at all. Having thus proved that invisible warm air may act as an acoustic cloud, he said that, when such clouds are close to the source of sound, the echoes are immediate, and mix with the original sound; but if the acoustic clouds are further off, then there are prolonged echoes. Further, the length of an echo is a measure almost of the depth of the acoustic cloud whence it comes. In the experiments at the South Foreland, he discovered that, when a sound penetrated to a great distance, then the echoes were longest.

At the close of his lecture he argued that the phenomenon which Arago could not explain was due to warm air from the chimneys of Paris, forming acoustic clouds which surrounded the station at Villejuif, while the other station at Monthlery was free from this heterogeneous atmosphere.

### The Micro-Lantern.

Discarding the usual microscopic low powers, we have now adopted, with increased advantages, an objective constructed on the same principle as the well known portrait combination, very short in focus, and with a large aperture in comparison with its focal power. The tube in which the lenses are mounted is very short, so as to permit of the passage of a ray at a great degree of obliquity to the axis. This enables the objective power to cover a large field, or, speaking inversely, to project an image of large dimensions compared with its focal power. But no one who has bestowed attention upon the transmission of large oblique pencils will fail to see that, if the object to be enlarged were mounted upon a flat glass, the astigmation would be so great that, while there would be plenty of light, there would be no marginal definition worthy of the term in the enlarged image. This is quite true; hence we will afford some explanation of the manner by which we so managed that, whereas by one of the usual microscopic objectives only one extended wing of a grasshopper was shown on the screen, we showed not only the one wing, but also the body and the second wing, and not only the whole of one insect or fly, but the whole of three of them which were mounted on one slide, and this with such good marginal definition as to permit the spectators to advance to the screen and examine the details through hand magnifying glasses.

There is sold, in the watch glass makers' shops in Clerkenwell, a foreign made watch glass of a peculiar kind, and known in the trade as "concave crystal." The price we paid was at the rate of five shillings a dozen, or more than six times that at which ordinary lunette glasses can be obtained when purchased in quantities. They are stout and strong, the edges finely polished, and they are curved, spherically, to a very slight degree. The diameter of those we obtained were an inch and a half, and, instead of mounting the objects which were intended to be subsequently magnified between two circular but flat glasses as usual, we mounted them between two of these "concave crystals." Here was the whole secret. The two glasses must be placed "spoon fashion," and the object, being between them, is bent in a gentle curve. With objects mounted in this way, and employing an objective of the kind we have just described—what is known by photographers as a "locket portrait combination" will answer well if of short focus—the lime light need no longer be regarded as an indispensable requisite in the showing of microscopic objects; for with a good lamp, burning paraffin oil, a disk of six feet may very easily be obtained.

Hitherto we have spoken of natural objects. But in practice we have also used this arrangement in connection with photography, both in obtaining pictures, with large aperture, which should be microscopically sharp all over the area of delineation, and, conversely, of producing enlargements from pictures thus obtained. As respects the exposure required to produce an absolutely sharp picture, it is, compared with that which is necessary on a flat plate, less than half, because in the latter case a stop must be used to secure intense definition at the margin; hence if proper mechanical contrivances be adopted for effecting a rapid exposure, there will be no difficulty in taking a fully exposed negative of any scene in which instantaneity is a pre-requisite, the picture afterwards bearing a great degree of enlargement. After several trials we can assert with confidence that the manipulation of a circular and slightly concave surface is quite as easy as that of a flat glass.—*British Journal of Photography.*

## THE VOLUME AND WEIGHT OF DISTILLED WATER AT DIFFERENT TEMPERATURES.

BY RICHARD H. BUEL.

In general, water expands when heated, and contracts on being cooled—with the exception that the greatest contraction occurs when the water has a temperature of about 39° Fah., so that expansion takes place whether the temperature is decreased or raised above this point. The precise temperature at which water attains its maximum density has not been accurately determined. The differences between the results obtained by independent investigations are, however, very slight, and the point of maximum density is commonly taken at 39·2° Fah., or 4° on the centigrade scale. At this temperature, the weight of a cubic foot of distilled water, as determined by the best authorities, is 62·425 lbs.; the weight of a United States gallon is 8·379927 lbs., of an imperial gallon, 10·05312 lbs., and of a cubic inch, 252·8787 grains. In French measures, it is usually assumed that a cubic decimeter of distilled water weighs 1 kilogramme. This is not strictly accurate, owing to a slight error, in regard to the weight of water of maximum density, which was made at the time of fixing the measure; and the absolute standard is the liter, which is a volume of a kilogramme of pure water at the temperature of maximum density. In practice, however, the volume of a liter is commonly assumed to be one cubic decimeter, and the error arising from this assumption is unimportant, being less than 0·00002 of a kilogramme. The expansion of water by heat is not regular for equal increments of temperature, but the law of the expansion has been determined by numerous experimenters, the most prominent of whom are Kopp, Matthiessen, Sorby, and Rosetti. The formulas constructed from their experiments are given below, being taken from Watt's "Dictionary of Chemistry."

Let V = ratio of a given volume of distilled water, at the temperature, T, on Fahrenheit's scale, to the volume of an equal weight, at the temperature of maximum density.

W = weight of a cubic foot of distilled water, in pounds, at any temperature, Fahrenheit.

For temperatures from 32° to 70° Fah.: $V = 1{\cdot}00012 - 0{\cdot}000033914 \times (T-32) + 0{\cdot}000023822 \times (T-32)^2 - 0{\cdot}000000006403\,(T-32)^3$.

For temperatures above 70° Fah.: $V = 0{\cdot}99781 + 0{\cdot}00006117 \times (T-32) + 0{\cdot}000001059 \times (T-32)^2$.

$$W = \frac{62{\cdot}425}{V}$$

The table given below has been computed by the aid of these formulas. The experiments on the expansion of water have not been carried beyond a temperature of 412° Fah., so that the results given in the table for higher temperatures have not been verified. It is not probable, however, that they are greatly in error. The highest temperature in the table corresponds to a pressure of saturated steam of more than 1,000 lbs. per square inch. The successive increments of 10° Fah. give such slight changes in the successive differences in relative weights and volumes as to render interpolations by proportion sufficiently accurate for most purposes. The weights given in the tables are for pure water, so that, when water contains foreign matter, it will be necessary to multiply the tabular weight by the specific gravity of the water. For ordinary rain, spring, or river water, the correction is generally so slight that it may be neglected. Below are given the specific gravities of waters from different localities, the most of which have been taken from Professor Chandler's lecture on "Water," published in the thirty-first annual report of the American Institute:

| | |
|---|---|
| Atlantic Ocean | 1·0275 |
| Dead Sea | 1·17205 |
| Great Salt Lake | 1·17 |
| Mississippi River | 1·00068 |
| Croton (New York Water Supply) | 1·00008 |
| Ridgewood (Brooklyn Water Supply) | 1·000067 |
| Cochituate (Boston Water Supply) | 1·000053 |
| Schuylkill (Philadelphia Water Supply) | 1·00006 |
| Delaware River | 1·000059 |
| Lake Erie | 1·000107 |
| Lake Michigan | 1·000113 |
| Genesee River | 1·000226 |
| Passaic River | 1·000127 |
| Thames, at London | 1·000279 |
| Seine, above Paris | 1·000151 |

It will be seen from these figures that, for most cases, it will be sufficiently accurate to use the weights given in the table. If the weight of a gallon of water at any temperature is desired, it may be obtained by dividing the weight of a gallon of water at the temperature of maximum density, previously given, by the relative volume at the required temperature. It may also be obtained by multiplying the weight of a cubic foot of water, at the given temperature, by 0·13368 to find the weight of a United States gallon, and by 0·160372 to find the weight of an imperial gallon. When water contains foreign matter in solution, its rate of expansion by heat is not exactly the same as in the case of distilled water. There has not been a sufficiency of experiments, however, to determine the law of the variation, and no great error will arise from the assumption that the expansion is in accordance with the formulas given above.

With these explanations, the use of the following table will be rendered plain to the reader

VOLUME AND WEIGHT OF DISTILLED WATER AT DIFFERENT TEMPERATURES ON THE FAHRENHEIT SCALE.

| Temperature, Fahrenheit. | Ratio of volume to volume of equal weight at the temperature of maximum density. | Difference. | Weight of a cubic foot in pounds. | Difference. |
|---|---|---|---|---|
| 32° | 1·000129 | | 62·417 | |
| 39·2° | 1·000000 | ·000129 | 62·425 | ·008 |
| 40° | 1·000004 | ·000004 | 62·423 | ·002 |
| 50° | 1·000253 | ·000249 | 62·409 | ·014 |
| 60° | 1·000929 | ·000676 | 62·367 | ·042 |
| 70° | 1·001981 | ·001052 | 62·302 | ·065 |
| 80° | 1·00332 | ·001339 | 62·218 | ·084 |
| 90° | 1·00492 | ·00160 | 62·119 | ·099 |
| 100° | 1·00686 | ·00194 | 62·000 | ·119 |
| 110° | 1·00902 | ·00216 | 61·867 | ·133 |
| 120° | 1·01143 | ·00241 | 61·720 | ·147 |
| 130° | 1·01411 | ·00268 | 61·556 | ·164 |
| 140° | 1·01690 | ·00279 | 61·388 | .168 |
| 150° | 1·01995 | ·00305 | 61·204 | ·184 |
| 160° | 1·02324 | ·00329 | 61·007 | ·197 |
| 170° | 1·02671 | ·00347 | 60·801 | ·206 |
| 180° | 1·03033 | ·00362 | 60·587 | ·214 |
| 190° | 1·03411 | ·00378 | 60·366 | ·221 |
| 200° | 1·03807 | ·00396 | 60·136 | ·230 |
| 210° | 1·04226 | ·00419 | 59·894 | ·242 |
| 212° | 1·04312 | ·00086 | 59·707 | ·187 |
| 220° | 1·04668 | ·00356 | 59·641 | ·066 |
| 230° | 1·05142 | ·00474 | 59·372 | ·269 |
| 240° | 1·05633 | ·00491 | 59·096 | ·276 |
| 250° | 1·06144 | ·00511 | 58·812 | ·284 |
| 260° | 1·06679 | ·00535 | 58·517 | ·295 |
| 270° | 1·07233 | ·00554 | 58·214 | ·303 |
| 280° | 1·07809 | ·00576 | 57·903 | ·311 |
| 290° | 1·08405 | ·00596 | 57·585 | ·318 |
| 300° | 1·09023 | ·00618 | 57·259 | ·326 |
| 310° | 1·09661 | ·00638 | 56·925 | ·334 |
| 320° | 1·10323 | ·00662 | 56·584 | ·341 |
| 330° | 1·11005 | ·00682 | 56·236 | ·348 |
| 340° | 1·11706 | ·00701 | 55·883 | ·353 |
| 350° | 1·12431 | ·00725 | 55·523 | ·360 |
| 360° | 1·13175 | ·00744 | 55·158 | ·365 |
| 370° | 1·13942 | ·00767 | 54·787 | ·371 |
| 380° | 1·14729 | ·00787 | 54·411 | ·376 |
| 390° | 1·15538 | ·00809 | 54·030 | ·381 |
| 400° | 1·16366 | ·00828 | 53·645 | ·385 |
| 410° | 1·17218 | ·00852 | 53·255 | ·390 |
| 420° | 1·18090 | ·00872 | 52·862 | ·393 |
| 430° | 1·18982 | ·00892 | 52·466 | ·396 |
| 440° | 1·19898 | ·00916 | 52·065 | ·401 |
| 450° | 1·20833 | ·00935 | 51·662 | ·403 |
| 460° | 1·21790 | ·00957 | 51·256 | ·406 |
| 470° | 1·22767 | ·00977 | 50·848 | ·408 |
| 480° | 1·23766 | ·00999 | 50·438 | ·410 |
| 490° | 1·24785 | ·01019 | 50·026 | ·412 |
| 500° | 1·25828 | ·01043 | 49·611 | ·415 |
| 510° | 1·26892 | ·01064 | 49·195 | ·416 |
| 520° | 1·27975 | ·01083 | 48·778 | ·417 |
| 530° | 1·29080 | ·01105 | 48·360 | ·418 |
| 540° | 1·30204 | ·01124 | 47·941 | ·419 |
| 550° | 1·31354 | ·01150 | 47·521 | ·420 |

### Preparation of Wool before Carding.

Messrs. Whittaker and Ashworth state that this operation effects an economy in oil in the usual process of oiling the wool. The first treatment is in an alkaline bath. The wool is then worked for one or two minutes in an acid bath, at a temperature of about 99° Fah. This bath is composed of 200 gallons water and 3 pounds of commercial sulphuric acid; it serves for the treatment of about 200 pounds of wool. The wool is now carefully washed and dried. Thus prepared, the amount of oil requisite for the oiling process is reduced 50 per cent. The above is the subject of an English patent.

## DECISIONS OF THE COURTS.

### United States Circuit Court.--District of Massachusetts.

UNION PAPER COLLAR COMPANY *vs.* EMERSON LELAND.—PATENT EMBOSSED COLLARS.

[*In equity.—Before* CLIFFORD *and* LOWELL, *Judges.—October*, 1874.]

LOWELL, *J.*:

This suit is brought to restrain the infringement of the second reissue of W. E. Lockwood's patent of 1859, the reissue being granted in 1873.

The specification declares the invention to consist of a collar or cuff having a paper surface imitative of the textile surface of a collar or cuff of textile fabric; that in carrying out his invention Lockwood uses a fabric composed of paper and muslin, or equivalent fabric, having a smooth, white, polished, or enameled paper surface to represent that of starched linen. It then describes one mode of making the imitation of a linen or muslin surface, by dies, but does not claim nor limit the invention to any particular appliances or machinery for embossing the fabric. The claim is for a collar having a paper surface imitative of the textile face and fiber of a dressed linen collar, as set forth. *

The case turns on the question of novelty. * There is the English patent of De La Rue, taken out in 1834, for embossing paper in parallel lines; and one granted to John Evans, in 1854, for ornamenting paper with an imitation of the patterns of textile fabrics. * Samples are produced from papers actually made before 1859, which are of this character. *

Collars and similar articles made of paper were patented to Walter Hunt in 1854 as a new manufacture; and Lockwood was the owner of this patent when he made the improvement now in controversy.

In this state of the art, collars and cuffs made of paper being known, and paper embossed in various modes, some of which were imitations of the surface of textile fabrics, being known, we are of opinion that there was in 1859 no patentable novelty in the application of paper embossed in imitation of linen to the making of collars and cuffs.

The evidence in the record goes even beyond what we have already mentioned, and renders it probable that paper embossed in imitation of a linen surface was used for collars and cuffs long before the date of the alleged invention, and that such articles were offered for sale in New York and known to several persons. It is true that they were not found to be acceptable to the trade, and they had very probably been forgotten; but they were imitations of linen, and the reasons which operated to prevent their general use were of a commercial and economical character.

Bill dismissed with costs.

[*W. G. Russell*, for complainant.
*A. J. Robinson*, for defendant.]

### United States Circuit Court---District of Connecticut.

SAMUEL G. MONCE AND ROLLIN J. IVES *vs.* BENJAMIN F. ADAMS.—PATENT GLASS CUTTER.

[*In equity.—Before* SHIPMAN, *Judge.—April*, 1874.]

The invention covered by letters patent to Samuel G. Monce, June 8, 1869, for an "improved tool for cutting glass," consists, so far as the revolving steel cutter is concerned, in the fact that the sides, which are parallel at the axis, are beveled toward each other, at the perimeter, at an angle of about forty-five degrees to the axis, thus meeting about midway and forming a cutting edge, which is approximately a right angle.

Such an instrument embodies the conditions that give efficiency to the glazier's diamond, viz.: the cutting edge is *curvilinear;* it is formed by two surfaces meeting at *right angles;* these surfaces are *equally inclined* to the axis of the cutter; and when the cutter is properly mounted in its frame, the inclination of the cut will naturally be at *right angles to the surface of the glass.*

It is a fact worthy of mention that this small and inexpensive tool has proved to be of great utility and has achieved success, having confessedly superseded all other inventions as a substitute for the glazier's diamond.

Monce's invention is not anticipated by revolving cutters designed and used for other purposes (as for dressing the surface of grindstones, the cutting of gas pipes, or the cutting of paper or of pasteboard, or of leather), in which the distinctive feature of the invention—the double bevel forming the right-angled edge—is present, if at all, by accident, and which, although capable in exceptional cases of being used to cut glass, will not practically perform the office of a successful glass cutter for glaziers' purposes.

The cutter of the patent, which makes a cut at right angles to the surface of the glass, is not anticipated by the Pike cutter, which bears upon the glass in a slanting direction.

The patentee having disclaimed a revolving cutter, his claim to "The cutter A, constructed substantially as shown and described, and for the purposes set forth," is a claim to the particular form, shape, and angles of the cutter, which adapted it to the purposes of a glass cutter, and is as exact and accurate as the nature of the subject will permit.

The patent is not void for ambiguity, because the specification merely says that the cutter is to be "hardened," without specifying what degree of hardness is to be given to it.

[*Charles E. Mitchell*, for complainants.
*W. Edgar Simonds*, for defendant.]

## Recent American and Foreign Patents.

### Improved Corn Planter.

Jens Elverud, Red Wing, Minn.—By suitable construction, as each hole of a wheel comes beneath a hole in the reservoir and receives the seed, a corresponding arm comes above said hole and serves as a cut-off to prevent any more seed passing out than the amount contained in said hole. The wheels are revolved by tubes, which strike the ground and serve as fulcrum points around which the wheels move, the axle moving up and down in loops. The sleeve of each tube is pushed up to discharge the seed into the soil as the weight of the wheels and axle are thrown upon said tube.

### Improved Invalid Bedstead.

Oscar G. Cosby and George W. McGovern, Richmond, Va.—The object is to enhance the ease and quiet of the patient when changing his position. The device consists in the combination of an endless cord, with mechanism for raising the hinged head section, consisting of a lever bracket, a slide, and a band and pulley, for the purpose of giving a positive and easy downward adjustment of the head section.

### Improved Double Reversible Hinge.

Edward Halsey, San Jose, Cal.—The invention is an improvement in the class of reversible hinges which are formed of two plates, one having eyes or sockets, and the other pintles, on each side, and the eyes being slotted to receive the pintles, so that the door may swing in either direction without becoming detached. The improvement relates to a construction and arrangement whereby the hinge is strengthened and its operation made as nearly noiseless as practicable.

### Improved Tank for Preserving.

John Peter Schmitz, San Francisco, Cal.—This invention relates to certain improvements in preserving apparatus, and it consists in an airtight tank in which the substance to be treated is placed, the said tank having a fire protector and a burner inside, which latter connects through a flexible tube with a lamp upon the outside. The flame of the lamp abstracts oxygen from the air in the tank, and substitutes therefor the preservative products of combustion, the flexible tube being tied, severed, and its tied end enclosed by a screw cap when the process of preserving is complete, and the tank and its contents are to be stored away.

### Improved Stair Builder's Rule.

John J. Robinson, Orange C. H., Va.—The object of this invention is to provide an improved rule for stair-building, and it consists in a square rule, inside of which is contained a graduated extensible portion, and at the opposite end an adjustable prick, the said rule being provided with two spirit levels, one for plumbing and the other for ordinary leveling purposes. The inventor claims to be enabled, by means of this improved rule, to rapidly construct and fit the balusters to the hand rails, uniformly and in proper position.

### Improved Sewing Machine.

Daniel Williamson, Sunbury, Pa.—This invention consists of an arrangement of cams on the driving shaft and a spring for working an upper feed; also a cam on the shaft and a spring for working the presser, whereby the same shaft shall operate the needle bar, presser bar, and feed bar.

### Improved Gymnastic Apparatus.

Horace S. Carley, New York city.—This consists of a grooved wheel with a handle pivoted to each side, mounted on a rope stretched horizontally. The handles hang down each side for the performer to suspend himself by to perform his feats, and at the same time propel himself along the rope. The performer may mount above the wheel, either on the rope or on the ground, turning the handles upward and the stirrups downward, and thus ride on the wheel.

### Improved Runner Attachment for Vehicles.

John A. Hyde, Englewood, N. J.—This invention consists of runners which are secured to the lower portions of the wheels by hinged jaws and clamps, the object being to convert the wagon temporarily into a sleigh.

### Improved Miter Box.

Peter Suydam and William G. Suydam, New Brunswick, N. J.—For the saw guiding and regulating posts there are two rigid rods side by side, with tubes to rise and fall on them. Said tubes carry guides, for the sides of the saw, which are adjustable for saws of any thickness, and for taking up the slack caused by wear. One of said tubes carries a spring presser to hold the guides above the working position when required for adjusting the saw on the work. One of the posts has an adjustable stop collar to regulate the descent of the saw. The adjustable holders for spring miters consist of horizontal bars with a vertical piece at one end arranged to slide forward and backward, across the bottom of the box, and toward and from the back of the box, to hold one edge of the work while the other rests on the top of the back, said bars being provided with set screws for holding them.

### Improved Scaffold Bracket.

Samuel Nelson Fisher, Milford, Mass.—This apparatus for supporting scaffolds in the erection of buildings consists of a folding bracket having an adjustable hook for fastening it to the building.

### Improved Thill Coupling.

Axel Olsson, Williamsburgh, N. Y., assignor to himself, J. W. Cox, and D. Merritt, of same place.—This thill coupling locks itself when forced into place upon the coupling bolt, and at the same time may be easily unlocked when removed.

### Improved Rolling Shutter.

Hector J. Defrenne, Green Bay, Wis.—This is a blind made of slats hooked together, to be raised and lowered by rollers suspended by cords. The latter pass over an upper roller in a chamber above the window, and down to another roller at the bottom of the chamber, on which they wind. The rollers are worked by an endless cord, which is so arranged on pulleys that one part of its course is alongside of one of the sides of the window frame, where it can be worked inside of the house for raising or lowering the blind whether the window is open or not. The invention also consists of a novel mode of connecting the slats together by wire links.

### Improved Stays for the Bottoms of Pantaloons.

Stephen D. Mills, Kingston, N. Y.—This is an india rubber stay designed to take the place of the canvas stay now used in the manufacture of pantaloons to keep the bottoms of the legs in shape.

### Improved Bridge.

Peter M. Fulton, Rhinebeck, N. Y.—Towers are erected at suitable required distance from each other, and bear arch-supporting cables. The hight of the towers may be reduced to a considerable extent, and thereby the great cost of the same, as compared to suspension bridges, lessened. The towers serve also as abutments for the arch-sections, which are stretched and supported across the span between the towers, their symmetrical semi-sections being firmly joined by central key pieces. The arch sections are constructed from both towers toward the center without a supporting scaffolding, by the use of a derrick above and a traveling truck underneath, which forms the platform for the workmen. One arch section after the other is joined to the other and hung to the cables, until the grooved and pointed approaching ends of the arch sections may be connected by the correspondingly perforated key pieces. The roadway is then hung by vertical suspension rods to the lowermost arc.

### Improved Plow.

Thomas S. Macomber, Hamilton, N. Y.—The invention consists in devices whereby the mold boards and their attached shares are connected to the beam of the plow, so that, by turning the right hand mold board down against the landside, the other mold board will be raised into a horizontal position, forming a right hand plow, and by turning the left hand mold board down against the landside the right hand mold board will be raised into a horizontal position, forming a left hand plow.

### Improved Oscillating Engine.

George W. Heald, Baldwinsville, N. Y., assignor to himself and William F. Morris, of same place.—This improvement in oscillating engines consists of a novel contrivance of tightening bearings and adjusting screws therefor with the crosshead of the piston rod, which is arranged in guides projecting from the cylinder head, to take the strain of oscillating the cylinder from the rod.

### Improved Steam Engine Governor.

Frederick M. Brown, Warren, R. I.—This governor is contrived similarly to some governors now in use, the peculiar feature of it being the upward movement of the balls on the arms when the speed diminishes, and the downward movement when the speed increases, and in the levers and rods by means of which these movements are produced.

### Improved Map Exhibitor.

John Lichtenberger, Fort Wayne, Ind.—A hanging bracket supports the map rollers, which may be mounted directly in the bracket, one in front of another; or they may be arranged in a hollow cylinder mounted on pivots, so as to revolve upon its axis to bring the maps into position for pulling them down. A slot is formed for each map to drop through, and an endless cord with an idle pulley may be employed for turning the cylinder.

### Improved Plow.

Albert Hampe, Staunton, Ill.—The greater or lesser depth of the share is regulated by swinging the standard backward or forward on its pivot bolt, and setting a fastening bolt to the position of the same. The lateral position of the plowshare sideways from the beam is adjusted by means of an end clevis and screw bolt, so that the plow can be set as required, increasing thereby the strength of the parts and the efficacy and usefulness of the plow.

### Improved Harvester Rules.

David S. Fulton, Paris, Pa.—This invention is a machine for harvesting grain, and consists of a reel, the arms of which act independently of each other. Cam devices throw the arms into the proper position for sweeping the apron.

### Improved Wrought Iron Column.

John B. Cornell, New York city.—The invention relates to the employment of a T-shaped bar for forming the joint between the vertical ribbed plates composing the chord, the edges of said plates being riveted to the lateral wings or flanges of the bar. The joint is therefore an element of strength, and a strut or cord of minimum size and weight and maximum strength is provided.

### Improved Machine for Coiling Metal Rods.

Philander H. Standish, Jefferson City, Mo.—The mandrel consists of a flat bar of steel, wide and thick as the largest coil to be bent, with an oval tapered point, graduated from the size of the largest to that of the smallest coil. The bar is fitted in the hollow shaft of the driving wheel, so as to be shifted along it, to cause the tapered point to project under the bending wheel more or less, and is provided with a collar. There is a set screw at each end of the hollow shaft, for holding it wherever it may be set, to utilize the same machine for coils of all sizes, the bending wheel only being changed. The said wheel for that purpose is fitted detachably in a slotted lever, and the guide is fitted adjustably in the slot of the lever, to adjust to the wheels of different sizes.

### Improved Bale Tie.

John B. Arrants, Society Hill, S. C.—This tie consists of a block to which one end of the hoop is riveted at the middle of the side which is outward when applied to the bale, and across the outside of the upper end. The inside of the lower end is a transverse groove, in which a loop is secured of wire, around one bar of which the other end of the hoop is bent. The loop is so adjusted on the aforesaid block that the strain of the hoop keeps it in place, and the loop so binds the part of the hoop bent around it in one of the said grooves in the block as to hold it securely.

### Improved Water Closet.

Edwin O. Brinckerhoff, New York city.—By suitable construction, when water is admitted into a ring pipe, it will be discharged on all sides of the basin, so that the entire inner surface of said basin will be thoroughly washed, cleaning it much better and with less water than when the water is admitted at one side of the basin in the usual way.

### Improved Rein Holder.

Benjamin R. Hamilton, South Deerfield, Mass.—This invention relates to the construction of rein holders, and consists in a wedge-shaped tube and a cross-grooved wedge confined therein, the reins being passed through the tube and the wedge made to act between them.

### Improved Machine for Tapering Leather.

John Settle and George W. Settle, Lebanon, Oregon.—In using the machine, a semicylindrical block is adjusted as required, a knife-carrying frame is turned back, the strap or other leather to be operated upon is inserted between the block and the knife and roller of the frame, and the frame is swung forward, paring off the leather to exactly the desired taper.

### Improved Station Indicator.

John W. Bryan, Watertown, Tenn.—This consists of a casing with an upper and lower chamber, provided with sliding frames and spring followers for holding the station-indicating plates, in connection with a sliding key or frame having shoulders for carrying the station plates to the upper front opening and retaining them, by springs at the sides of the opening, exposed to view. A false spring bottom carries the lower spring follower upward for receiving the station plates in regular order after each trip.

### Improved Waterproof Liquid Blacking.

Edward Clark, New York city.—This waterproof blacking is made of gum shellac, methylic alcohol, gum camphor, lampblack, sweet oil, mutton tallow, turpentine, and oil of mirbane. It is applied with a soft camel hair brush, and requires no rubbing beyond what is necessary to spread it evenly over the surface to be blacked.

### Improved Paper Bag Machine.

Charles H. Kellogg, Leverett, Mass.—The paper is moved along over a table, cut off, and then folded over a former; then the horizontal bottom folders move forward and fold in the sides of a portion of the tube which projects beyond the table, to form the upper part of the bottom; then the upper vertical bottom folder comes down, and the lower vertical folder moves up to fold the remaining portions and stick them to the other portions, paste having been suitably applied for the purpose beforehand.

### Improved Water and Steam Indicator for Boilers.

William L. Carman, Belvidere, Neb.—To the upper end of a cylinder is bolted a cover, upon the inner side of which are two projections. Through one projection is formed a steam port, which passes out through the top in such a direction that the steam may strike a whistle. The inner end of the port is covered with a valve attached to a float, which floats upon water in the cylinder, and is kept in place by two guide pins. The cylinder is connected with the boiler by a water pipe and by a steam pipe, so that the pressure of steam may be the same in both boiler and cylinder. By this construction, as the water in the boiler becomes either too high or too low, the port will be uncovered, and the escaping steam will sound the whistle. By other construction, if the steam pressure reaches a point above that which a lever is weighted to resist, another valve will be raised, allowing the steam to escape and sound the whistle. There are also arrangements whereby the escaping steam from the ports may give a different sound, and thus show by the sound whether the alarm has reference to the water or the steam.

### Improved Brush.

Charles A. Hussey, New York city.—This invention consists in a brush having a flexible handle for containing the mucilage, with a discharging tube through the neck of the handle, and a metallic shield or cover over the brush, which screws tightly to the neck.

### Improved Washing Machine.

John F. Bassett, Limestone, N. Y.—In this machine the rollers between which the clothes are passed, are reciprocated longitudinally, so that the clothes are subjected to both a rubbing and rolling pressure. The improvement relates particularly to the means for adjusting the spring pressure on the lower roller.

### Improved Pump.

George W. Hooper, Greene, Me.—This invention consists of packing for the piston rod, composed of a metal thimble fitted snugly to the rod, and held so as to accommodate it to the piston by a leather diaphragm, in which the thimble is fixed so as to be movable. The invention further consists in the construction of the end pieces of the cylinder which forms the cylinder heads, ways, or conduits for the water, and seats for the valves, and in the means for fastening the valves to the said seats, by passing the flexible end of the elastic face of the valve through a slot in the top of the said end pieces. The pump handle is arranged in a pivot block to shift forward and backward, to regulate the stroke to the depth of the well.

### Improved Boot Leg Turning Machine.

David Bissell, Detroit, Mich.—In this machine a pulling bar is operated inside of a tube on which the leg is drawn, and a pushing bar is operated on the outside, to turn the leg over the end of the tube. The said bars move simultaneously in opposite directions. The invention consists in devices whereby the mechanism may be worked in the way most natural to the operator, also to avoid the shock and strain on the machine caused by the sudden stopping of the crank. The machine may be worked by hand or power, and be readily changed from one condition to the other, and smaller legs can be turned on the machine than it has been possible to turn as it has been heretofore made.

### Improved Sheep Shears.

James L. Smith, Tuscola, Ill.—This invention consists in a guard placed on the inside near the point of one of the blades of shears, to shield the skin and guide the shears in the operation of shearing sheep or other animals.

### Improved Watch Key.

John S. Birch, New York city.—This is a watch key adjustable to square pivots of different sizes, to enable the key to wind any watch. The key is made in two pieces, the upper ends of them being fastened in a solid handle; the lower ends are bored out to receive the square pivot; and the distance apart of the lower ends is adjusted to any size of pivot by a screw which passes through them and enters a nut on the other side. The head of the screw is concave underneath, and rests on one side in a slot in the jaw of the key. This appears to be an excellent invention in its line, being made of the finest hardened steel to ensure durability, and is the result of eight years' experiments on adjustable watch keys, of which Mr Birch is the original inventor.

**Chief Engineer's Office, U. S. Navy Yard,**
WASHINGTON, November 18, 1874,

*Commodore Thos. H. Patterson, U.S.N., Commandant:*

SIR:—In obedience to your order of October 5th, 1874, to carefully test the EMPIRE PORTABLE FORGE, manufactured at Troy, N. Y., I have the honor to submit the following report:

* * * * * * This is a very excellent and convenient forge. It works easy and with but little noise, and the power being applied with a lever, it can be worked without interfering with the manipulation of the fire.

I can recommend it as a very useful tool for work on ship board or shop use.

Very respectfully, your obedient servant,
[Signed] EDWIN FITHIAN,
Chief Engineer, U.S.N.

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Dry steam dries green lumber in 2 days, and is the only Cheap House Furnace. H. G. Bulkley, Cleveland, O.

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Fleetwood Scroll Saw, with Boring Attachment, for all descriptions of light Scroll Sawing. See adv't., page 188. Trump Bro's, Manufacturers, Wilmington, Del.

For Sale—No. 6 McKenzie Blower; cost $500; used two years. Price $200. Enterprise M'f'g Co., Phila., Pa.

Heavy Planer and Matcher (second hand) wanted. State lowest cash price, maker, and condition. P. P. Toale, Charleston, S. C.

Housekeepers, House Furnishers in Tin, Tinmen, send Postal Card to J. B. Abbe, Providence, R. I.

We have had continuous business relations with Geo. P. Rowell & Co. for between three and four years, and have found them honest and prompt in every instance. Persons contemplating a wide-spread venture in advertising would do well to communicate with G. P. R. & Co., 41 Park Row, New York. They have unusual facilities for the transaction of such business.—(Observer, Fayetteville, Tenn.)

Thomas's Fluid Tannate of Soda never fails to remove Scale from any Steam boiler; it removes the scale-producing material from all kinds of water; cannot injure Boiler, as it has no effect on iron; saves 20 times its cost both in Fuel and repairs of Boiler; increases steaming capacity of Boiler; has been tested in hundreds of Boilers; has removed Bushels of Scales in single cases. It is in Barrels 500 lb., ½ Bbls. 250 lb., ¼ Bbls. 125 lb.. Price 10 cents per lb., less than ½ price of other preparations, and superior to all others. Address orders to N. Spencer Thomas, Elmira, N. Y.

Tin Manufacturers, who have waste strips, pieces, or round blanks to sell, address—giving sizes—Norton Bros., 44 & 46 River St., Chicago, Ill.

$3,000 in Premiums; Stamp for Circular. Thomas Schofield, Grass Valley, Cal.

For Sale—The entire Patent or State Rights for the best Music Leaf Turner out. Will turn back, forward, Dal Sig, or Da Capo, without using the hands. Address J. T., Birmingham, Conn. (P. O. Box 120.)

See N. F. Burnham's Turbine Water Wheel advertisement, next week, on page 189.

Wanted—Traveling Agents, to appoint Sub-Agents, or Canvassers, everywhere. Address E. F. Landis & Co., Lancaster, Pa.

Zero-Refrigerator with Water Cooler. Best in the World. Send for Catalogue. A. M. Lesley, 224 W. 23d street, New York.

For Sale—Engine 2x4½—½ H.P. Will send photo. A. R. C., Dentist, Lincoln, Ill. Very cheap!

The Lester Oil Co., 183 Water St., N.Y., Exclusive Manufacturers of the renowned Synovial Lubricating Oil. The most perfect and economical lubricant in existence. Send for Circular.

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Millstone Dressing Diamond Machines—Simple, effective, economical and durable, giving universal satisfaction. J. Dickinson, 64 Nassau St., New York.

Position Wanted in a Machine or other Mechanica Works—preferably Steam Engines—as Foreman or Assistant, by a practical Machinist and experienced Mechanical Engineer and Draughtsman. Address Frank H. Pond, M. E., Woonsocket, R. I.

2nd Hand Engines and Boilers for Sale at Low prices. Address Junius Harris, Titusville, Pa.

An old established responsible House wishes, in connection with their different European Offices, to take the exclusive European Agency for first class special Machinery. Only established firms, who can guarantee their ware, need address D. & W., Box 2620, New York.

For small size Screw Cutting Engine Lathes and Drill Lathes, address Star Tool Co., Providence, R. I.

W. Campbell's Self-Acting Shade Rollers. The Trade supplied, 87 Center Street, New York.

Send for Illustrated Circular—New principles of propelling vessels—speed increased, and power saved. C. H. Jenner, Brockport, N. Y.

For Sale, or Partner Wanted for Patent on Canal Boat Propeller. Address G. Heydrich, New Ulm, Minn.

Miller's Brick Presses for fire and red brick. Factory, 309 South Fifth Street, Philadelphia, Pa.

To Machinists.—For Sale, Cheap—A partially finished Engine Lathe, 11 feet bed, 28 inch swing. For further particulars, call on or address Clark, Smith & Co., Fort Plain, N. Y.

Price only $3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 263 Broadway, New York.

Piano and Organ Wire Work of all kinds, Valve and Key Pins, Iron and Brass Finishing Nails, &c. &c. The Hendey Machine Co., Wolcottville, Conn.

Send to Atlas Works, Indianapolis, Ind., for a Photograph of their 20 inch Engine Lathe.

Wash Stands, New Styles, Marble Tops, can be used in any situation. Prices very low. Send for a catalogue. Bailey, Farrell & Co., Pittsburgh, Pa.

Grindstones—4,000 tuns. Berea Stone Co., Berea, O.

Send for Circular of a very Superior Boiler Feed Pump. D. Frisbie & Co., New Haven, Conn.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $6, with good Battery. F. C. Beach & Co., 263 Broadway, New York, Makers. Send for free illustrated Catalogue.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

Buy Boult's Paneling, Moulding, and Dove-tailing Machine. Send for circular and sample of work. B. C. Mach'y Co., Battle Creek, Mich., Box 227.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

For Sale—One "Cottrell & Babcock" Water Wheel Regulator, in good order—by D. Arthur Brown & Co., Fisherville, N. H.

For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, &c.

"Book-Keeping Simplified." The whole system in a few pages. Cloth, $1. Boards, 75 cents. Sent, post-paid. D. B. Waggener & Co., 424 Walnut St., Philadelphia, Pa., Publishers "Waggener's Trial-Balance Book."

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Temples and Oilcans. Draper, Hopedale, Mass.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York.

All Fruit-can Tools, Ferracute, Bridgeton, N. J.

Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

Genuine Concord Axles—Brown, Fisherville, N.H.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass. Send for sample and price list.

Power Hammers and Bolt Forging Machines—Nine sizes of the former and two of the latter, guaranteed the most economic tools of their kind known. For price and cuts, address S. C. Forsaith & Co., Manchester, N.H.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street New York.

## Notes & Queries

J.P.S. can utilize old rubber as described on p.349, vol. 26. Galvanizing castings is described on p. 346, vol. 31.—A. L. and others will find a recipe for a blackboard composition on p. 91, vol. 30.—S. A. H. will find a formula for proportioning cone pulleys on p. 100, vol. 25.—F. P. can keep moths out of clothing by the process given on p. 225, vol. 27. Inkstains can be removed by the method given on p. 139, vol. 29.—T. & L. will find directions for purifying rancid butter on p. 119, vol. 30.—J. D. V. Jr. will find a recipe for bronzing brass and copper on p. 331, vol. 29.—S. M. can bleach cane juice for sugar by the method given on p. 378, vol. 30.—O. K. will find directions for making rubber stamps on p. 156, vol. 31.—S. A. T. can fasten paper to brass by painting the brass with oil paint, letting it dry, and using common glue. (This answers H. H. R.) Lead is readily run into plaster molds. A recipe for a soldering liquid is given on p. 43, vol. 31.—W. S. will find directions for galvanizing iron on p. 12, vol. 346. Rubber can be fastened to wood with glue.—T. R. B. will find a recipe for transparent varnish on p. 11, vol. 31, which will do for making cloth airproof.—S. M. E. will find a formula for the dimensions of a safety valve on p. 107, vol. 31.—A. E. A. can bleach skeletonized leaves by the process given on p. 155, vol. 31.—P. B. will find directions for bending wood by steaming on p. 26, vol. 31.—A. M. J. and others are informed that no preventive for boiler scale can be recommended unless the nature of the mineral deposit is known.—W. M. ought not to try and remove canceling ink from postage stamps, as it may lead to fraud.—J. F. H. will find a recipe for Babbitt metal on p. 364, vol. 29.—E. T. D. will find a description of artificial pearls on p. 250, vol. 30.—J. H. R. should consult a dictionary as to the meaning of words in common use.—A. A. will find a rule for calculating gears on p. 187, vol. 29.—L. K. Y. will find full descriptions of solder of all kinds in our last three issues.—P. S. can join his water spouts with waterproof glue; see p. 91, vol. 31.

(1) S. A. T. asks: How can I cement a porcelain mortar? A. Use a mixture of black japan varnish and white lead.

(2) W. B. B. asks: Having a good violin, to improve it I removed all polish and paint with alcohol, which spoilt the tone. How can I restore it? A. Take coarsely powdered copal and glass, each 4 ozs., alcohol (64 over proof) 1 pint, camphor ½ oz; heat in a water bath, stirring frequently until the solution is complete. When cold, decant the clear portion. This is an excellent varnish for any musical instrument of the violin species.

(3) J. J. D. asks: What is meant by slack coal? A. Coal dust. The term is commonly applied to the dust formed in cutting out coal in the mine, which is frequently piled in heaps at the pit's mouth.

(4) F. O. asks: What metal is best for making candy molds? I want to find one that cools quickly. A. Tin molds are commonly used. Dust them with powdered sugar to prevent the adherence of the candy.

(5) C. F. F. asks: Which is the front side of a mill dam? A. The side which the water runs to.

(6) D. G. K. asks: How can I prepare coach varnish? A. Fuse 8 lbs. fine African gum copal, add 2 gallons clarified oil, boil for 5 hours until quite stringy. Mix with 3½ gallons turpentine, and strain.

(7) P. H. K. asks: Can you give me a rule to measure corn in a crib? A. Multiply the depth of the corn in inches by the length and width of the crib in inches, and divide by 2150·42. The quotient will be the number of bushels.

(8) M. A. B. says: The best thing for taking dirt and grease off the hands without injury is bicarbonate of soda, used in place of soap.

(9) I. R. M. asks: How can I calculate the speed of a train of pulleys? A. Proceed as in vulgar fractions, placing the number of the revolutions of the prime mover as the numerator of a compound fraction, and the diameter of each of the driving wheels in inches also as numerators, and the diameters of each of the pulleys in inches as denominators, and proceed by cancelation.

(10) A. E. S. asks: How can I paste newspaper clippings into a scrap book without the leaves curling up and warping? A. Use a gum arabic mucilage with some refined sugar dissolved in it.

(11) A. B. L. asks: How can I make a washing crystal? A. The soda ash and soda crystals of commerce are used for this purpose, and you could not make them on a small scale to advantage.

(12) C. asks: Is there an animal generally known as the sea otter? A. Yes. It is found in the Northern Pacific.

(13) S. says: I read an article on the beneficial effects of glycerin in boilers. I tried the experiment, and the result was the reverse of beneficial. We got rid of most of the earthy matter by using a surface blower, but the glycerin had the effect of depositing the earthy matter in a hard crust, and the surface blower showed clear water in the boiler. A. The use of glycerin, as a solvent for the salts in impure matters, has been recommended for cleaning woolen fabrics, but your experiment of its use in steam boilers is the first of which we have heard. It is possible that, by blowing off from the bottom, you might get rid of the deposit. We shall be glad to hear further on this matter from any of our readers who can communicate any information.

(14) J. K. asks: What constitutes a yard of plastering? A. Nine square feet of surface.

(15) J. B. S. asks: What is the best way of polishing holly wood? A. Use a white shellac varnish.

(16) J. H. asks: Is the Pacific Ocean higher than the Atlantic at the point where it is proposed to connect them by a canal? A. No.

(17) W. R. B. says: In Dick's "Practical Astronomer" is a description of Rogers' achromatic telescope on a new plan. It consists of placing a small compound lens of flint and crown glass in a small part of the cone of rays of a large crown glass objective, and thus correcting the rays, enabling a person to use a large crown glass objective and making it achromatic by the small compound one. 1. I have a good crown glass double convex lens, of 5 inches diameter and about 100 inches focus. What should be the size, shape, and focus of each of the lenses forming the compound one, to produce the proper correction for the above mentioned lens? A. Plano concave of double dense flint, of 2¼ inches diameter, 3½ inches radius, and plano-convex of plate glass same dimensions. 2. At what distance should the given compound lens be placed from the object glass? A. About 60 inches. 3. With the compound lens adjusted, what would be the entire focus of the instrument? A. Twelve feet six inches. 4. Are you acquainted with any telescope on the above plan, and is it satisfactory? A. An inch dialyte, by Plossl, of Vienna, divided γ *Coronæ*, distance 0·6".

(18) S. G. S. asks: If the daily motion of the earth were to cease, would all the loose bodies on the surface fall into space? A. No.

(19) J. C. C. asks: Where is the best place to hang a thermometer to ascertain the heat of the atmosphere? A. If it is desired to know the temperature of the surrounding atmosphere, the instrument should be placed in some shady spot, protected alike from the direct rays of the sun and cooling drafts of air. If exposed to the direct radiation of the sun, the instrument itself will become overheated (the materials of which it is composed being better absorbers than the surrounding air), and the consequence will be that the thermometer will indicate the temperature of the materials composing it and not that of the air. The indications of cheap thermometers are never absolutely correct.

(20) P. E. R. asks: How can I cement glass together, to withstand the action of electro-plating solutions? A. Try a solution of shellac in alcohol, evaporated to the consistence of a thick paste.

(21) G. A. N. says: I want a small engine, to run a sewing machine or small lathe. Would a ¾x1½ inches cylinder, 20 or 30 lbs. pressure, and 300 or 400 revolutions per minute, be large enough for the purpose? A. Yes.

(22) H. S. P. asks: 1. What would be the horse power of an engine, with a cylinder of 5 inches bore by 6 inches stroke, running at 300 strokes per minute, with 70 lbs. of steam? A. It would develope from 4 or 5 horse power. 2. Would it do to run a circular saw 15 inches in diameter through two inch oak plank? A. Yes. 3. How large a boiler would this engine require? A. Make a boiler with 60 or 70 square feet of heating surface. 4. Will an upright boiler last as long as a horizontal one? A. Upright boilers, when well made, are quite serviceable.

(23) P. B. asks: 1. What is the average weight of freight locomotives? A. There is a very great variety, an average example being somewhat as follows: Weight, 60,000 lbs. 2. What is the diameter of the drive wheels? A. Five feet. 3. What is the length of the stroke? A. Two feet. 4. What is the diameter of the cylinder? A. Sixteen inches. 5. What is the weight of an average freight car? A. Eight tuns.

(24) W. P. asks: 1. What size of engine would it take to run a boat 15 feet long at the rate of 8 miles per hour? A. Make the cylinder 2½ x 4. 2. I have a boiler 36 inches high x 15 inches diameter, carrying from 40 lbs. to 50 lbs. pressure per square inch. Would it be large enough? A. The boiler is too small for the speed.

(25) H. J. asks: 1. Will an engine having a cylinder 3x6 inches, steam pressure of 60 lbs., running at 300 revolutions per minute, with a cut-off at ¾ stroke, do to run a circular saw 6 inches in diameter with? The fly wheel of the engine is 24 inches, and the mandrel pulley 6 inches, in diameter. A. The engine is quite large enough. 2. My boiler is 13 inches in diameter by 5 feet in length, a plain cylinder in form. Is it big enough? A. No.

What will take the stains of varnish or paint off marble? A. Try a paste composed of soda, pumicestone, and chalk.

Where is the best place to put exhaust steam in a smoke stack, at top or bottom? A. The top.

(26) S. E. P. asks: How can I remove rust from joiner's tools? A. Use emery and oil, with a piece of wood. This also answers S. A. T.

(27) W. W. says: I have a small upright engine, cylinder 4 inches diameter by 6 inches stroke. Would it do to run an ordinary row boat? How fast would she go, and what would be the best kind of propeller wheel to use? What kind of boiler would be best? Would it be necessary to have a counterbalance on the crank? A. Your engine is large enough for a boat 25 feet long, with a propeller 30 inches in diameter and a boiler from 30 to 36 inches in diameter. Some slight counterbalance may be put on, but it is not a matter of any great importance.

(28) G. asks: What amount of sulphuric acid will it require to entirely dissolve 1 lb. zinc? A. For its complete conversion into sulphate of zinc, 1 lb. of pure zinc requires 1½ lbs. of sulphuric acid of specific gravity 1·84=66° Baumé at 66° Fah. 2. What volume of hydrogen gas will the mixture give off? A. One pound of pure zinc, by its reaction with hydrated sulphuric acid, will liberate about 40 gallons of hydrogen.

(29) C. S. R. asks: What is the cause of the bursting of water backs? Two such accidents occurred lately. A. There was probably ice in the circulating pipes, so that the steam which was formed could not escape. Under such circumstances, fire should never be permitted in a range.

(30) K. K. asks: What would be the difference between the pressure necessary to explode a steam boiler from the inside, and that necessary to crush or flatten it from the outside? A. In the case of a wrought iron boiler, perfectly cylindrical, the internal pressure that would rupture it is thickness in inches × tensile strength in lbs. per square inch ÷ the diameter in inches. The external crushing force is: $111{,}000 \times (\text{thickness in inches})^2 \div$ diameter in inches × length in feet.

(31) B. R. asks: Can ice be torn off a dam by powder? The ice is 18 inches thick and the water 12 or 13 feet deep. A. We advise you not to attempt this kind of blasting, unless you have had some previous experience.

(32) J. H. asks: 1. How are red mortar and black mortar made, for laying face bricks in? A. Mortar is made red by mixing therewith a certain proportion of Spanish brown, and black by lamp black, but neither is sufficiently permanent to be satisfactory. 2. Is fresh water better than salt for making mortar in winter? A. Pure water is better than salt water in any weather.

(33) H. says: The atmosphere in a certain building is raised from 0° to 75° by water at 212°, passing through coils of iron pipe. Suppose this operation should be reversed, and an attempt made to cool the atmosphere at 90° by cold water at a temperature of 35°, provided the circulation were kept up, to what degree of temperature could the atmosphere be reduced? A. This question cannot be answered except by experiment.

(34) J. S. asks: How much water can be boiled away in 10 hours in a vat, 5 by 12 feet, with 1¼ inch pipes laid close together over the bottom of the vat, with steam at 60 or 70 lbs. per inch? A. It will depend upon the arrangement whether you boil away 25 or 75 per cent as much water as you have steam. With a good apparatus, you may calculate to evaporate ⅞ of a gallon of water in the vat for every gallon of water evaporated in the boiler.

(35) S. G. says: Suppose a water tank, 8x10 x5 feet deep, is placed on top of a house, 1,000 feet from an engine house, what kind of an indicator would be best to show how much water there is in the tank? A. Put up a stand pipe, say one inch in diameter, in the engine house, and connect it at bottom with the pipe running from the pump to the tank. Enlarge the upper part, which must be on a level with the tank, so as to introduce a float; connect this float by a cord over a pulley, with an indicator in the engine room below. As the water in this pipe will stand higher, when pumping, than in the tank, it will be necessary to stop the pump to find the true hight.

(36) F. S. says: 1. Please give me a rule for finding the strength of a boiler when diameter of shell and thickness of iron are given. A. For a single riveted iron boiler, the safe working strain, in pounds per square inch, may be found by multiplying the thickness in inches by 7,000, and dividing the product by the diameter of the boiler in inches. 2. Would it make any difference in the working of an engine which end of the boiler I took the steam from, or at which end I let in the feed water? A. Ordinarily, no.

Are large mill saws tempered after they are made? A. Yes.

(37) S. D. K. says: We have a large hall, built of brick, 50 feet square and 20 feet high. The reverberation is so great as to make it very disagreeable to speak in, causing confusion of sound. What is the best remedy? Will wires do, and how

are they applied? A. The use of wire to improve the acoustics of halls, etc., is of comparatively recent date, and is not sufficiently extended in the number of reported experiments to warrant a very great degree of certainty in assigning either the sizes of the wire, their distance apart, or their exact location. It is generally thought best to place them in front of the vertical wall opposite the speaker, about 5 inches from the wall and 6 inches apart, extending vertically from the floor to ceiling. The object being simply to break the wave of sound, as small a wire will answer as is consistent with strength.

(38) J. G. R. asks: 1. Would it be practicable to have the telegraph wire within ⅛ inch of the wood at every pole? A. Yes. 2. What is the smallest distance that will work well? A. Any distance if they do not touch. Air is an insulator, and galvanic electricity will not pass through it unless some other substance is present. It is better to keep the wire at some distance from the pole on account of snow or ice forming a connection between the wire and pole.

(39) G. W. M. asks: Is cement pipe much used for aqueducts for water supply? When laid entirely below the action of the frost, and bedded in clay, would it be durable and not likely to become leaky from cracking or otherwise? What thickness should three-inch cement pipe be to conduct water under a head of 30 feet? Would such a pressure be likely to produce leakage by filtration through the pores? Which would be most economical in the beginning, and less liable to further expense for repairs, to make the pipe in short joints before laying it, or to lay the cement in its final bed in a plastic state, forming the hole as fast as the work progresses? What is the process of the latter mentioned mode of laying pipe? What are the ingredients required, and their proportions? A. Cement pipe is principally used for drainage and very seldom for supply, except when the current runs to a grade without filling the pipe, and so not under pressure. A notable instance of a cement concrete pipe is that of the Vanne aqueduct, thirty-seven miles in length, for supplying water to the city of Paris. This aqueduct has two and a half to three miles of arches, some of them fifty feet in hight, and eleven miles of tunnels, which, with the aqueduct pipe, are all constructed of béton Coignet. The pipe is circular, 6½ feet in interior diameter, with a thickness of 9 inches at the top, and 12 inches at the sides, at the water surface. It has proved to be impermeable to water. But cement pipe of small size, bedded in the earth is much too liable to be broken by unequal pressure, caused by the washing away of its support, to be safe under ordinary circumstances.

(40) J. D. M. asks: What is the capacity of a cylinder 6x8 inches, carrying a pressure of 50 lbs. to the inch, and making 200 revolutions?

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|---|---|
| A. Area of piston in square inches | 28·27 |
| Multiply by steam pressure | 50 |
| | 1413·5 |
| Multiply by twice the length of stroke in feet | 1·33 |
| | 1,818 |
| Multiply by revolutions per minute | 200 |
| Divide by 33,000 | 363,600 |
| Horse power | 11+ |

(41) W. W. F. says: 1. In a church are two furnaces for heating, which can be made to draw only when the atmosphere is in strong motion. Two large coal stoves have been substituted, with 8 inch pipes running the whole length of the church. These also operate the same way. What is the reason? A. The draft is checked by the great length of horizontal pipe, and most probably by the small size of the vertical flues likewise. The best conditions for draft in such cases are the location of the former at the bottom of the vertical flue, with little or no horizontal pipe, and the size of the flue being sufficient for the work it has to do. One of the worst conditions is that of a horizontal pipe running in a direction contrary to that of the strongest and most prevalent winds; and the same difficulty occurs in carrying heated air in pipes from a furnace. The furnace therefore should be placed at the windward end or side of the church, and have large flues ascending directly from them. 2. In building chimneys, is there any prescribed rule for the size or shape of flue? A. No graduated scale for the size of flues has been indicated, but 12 by 16 inches or 12 by 12 inches ought to be sufficient in a case like this.

(42) A. B. A. asks: Is there any process by which freckles can be removed from the face without injury to the skin? A. A good lotion is made of: Bichloride of mercury 6 grains, pure hydrochloric acid (specific gravity) 1 fluid drachm, water (distilled) ½ pint, mix, and add of rectified spirits and rose water, each 2 fluid ozs., and glycerin 1 oz.

(43) J. M. says: I have a boiler 1 foot in diameter and 21 inches long, with 14 flues. The firebox and flues get choked. What is the cause of it? A. The flues are probably too small for ordinary fuel. Try charcoal. The power of your steam engine depends upon the steam pressure and speed, which you do not mention.

(44) O. A. asks: Would a room, partitioned off in a cellar, do to store ice for summer use? If so, how must I arrange it? A. You can make an ice room in your cellar that will most likely preserve ice, if the space you can devote to that object be large enough. Ice will keep best when compacted in a solid mass, and a cube of 12 feet will be found to be best for family storage, even where perhaps not more than one half of this amount will be required for use in one season. Place 2x12 inch uprights, 2 feet apart, around the room, with the edge to the wall, and line them with stout inch boards. Then fill in the spaces between the uprights with dry sawdust, and construct a similar protection on the ceiling of the room. Cover the ground with shavings 6 inches deep, and lay sleepers and a tight floor thereupon, arranged to drain to one side, and provide a drain to carry off the water. Also provide ventilation from the top of the ice room. Put in a double door at the entrance, and provide a sawdust mattress to fill the space between them, making the inside door in sections to take down from the top. A space partitioned off outside of the ice room can be used as a cold closet.

(45) G. asks: Are there any ingredients that can be molded into artificial stone for building purposes, that will stand the action of the weather? A. Artificial stone, made in the manner you refer to, is manufactured by three or four companies in this city and elsewhere; but their combination of ingredients is in each case protected by a patent. The peculiarity of each consists in its use of some choice and noted cement as a basis for its composition, and upon this their success mainly depends. One of these companies uses the hydraulic lime of Teil, and another Portland cement, and great care is taken to wash the sand perfectly clean and to cause the combination of the sand and cement to take place under the best conditions. This is sometimes done under pressure. The operations of these companies are now very extensive, but their processes are mainly concealed from the public, especially the points wherein their peculiarities consist.

(46) P. M. J. M. and many others.—We do not know of any rule for determining the horse power of a boiler.

(47) O. D. B. says, in reply to G. M. B. (who asks: How can I construct a receptacle in a garret for water from the roof of a house? It must not let the water be frozen in winter, or spoiled in summer): My garret being sufficiently tight, frost does no harm. For my tank I used a poor grade of 1½ inch pine, sawn into strips 2½ inches wide, all pieces of equal length. I took one thickness of matched 1¼ stuff for the bottom, and then laid on the strips around next the edge of the bottom, and nailed each layer, breaking joints at the ends, until the requisite hight was reached, thus making a a tank needing no tongues or grooves. If it is to be over five feet high, saw the strips 2¾ or 3 inches wide. Having lined the tank with sheet lead, the water was taken from the roof, and (through an elbow and conductor pipe of galvanized iron) was discharged into the bottom of the tank (the conductor being in the tank and reaching to the bottom); thus each successive shower moved all the water in the tank, stirring it up and causing the surplus or overflow to pass on to the main house cistern. The more roof water that can be conveniently turned into the tank the better, for the supply is thus kept constant and the changes are more frequent. A. We understand our correspondent's plan of building a tank to be something like that of erecting a log house, with the strips he refers to overlapping each other at the corners, and the whole wall nailed down into each other as the walls rise. We do not see the necessity of multiplying the number of joints to so great an extent as this plan involves, and think there is less labor required to be expended on the ordinary style of tank. When the tank is high, a cradling of slight scantlings will be necessary to bind it together and sustain the pressure of the water, in either case.

(48) J. B. B. asks: Please explain the construction and mode of working the automatic telegraph instruments in use in many brokers' offices of New York and Philadelphia. A. There are many kinds. In one of them a type wheel containing letters is propelled, step by step, by electro-magnetism, and another wheel containing figures is propelled in a similar manner. The printing is done by a third magnet, which attracts an armature attached to a lever, the distant end of which brings the paper against the type wheel. The paper is moved along by the movement of the lever.

(49) W. & Co. ask: What are the *modus operandi* and ingredients used in making electric carbons? A. The fine dust of coke and coking coal is put into a close iron mold of the shape required for the carbon, and exposed to the heat of a furnace. When taken out, the burned mass is porous and unfit for use; but by repeatedly soaking it in thick sirup or gas tar, and reheating it, it at length acquires the necessary solidity and conducting power. The carbon that forms on the roof of gas retorts is harder and better than the carbon thus made, but it is difficult to work, and the supply of it is limited.

(50) A. T. O. says: I am building an engine of 3 inches stroke by 1½ inches bore. What sized boiler ought it to have to run a foot lathe? A. Make the boiler of ¼ inch iron or copper, 15 inches in diameter, and 30 to 36 inches high.

(51) A. W. P. asks: Is there any spot in the depth of the ocean where the density of the water is such as to prevent a 50 lbs. weight from sinking any farther? A. Possibly.

(52) A. K. asks: What causes a conical shot fired from a smooth bored gun to fly end over end? A. It is on account of the resistance of the air, since the axis of the shot is not permanent, as it has not been made to rotate on its axis while being forced from the gun.

(53) J. M. W. asks: Is there any means of finding gold and silver that is buried in the ground? A. Digging till it is found is the only solution of the difficulty.

(54) G. B. asks: What is the best polish for handles, such as chisel handles, etc.? A. Ordinary polishing paper answers very well.

What power have I on my foot lathe, the driving wheel being 26 inches in diameter and the driven wheel 3½ inches? The belt is 2½ inches in width. A. You must measure with a spring balance, or otherwise, how much pressure you produce on the treadle, multiply it by the distance the pressure is exerted in feet for each revolution, multiply also by the number of revolutions per minute, and divide by 33,000.

Why is wood seasoned under water heavier than that seasoned by boiling or steaming? A. Generally because as much of the sap has not been expelled in the former case as in the latter.

(55) R. U. asks: What is Chatterton's compound, for insulating electric cables, composed of? A. Stockholm tar 1 part, resin 1 part, gutta percha 3 parts, by weight.

(56) A. L. C. asks: Does the perihelion of the earth's orbit to the sun always lead the sun in its course among the stars, or does it occupy a fixed position? A. It retrogrades slowly, moving in a direction contrary to the order of the signs.

How do you account for the ocean waters being salt? A. Streams carry down minerals, especially soluble chlorides, the water returning by evaporation and rain.

Will iron weigh the most when hot or cold, and why? A. A cast iron ball at first sinks in melted cast iron, then floats, and finally melts.

How much will a ball drop in the first mile, when shot from a cannon? A. A falling body describes in 1 second 16 1/12 feet, in 2 seconds 64⅓, in 3 seconds 144¾, in 4 seconds 257⅓, in 5 seconds 402 1/12. The United States 0·45 caliber bullet (charge 7 grains), at 1,050 yards range, elevation 3° 34′ 15″, has a dangerous space of 75 feet, and rises 35 feet above the line of sight at 500 yards. Initial velocity 1,300 feet per second. Pressure 16,300 lbs. per square inch.

I always notice that men, horses, and other animals, when running in a circle, always prefer to run with their left side toward the pole. How do you account for this? A. Because the left half of the brain and the right side of the body (which it governs) are best developed.

(57) F. E. R. asks: How many cells of a Callaud or of a Daniell battery would be required to silver plate small articles, such as buttons, coins, etc.? A. Two cells of either will do.

(58) M. D. H. and others.—It is self-evident that the earth and moon must gyrate about their common center of gravity. The pseudo science of metaphysics consists of an insensible change in the meaning of words during a course of reasoning. We may thus prove mathematically that one equals two, that a straight line is always perpendicular to itself, that a straight line may cut a circle in 4 points, etc.

(59) W. J. asks: How can I make a cheap apparatus to govern electricity, so that it can be taken in light or heavy shocks? A. Take 50 feet of No. 16 copper wire covered with cotton, and make a helix, and then take 1,000 feet of No. 30 copper wire insulated with copper and make another helix around the first. Connect a battery to the two ends of the first helix; and by rapidly breaking and making connection with the battery, a current will be developed in the second coil which can be felt by taking hold of the two ends of the second wire. By inserting a bundle of iron wires in the center of the first helix, the shocks will be greatly increased, and the amount of the shocks can be varied by the distance to which the iron wires are inserted in the helix. 2. What is an electric circuit? A. A circuit is made by connecting the two poles of a battery together.

(60) J. T. M. asks: 1. How many men's work is equal to one horse power? A. From 6 to 7. 2. Is an engine with its cylinder 3 inches long by 1 inch diameter large enough to run a half medium Gordon printing press? A. It is rather too small.

(61) G. C. P. Jr. asks: How can I make an electric battery for a telegraph apparatus? A. Get some cheap glass tumblers and place in the bottom of each an ounce of blue vitriol. Place over the blue vitriol a small coil of copper wire. Attach to the copper wire coil an insulated copper wire extending out of the top of the tumbler (gutta percha covered wire is the best for this purpose). Get some thick sheet zinc and cut out disks of it which will fit into the top of the tumblers, and to the zinc attach a short piece of copper wire. Fill the glass with water. Connect the wire leading from the copper coil of one tumbler to the wire leading to the zinc in the next tumbler. The strength of one cell will be one volt. Use as many tumblers as are necessary to get what power is required.

(62) S. asks: Why does the sun appear larger at the horizon? A. It is an illusion, caused by comparing the size of the sun with terrestrial objects.

When an author gives the strength of wood as 100 lbs., in what direction does he mean that the strain shall be applied? A. It is impossible to tell, unless there is something immediately preceding the information to explain it.

Why does a heated razor cut better than a cold one? A. We are not sure that this is a fact.

(63) S. H. B. asks: Is it enough to test kerosene oils to heat in an open vessel to 110°, and then apply a lighted match? A. Yes, it is a very good test.

(64) J. says: I have made a small steam engine (of one inch bore and three inches stroke) entirely of lead, and so far it runs well. Will it be comparatively durable, and can there be sufficient power got from it to run a sewing machine? A. If it is run light, with low steam, it will probably continue in order for a considerable time. It is probably quite powerful enough to drive a sewing machine, but it is doubtful whether it would stand the work for any long period.

(65) S. P. H. asks: In tempering sickles for cutting grass, to what color should they be drawn? A. A light purple, or a temperature of about 530° Fah.

Claret wine poured into a tumbler of water will penetrate the water and mix; but if a piece of bread is put into the water and the wine poured in, the wine will float on top of the water, part being absorbed by the bread. Why is this? A. We think this experiment can be performed without the bread, if carefully managed.

(66) F. asks: How many barrels of water per foot in depth will cisterns 7 feet, 8 feet, 9 feet, and 10 feet in diameter contain respectively? A. Multiply the square of the diameter by the decimal 0·186. Thus the cistern 7 feet in diameter contains for each foot in depth 49 times 0·186 or 9·114 barrels.

(67) W. S. P. asks: 1. Is a 400 barrel water tank, 16 feet square by 10 feet high, made of 3 inch plank properly braced and bolted, as strong and useful as a round tank of 16 feet diameter by 12 feet high, made of staves 2½ inches thick and properly banded? A. Yes. 2. If the square tank were cased inside with the lightest make of sheet zinc, or galvanized iron, would it be better? A. Yes. 3. How long would it last as a watertight vessel with more or less chalybeate or iron water in it and exposed to the air? A. From a few months to several years, according to the condition of the wood. 4. Would an iron varnish (distilled coal tar) be a protection to the iron or zinc? A. Yes.

(68) J. H. M. says: A friend states that, if it were possible for a man standing in a car 100 feet high, moving at the rate of 60 miles per minute, to throw an iron ball straight up 100 feet, it would drop exactly in his hands. I contend that, while the ball would descend in a straight line, yet, in the time required for the ascent and descent of the ball, the car would have moved a mile for every second from the place where the ball started, so that by the time the ball reached its starting point the man would be too far away for it to drop into his hands. He also says that, if he was standing on the roof at the rear end of the rear car, and I should be standing on the platform of the same car exactly underneath him, the car going at the same rate of speed as before, and he should drop this iron ball, it would strike me. I contend that by the time it reaches my level I would be as many miles from it as it occupied seconds in falling. Which is right? A. Your friend is right, if the resistance of the air can be disregarded.

(69) W. L. D. asks: When it is noon on Friday, at Greenwich Observatory, London (longitude 0), is it Friday or Thursday midnight, at opposite (longitude 180°)? A. Looking at the south pole of a globe, the day of the month is one later at all places between meridian 180° and midnight, counting toward the left, than between 180° and midnight, counting toward the right; that is, it is always later at the first meridian than at any place in west longitude, and earlier than at any place in east longitude.


(70) M. says, in reply to M. B., who asks for a rule for cutting a tree so that its top shall fall at a certain distance from its root: Let A B represent the tree, and C the point on the ground. Draw B C and calculate its length. From D, the center of B C, draw D E perpendicular to B C, and E will be where the tree should break. B A C and B D E are similar triangles, hence B A : B C :: B D : B E.

(71) C. W. says: You mention, as good for steps for turbines, rock or swamp maple. I have known the knots of light wood or pitch pine to last for years in this service.

(72) R. E. B. says, in reply to a question how to remove clinkers from firebrick: Pour vinegar where the clinker collects, and the latter can be peeled off after being well saturated.

(73) C. T. S. says, as to corrosion of engine bolts by using tallow as a lubricant: I think that D. K. has given the real reason for the cutting out of screws and other parts of pistons. After a practical experience of nearly twenty-five years, I am convinced that the use of oil of any kind in the steam chests and cylinders of steam engines is a positive damage and an inexcusable waste, except in the case of locomotives, when running down grades without steam. Nearly all oils contain salts and acids which are destructive to iron under the conditions above described. Oil thrown into a steam chest (where the temperature is high) almost instantly vanishes, leaving a residuum between the wearing surfaces, which is anything but a lubricant, causing more friction and wear than the oil ever compensates for. Oil pumps are sometimes resorted to where it is thought necessary to waste a gallon or two of oil weekly through an engine. Having occasion to make some slight repairs upon an engine a few days ago, I took off the cylinder head, and examined a piston which I put in new five years ago. I found the follower screws, and the screws and nuts under the packing springs, as perfect as when put in; and the cylinder was as bright and smooth as a mirror, also the valves and valve seats. Yet this engine had run 5 years without oil inside the cylinder, and made a saving to the proprietor of not less than $100 in the item of oil alone. Piston and valve rods can be oiled from the outside if necessary; but if the packing in the stuffing boxes is renewed before it becomes hard and charred, very little oil will be needed. A. You do not state what kind of oil you found to leave a residue creating friction.

(74) J. H. S. says: D. K., in his reply to D. S. T. (No. 17, issue of Jan. 30), says that he had trouble with bolts, etc., being eaten away by the acid in the tallow he used, and that he now used lard oil. After a great deal of trouble from the same source, I got a large earthen crock and set on top of my arch, keeping it filled with crude tallow obtained at a meat market. It tried out very nicely, and is of course pure. I have used it on an an engine for 18 months, and everything is all right, although I am using the same water as I did when the trouble was in the cylinder. I have always found that, where lard oil was used in steam, everything ran very dry. It is not heavy enough.

(73) J. & J. T. say, in reply to J. C. & Co., as to the inclination of a bolting reel: At the Millers' National Convention in St. Louis, Mo., June, 1874, we learned that a fall of 1 in 48 always gave the best results.

S. A. T. asks: How can I make a fugitive ink that will disappear in two days after being written?—T. C. H. asks: How can I make an easily flowing ink for drawing on zinc plates, so as afterwards to etch the drawings with muriatic acid?—E. P. M. asks: How can I tan and color beaver skins?—L. M. asks: 1. Can you give me a good rule for getting the length of a carriage axle from shoulder to shoulder before welding, supposing the hub of the wheels to be 6½ inches long, and the track of the wheels 4 feet 7 inches? 2. Please give me a rule for setting axles.—J. F. E. asks: What is put in soap to keep it from shrinking in drying?

### COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Generation of the Wicked. By T. W. C., and by A. S.
On the Sagacity of the Partridge. By J. K.
On Glue as a Healing Remedy. By J. J. B.
On Honey. By A. L. F.
On Amalgamating the Precious Metals. By J. T.
On a Mammoth Skeleton. By A. R.
On a Lunar Phenomenon. By H. M. S.
On the New Rule at the Patent Office. By J. McC.
On the Slide Valve. By J. T. H.
On Squaring Numbers. By E. T.
On Spiritualism. By F. H. R.
On Small Steam Engines. By W. C. D.
On a Mathematical Fact. By E. H. W.
On the Human Will. By W. L. S.

Also enquiries and answers from the following: M. G. L.—E. W.—T., F & Co.—J. K.—J. G. T.—T. R.—A. E. O.—J. T. H.—S. T. J.—J. E. B.—F. H. W.—A. A. F.—C. C. C.—D. B.—G. W. H.—C. E. M.—J. K.—J. C. R.—G. C.—C. F. B.—J. C.—R. W. J.—J. B.—T. K. B.

### HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who publishes books on dressing and coloring furs, and on bleaching wool? Who sells magnesia and chloride of magnesium? Who makes machines for cutting thin stuff off round logs while the latter revolve? Who sells the best steamer for laundry purposes? Who makes steel castings? Who sells the best gage cocks, etc.? Are there glass-lined iron pipes in the market? Who makes engines suitable for boats 4 feet long?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

## INDEX OF INVENTIONS

FOR WHICH

**Letters Patent of the United States were Granted in the Week ending**

**February 16, 1875,**

**AND EACH BEARING THAT DATE.**

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### DESIGNS PATENTED.

8,057.—BRACKET.—N. L. Bradley, West Meriden, Conn.
8,058 to 8,061.—AQUARIUMS.—J. W. Fiske, New York city.
8,062.—CARPET.—A. Redfern, Philadelphia, Pa.
8,063.—SPICE CAN.—Z. R. Traver, Detroit, Mich.
8,064.—BOTTLES.—F. S. Upton, Rochester, N. Y.
8,065.—GAS FIRE LOG.—T. N. Dixon, Philadelphia, Pa.
8,066.—ALTO RELIEVO.—W. B. Gleason, Boston, Mass.
8,067.—HANDLE SOCKET.—J. R. Mackay, W. Meriden, Ct.
8,068.—CIGAR BOX.—M. Moll, New York city.
8,069.—FORK HANDLE.—C. Osborne, N. Attleboro, Mass.

### TRADE MARKS REGISTERED.

2,228.—CIGARS.—F. De Bary & Co., New York city.
2,229.—SALVES.—C Heinrich, Plainfield, N. J.
2,230.—MUSTARDS.—Jewett & Co., Milwaukee, Wis.
2,231.—MEDICINE.—J. Kaiser, Pittsburgh, Pa.
2,232 to 2,236.—CLOCKS.—F. Kroeber, Hoboken, N. J.
2,237.—CIGARS.—Lichtenstein & Co., New York city.
2,238.—MEDICINE.—E. G. Lewis, Pittsylvania county, Va
2,239.—PACKING.—W. H. Miller, Philadelphia, Pa.
2,240.—CIGARS, ETC.—G. Solomon, New York city.
2,241.—CIGARS.—J. M. Seip, Allentown, Pa.
2,242.—FERTILIZERS.—Walton & Co., Wilmington, Del.
2,243.—RAT POISON, ETC.—E. S. Wells, Jersey City, N. J.
2,244.—SUGARS.—Woods & Co., Baltimore, Md.
2,245.—SEWING SILK.—Brainerd & Co., New York city.
2,246.—BATHING POWDERS.—F. Rauchfuss, New York city.

### SCHEDULE OF PATENT FEES.

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|---|---|
| On each Caveat | $10 |
| On each Trade mark | $25 |
| On filing each application for a Patent (17 years) | $15 |
| On issuing each original Patent | $20 |
| On appeal to Examiners-in-Chief | $10 |
| On appeal to Commissioner of Patents | $20 |
| On application for Reissue | $30 |
| On filing a Disclaimer | $10 |
| On an application for Design (3½ years) | $10 |
| On application for Design (7 years) | $15 |
| On application for Design (14 years) | $30 |

## CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, FEBRUARY 12 to 24, 1875.

4,389.—A. Willson and E. M. Law, Bell Ewart, Ont. Car coupling. Feb. 12, 1875.
4,390.—Jas. Laing, Dundee, Scotland. Overhead sewing machine. Feb. 15, 1875.
4,391.—F. C. Porter, Buffalo, N. Y., U. S. Folding table. Feb. 15, 1875.
4,392.—C. W. Sellnas *et al.*, Montpelier, Vt. Door spring. Feb. 16, 1875.
4,393.—J. T. B. Bennett, Birmingham, England. Making coke and gas. Feb. 16, 1875.
4,394.—J. C. Tilton, Pittsburgh, Pa., U. S. Wash boiler. Feb. 16, 1875.
4,395.—J. Carpenter, Mariners' Harbor, Northfield, N. Y., U. S. Wagon spring. Feb. 16, 1875.
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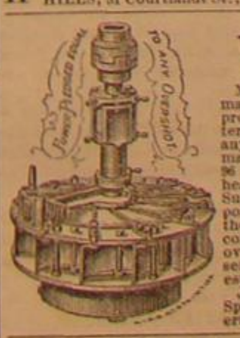

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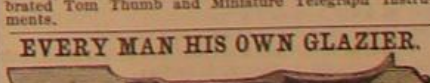

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