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Scientific American



AN ILLUSTRATED
JOURNAL OF ART, SCIENCE & MECHANICS

Vol. XXXIV



NEW-YORK
PUBLISHED BY MUNN & CO.

Центральна Наукова
БІБЛІОТЕКА при ХДУ
№ 110626

SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XXXIV.—No. 1.
[NEW SERIES.]

NEW YORK, JANUARY 1, 1876.

\$3.20 per Annum.
[POSTAGE PREPAID.]

SLOTING MACHINES.

We illustrate herewith a recently constructed slotting machine, the work of Messrs. New & Co., of Nottingham, England. It is a tool of great strength and admirable design, and embodies several improvements which enable the workman to keep all the operations of the machine immediately under control. It will be seen that the tool is fitted with a compensating balance, A, to the ram, acting in any position the ram may attain. It steadies the stroke and takes up any back lash that may be in the slide and connections. One end of the compensating balance lever is formed into a slot, carrying sliding blocks from the crank pin, giving the quick return and adjustable stroke. The link connecting the lever to the ram is fixed at the extreme end of the lever, which insures an almost direct vertical thrust without any side pressure. This arrangement relieves the ram slide of considerable friction, and thus effects a direct saving in wear and tear. The ram is provided with a bearing of exceptional length, so that it may be well and steadily directed in its stroke. A full stroke can be given, or a short stroke, close to the table or farthest from it. The screw for adjusting the height of the ram is worked from the front side at the bottom of the slot, B, for convenience. The machine is so arranged that all the movements, C, for the slide and tables may be worked from the side of the machine at which the workman stands, where are also placed the fly wheel and driving cone, with gearing at the opposite side. This arrangement has the double advantage of placing all the movements and adjustments to the machine within the convenient control of the workman, who has therefore no occasion to keep moving from the front to the back of the machine, and from back to the side, and then to mount on the table to adjust the ram, as in the ordinary machines, when setting work for operation. A further and most important advantage is that the machine can be placed as conveniently to the line shafting for driving as an ordinary lathe, the cone, D, being in parallel position to the shafting, and not at right angles, as in the ordinary way, where the cone is at the back of the machine. There is also ample provision made for varying the slide feed motions from one to ten teeth; and the circular table is provided with a simple and improved canting motion, so as to give a fixed and correct strip in key-way slotting. The proportions of the whole machine have been carefully considered in design and detail.

Chinese Acrobats.

A party of Chinese tumblers, lately introduced into the Chinese theater, San Francisco, are indeed marvels in their line. A number of athletic Mongolians appear, stripped to the waist, and begin a sort of combat on the stage. At first the fighting appears to be promiscuous; but six or eight finally ally themselves against one man and try to overcome him by springing against him and striking him full in the breast with the soles of their feet. He meets this curious mode of attack by standing like a statue, while the others fall heavily upon the floor. A number of tables are next brought

out and piled one above the other until a height of about twenty feet is obtained. A performer, whose weight is no less than 150 lbs., mounts them, and, springing in the air toward the floor and the stage, strikes both feet with a heavy thud upon the bare breast of a man standing about ten feet from the foot of the tables, throwing him violently to the floor. How a man can sustain such a blow is a mystery. Again the agile acrobat ascends to the top table, and, springing upwards, turns a somersault, while all the tables, except the lower one, are suddenly taken away. Upon the only table left he falls with a force apparently great enough

managers informed the reporter of the *San Francisco Call* that the tumblers are trained from childhood, and become habituated to the terrible concussions only by years of practice. He added that many are killed in training, or maimed for life. None of their feats are graceful, but simply indicate a tremendous amount of strength, nerve, and endurance.

A New Method of Finishing Photographs.

"In the first place, enamel your print, as enameling, though not absolutely a *sine qua non*, is a decided advantage. We will suppose this has been effected, the subject having been printed in an oval. Now let a mask be constructed, of eight-sheet cardboard, of sufficient size to entirely cover the enameled and mounted picture, with margin to spare; glue a piece of sand paper on one surface, rough side out, and when dry cut out an aperture of the exact dimensions of the picture to be finished, taking care the edge is accurate and smooth; adjust this paper die, so to speak, on the face of the enameled picture, and apply pressure. Passing them through an ordinary rolling press answers the purpose well. The result is that the parts in contact with the sand paper surface are roughened or rendered matt, offering a pleasing contrast to the polished surface of the picture, and in this consists the novelty.

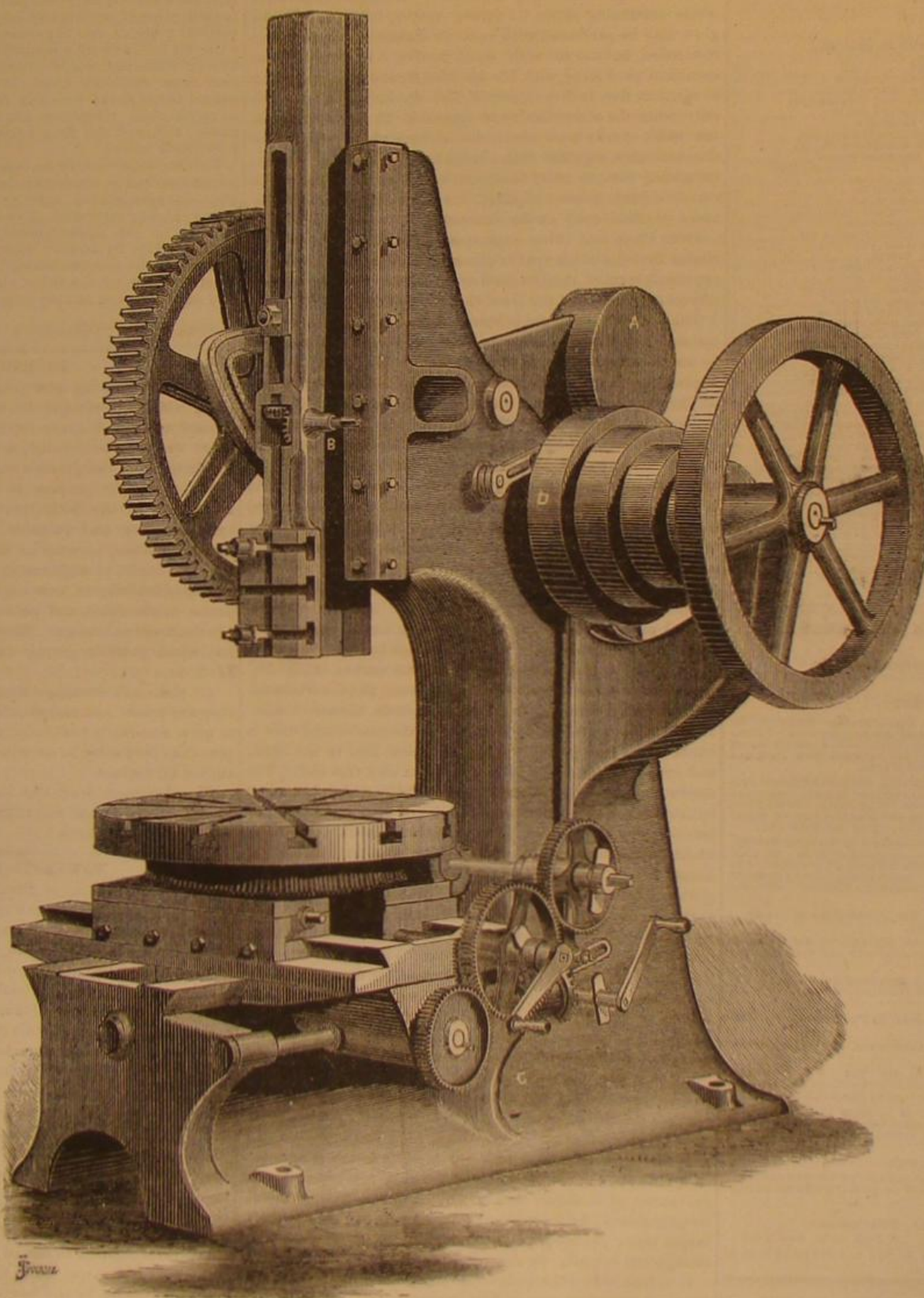
"Paper lace and various textile and other fabrics can be substituted for sand paper, or a metal plate could be engraved to produce any pattern. Many substances will suggest themselves to the experimentalist, and variety of ornamentation can be easily devised by altering the shape of the mask. For my own part I prefer sand paper to most other substances. Any degree of fineness of surface may be got by this means, and by slightly shifting the position of the mask and putting through the press after each alteration.

"I think that ornamentation, when produced by merely altering the texture of the surface, is of a much more refined character than when gold or color is applied for the same purpose. The plan here described has been found thoroughly workable with little trouble and less expense, as one sand paper mask will impress a great number of surfaces, and its renewal is most easily managed. All I can say to photographers, more than this, is to advise them to—try it."—*Eduard Dunmore, in the British Journal of Photography*

Alleged New Cereal.

A new cereal has been grown in the State of Oregon, and thus far no one has been able to classify it; for while it bears a general resemblance to wheat, yet its stalk, mode of growth, and heavy filaments cause it to be taken for rye or barley by the most experienced farmers. The grain was originally discovered in the stomach of a wild goose, by a farmer. From seven to ten stalks spring from one root, and attain a height, when ripe, of four and a half to five feet. They are very thin, compact, of a bright straw color, and extremely hard, as if they contained a large quantity of silica.

The thread on a $\frac{1}{2}$ inch gas pipe will sustain a weight of 5,000 lbs., $\frac{3}{4}$ inch, 7,000 lbs., and $\frac{1}{2}$ inch, 9,000 lbs., so that chandeliers cannot readily be shaken from their supports.



NEW ENGLISH SLOTTING MACHINE.

to break every bone in his body; but he leaps up again immediately and turns back handsprings across the stage. Again he climbs to the top of the tower of tables, while a second lies down upon a table a few feet from the base of tower. Turning a somersault in mid-air he falls upon the other body, the two breast to breast, and bounds off again with a second somersault. Other acrobats climbed to various altitudes and fell upon the stage, alighting square upon their backs with a force which was astonishing. These feats are all executed by men in a semi-nude condition, so that there is no chance for padding their clothes. While the Americans in the theater applaud, the Chinese make no demonstrations of approval, but sit looking stolidly on. The

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS.

One copy, one year, postage included.....\$3 20
One copy, six months, postage included..... 1 60

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VOLUME XXXIV., No. 1. [NEW SERIES] Thirtieth Year.

NEW YORK, SATURDAY, JANUARY 1, 1876.

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ETHERIC FORCE AND WEAK ELECTRIC SPARKS.

It was long ago observed that, under certain conditions—for example, when a large number of sparks succeed each other from the conductor of an electrical machine or from a Leyden jar—a spark sometimes appears which differs in a marked degree from ordinary electric sparks. It is less intense in illuminating power, less loud, produces a weaker sensation, and, when the space over which the spark passes is not too small, the center of the spark appears dark. The distinguished investigator, Professor Reiss, who first succeeded in producing these sparks at will, calls them "weak sparks."

The apparatus used by Professor Reiss consisted of a Holtz machine with a 15 inch plate, electrodes 11½ inches apart, and two small Leyden jars, the inside coatings of the

jars being in communication with the electrodes and the outside with each other. After the machine had been put in full action, the rotation of the disk was lessened and the positive electrode gradually withdrawn from the negative one. At first a stream of strong sparks passed between the electrodes, becoming less numerous as the distance increased. When the electrodes were about an inch and a half apart, weak sparks appeared, with an occasional strong spark, as many as a hundred weak ones to a single strong one. On separating the electrodes still further, strong zigzag sparks appeared, and with further separation the electricity was dissipated in the star and brush forms. Occasionally weak sparks are produced with a single jar, but not, as yet, at will.

The characteristic of the weak spark is an exceedingly small momentary flash broken by a perfectly dark spot, variable in size and in position, but always nearest the negative electrode. The negative part ends in a sharp point, the positive in several points, and is often bent aside, the two parts seldom lying in a straight line. The color of the spark is reddish; and though far weaker than the strong spark, its light is intense enough to be visible in full daylight. The sound of the weak spark is as unlike the crackling noise of the strong spark as that is unlike the sound emitted by the brush discharge, making it possible to distinguish weak sparks by ear even at a considerable distance. Another remarkable peculiarity of the weak spark is the narrow range which the adjustable electrodes may have while producing them. Strong sparks, brushes, and the glow may be produced with variable distances between the electrodes, but not so with weak sparks. Professor Reiss speaks of producing with his machine strong sparks, varying as much as five inches in length, but weak sparks appeared only when the electrodes were separated 21 or 22 lines. A few weak sparks were also obtained both above and below the electrodes, together with a large number of strong sparks, indicating that, in order to obtain weak sparks, not only is a certain electric density required, but also a particular arrangement of the density on the electrodes.

From these and other experiments, Professor Reiss concludes that the weak sparks present a new (that is, newly recognized) form of electric discharge, a form relating especially to discharges of the least electric density.

These observations are of special interest just at this time, inasmuch as the phenomena in question were at first thought by us to correspond with those to which Mr. T. A. Edison applies the name etheric force. The truth is that the two sets of phenomena are distinct and apparently unrelated.

Thus far all attempts to generate the Edison "etheric force" by means of an apparatus such as Professor Reiss employed have been fruitless. It has been produced only by means of an interrupted current from several electropile cells, using a vibrator magnet or an electro magnet operated on by an ordinary telegraph key, the current following a wire connected with the core of the magnet or with a piece of metal within the magnet's sphere of influence. The force manifests itself as a spark when the wire is rubbed against a piece of metal; when a body of metal, as a stove or gas pipe, is connected with the wire and touched by a piece of metal, as a knife blade; or when two carbon points are brought in contact in a dark box, one carbon being connected with the wire leading to the magnet, and the whole apparatus being carefully insulated to exclude inductive electricity. Sparks are also obtained when the conducting wire is rubbed by a lead pencil or a piece of metal held in the hand, and even when the wire is rubbed by its own free end. The conducting wire does not require to be insulated. It may be led through water, wound around large bodies of metal, or trailed along the ground, yet the sparks appear. One rainy night Mr. Edison led the wire from the vibrator out of doors, across the sidewalk, up and down the block in the gutter, through which a torrent of water was pouring, thence by an alley way to the rear of his laboratory, and thence up stairs to the floor above, where the sparks were distinctly seen between carbon points in a dark box. (This box was illustrated in our last number.) On another occasion the vibrator was connected by means of a wire with the general system of gas pipes of Newark, whereupon signals were transmitted, without other connection, to his house in a distant part of the city. These experiments, however, do not prove that any "force" traversed the wire or the gas pipe, as the force might, by short circuit over the table, have reached the carbon points.

The hypothesis that etheric force, so-called, may be a new or hitherto unrecognized mode of electric action is supported by the appearance of the spark, which resembles that of galvanism of moderate tension; by its preference for metallic conductors; by its rapid motion, its velocity for short distances being practically instantaneous; by its being resisted, though but slightly, by electric non-conductors.

It differs from electricity—especially inductive electricity, to which its sparks were at first attributed—in that its sparks are different in appearance and effect. They scintillate, and require the actual contact of the points at which they appear. It differs from electricity in general in its entire independence of polarity. It does not require a circuit. It does not require insulation. It will not charge a Leyden jar. It fails to affect chemical compounds which are extremely sensitive to electricity, as, for example, iodide of potassium. It has no effect upon electrosopes or galvanometers. It is not felt upon the tongue, and causes no contraction in that most sensitive of all tests, a galvanoscopic frog. In Dr. Beard's experiments, the force was passed through a frog, causing no contraction; yet the same frog contracted in response to a galvanic current from one cell, after it had overcome a resistance of over one million ohms, or about 75,000 miles of

telegraph wire. This absence of chemical and physiological effect is probably owing to the extreme facility with which the force traverses the substances experimented with: meeting little or no resistance, the force passes on unchanged where electricity would be wholly or partially transmuted into some other mode of motion, resulting in chemical or physiological action. Substances which strongly resist the passage of electricity—glass, hard rubber, etc.—have much less influence upon "etheric force" so much less that such non-conductors of electricity may be practically regarded as good conductors of the new force.

Enough has been said to show that Professor Reiss and Mr. Edison are pursuing two widely different lines of investigation. So far from being identical, the phenomena are at variance in every particular: the cause of the one being statical electricity of low tension, and the cause of the other—etheric force, as Mr. Edison calls it—being, if not a new and distinct phase of force, as he suspects, at least a new and hitherto unstudied phase of electricity. In either case, Mr. Edison will rank with the most fortunate and eminent of scientific discoverers.

Since the above was written, Mr. Edison has sent us the following note in relation to the galvanoscopic frog experiment:

To the Editor of the Scientific American:

I have ascertained that the slight contractions in the legs of a galvanoscopic frog, upon the passage of the etheric current through it, were not caused by electricity, but by the transmission of mechanical longitudinal vibrations by the electrical vibrator over the conducting wire, as was proved by a tuning fork and by a resined pad. In fact the tuning fork, during vibration, would produce contractions when held one inch away from the frog. When the etheric current was passed through the wire and frog, without the transmission of mechanical vibrations, not the slightest effect was produced, although the frog exceeded in delicacy any of those previously tested.

Further experiments in other directions have been made which resulted in rendering the phenomenon more inexplicable. An uninsulated wire proceeding from the source of power (highly insulated, of course) was taken into the street and laid in the gutter around a whole block, and back into my laboratory by another door, and up to the floor above the one where the generator was. Excellent sparks were drawn from that end of the wire, although the ground the wire laid on was wet, it having rained all night.

THOMAS A. EDISON.

Newark, N. J., December 8, 1875.

TO ENGINEERS.

With the opening new year, we have the satisfaction of being able to command in our SUPPLEMENT a greatly increased amount of space—no less than sixteen large pages every week—to be devoted, as heretofore announced, to scientific topics of the greatest value and utility to our readers.

We especially purpose to make the ENGINEERING DEPARTMENT of the SCIENTIFIC AMERICAN SUPPLEMENT as full, complete, and valuable as possible: to this end we invite Engineers to send us for publication, whenever they can, full copies of engineering plans, with detailed drawings and specifications, of new engineering or mechanical enterprises, mechanisms, and public and private works, of notable character or design. These we shall engrave and publish when possible, giving due credit to the parties who favor us.

All plans and drawings should exhibit the scale to which they are made; and care should be taken in the specifications to give, accurately and fully, all principal dimensions. Papers thus forwarded to us will be carefully preserved and returned on request.

The amount of fresh and important engineering information furnished by our SUPPLEMENT in the course of the year will be very extensive.

POWERFUL EXPLOSIVES.

The recent disaster at Bremenhaven, Germany, in which so many persons lost their lives, calls public attention to the great danger attending all explosive preparations in which nitro glycerin is the active ingredient.

Dynamite, called giant powder (infusorial earth and nitro-glycerin), dualin (sawdust saturated with nitro-glycerin and saltpeter), lithofracteur (dynamite with coal, soda, saltpeter, and sulphur), vulcan powder (a product similar to lithofracteur), rend-rock, and many other compounds before the public under various names, which derive their explosive force from nitro-glycerin, are especially dangerous, and should not be allowed to be stored or transported, except under special conditions; for although, when freshly made, they are not so liable to explode by friction or slight concussion as the terrible liquid to which they owe their potency, they are all of them exceedingly sensitive to decomposition, excited by change in temperature which is followed by generation of heat, and is the forerunner of spontaneous combustion.

Professor Draper, in one of his works on popular science, states that Nobel was led to the experiments from which resulted dynamite by the fearful explosions of nitro-glycerin at Aspinwall, San Francisco, Sydney, North Wales, and elsewhere; and he adds that M. Guyot, a French chemist, has shown that the nitro-glycerin may exude from its absorbent, and saturating the paper of the cartridges and boxes, resume the state in which it is readily exploded by a slight blow.

Nitro-glycerin has a sweet, pungent, aromatic taste, but produces a violent headache if placed upon the tongue or even allowed to touch the skin at any point; thus those working with it or its compounds suffer excruciating pain. It also freezes at a very high temperature (39° to 40° Fah.); and before being used in winter, it has to be thawed out in order to explode it. This operation, on all the compounds alluded to, causes the nitro-glycerin to exude, and if they

are not quickly used, decomposition is liable to set in. And if once the absorbent yields up its nitro-glycerin, and the compound becomes moist, it will explode by a slight jar or shock. (See W. N. Hill, "On Certain Explosives.")

At this time, when engineering operations of vast extent are in progress and in contemplation, it is useless to expect that the employment of such materials, dangerous as they are, will ever be discontinued; and it becomes the duty of scientific men to look for some more controllable explosive. Such a preparation is found in pulp-compressed gun cotton, whose density is 62 lbs. per cubic foot, and it is considered six times as strong as gunpowder.

Vast strides have been made in improving this material by Professor Abel, of England, in the last few years; and his patent process enables him, it is stated, to manufacture it with perfect safety, and to transport and explode it in a wet state, and even store it under water without deterioration.

The English War Department recently appointed a special commission, composed of nine well known officers and gentlemen, to inquire into the whole system of manufacturing, storing, and using the different known explosives. In arranging the substances in the order of relative danger, they gave them thus: Nitro-glycerin, gunpowder, dynamite, lithofracteur, and, lastly, compressed gun cotton. "The investigation," writes a member of this special commission to the *London Times*, in April of this year, "was entered upon with a certain amount of prejudice against gun cotton, arising from the catastrophe which occurred at Stowmarket in the year 1871. A careful inquiry into the circumstances, however, conclusively showed that it was not the result of accident, but that it was caused by the wilful and malicious act of some person, possibly not aware of the grave consequences of this criminal proceeding." . . . "I feel," the writer continues, "that any one who will read the able and exhaustive report of Major Majendie, R.A., on this subject, must arrive at this conclusion;" and he further adds that "the improved gun cotton is manufactured by an entirely wet process throughout, the last stage being the formation of disks or short cylinders of various diameters by hydraulic pressure, in which state they contain 18 per cent of moisture, which is increased by the addition of water to 25 per cent, for the purpose of securing uniformity and a larger margin of safety, and because the gun cotton in this state can still be exploded, but only under special conditions applied by an expert. This fact was not known till some time after the date of the explosion referred to, it then being the practice to dry the disks and to store and transport them in that condition. In that state gun cotton cannot be exploded by any collision, however violent, even by a rifle bullet fired into it; nor even inflamed, unless it is enclosed in strong hermetically sealed cases, so that it might be transported by railway if some simple precautions were taken. In the damp state, as exclusively offered for transport, and without the appliances alluded to above, it cannot even be ignited, much less exploded, either by a spark, by heat, by friction, or by a collision, even if it resulted in the extreme case of the contents of a locomotive fire box being emptied upon a truck full of gun cotton; while, if exploded surreptitiously, it must be the act of a skilled malefactor, provided with the necessary appliances of dry gun cotton, waterproof materials, special detonators, patent fuzes, or electrical apparatus, and thoroughly acquainted with the *modus operandi*."

The result of the English investigation caused England, Germany, and France to adopt the use of gun cotton for torpedoes, submarine mining, and in the water shell, the two former governments manufacturing their own, while France has made a large contract with a company (manufacturing under Abel's process in England) to supply it. Walter N. Hill, chemist to the U. S. Torpedo Station, Newport, R. I., in his "Notes on Certain Explosive Agents," in speaking of gun cotton, says: "By the method of Abel, a perfect washing is obtained; and in addition, the material is prepared in a form convenient to use and yet perfectly safe. For blasting, demolitions, torpedoes, etc., the pulp-compressed gun cotton is an admirable agent. Wet compressed gun cotton is the safest of all explosive agents; it is not liable to be fired by a spark or a flame, nor affected by blows, friction, or other rough handling. The transportation of gun cotton presents no special difficulties, since there is no danger of leakage, neither is it sensitive to blows. In England, many of the railroads transport it as readily as other freight."

In selecting an explosive, and considering its advantages and disadvantages, too often the health of the employees is taken least into consideration. The smoke from gunpowder is deleterious in the air of mines, and the headache caused by the fumes of nitro-glycerin, or even by touching it or any of its compounds, must be most injurious to the health. Dr. Angus Smith, F.R.S., in his report to the English Parliament, says, in reference to gun cotton, that, owing to its freedom from smoke: "In every trial in which the effect on the senses, or the breathing, and, as far as we can judge, on health, was considered, gun cotton has come off with the highest character. I feel much confidence in speaking thus highly in its favor."

The value of life and health should be considered by all those who have it more or less intrusted to their power, as in the case of mining operations, where the owners or managers decide upon what explosive shall be used on their works; and in this age of progression and enlightenment, we feel justified in calling attention to Professor Abel's much-needed invention, which has been tested and vouched for by so many high authorities.

THE PLUMBER'S HARVEST TIME.

Now is the season of gloomy forebodings for the luckless city tenant. A very large number of houses in this city have been built simply to sell; and while their construction is frequently bad, the owners often insist upon putting in plumbing that is perhaps a shade worse than anything else. We have seen nearly a whole ceiling drop in a new house, because a plumber had forgotten to make a connection between a waste pipe and a bath tub. This is a specimen of a state of affairs in which constant trouble with the water arrangements is to be expected, and which cannot be guarded against even by average care. The occupant may find that his street pipe will freeze early in the winter; and if he seeks a reason, he will discover that the builder, in cutting into the rock which underlies very many New York up-town streets, has only blasted out the cellar, and the authorities have made a trench in the street deep enough for the mains; but the intervening ridge of rock between the dwellings and water mains is left, because it was expensive to remove it. The supply pipes are curved up over it to reach the house, and, of course, the uppermost part of the curve is far within the frost line of the ground, and sometimes close to the surface; and the freezing of that pipe is a necessary consequence. Another favorite plan of builders is to supply three houses from one connection to the main, a cheap dodge to avoid tapping the large pipe and ripping up the street for each house. The central house has a straight pipe, and the houses on each side have branches therefrom. The beauty of this is that, when the central pipe freezes near the main, three households are deprived of water instead of one.

With good plumbing work throughout a house, there is no reason for serious results of accidents, if the occupant will take proper precautions to prevent them, or if, in event of casualties happening, he inform himself as to what invention has done since last winter to help him out of his dilemma. The simplest way to prevent pipes freezing when water is abundant is to let the water run in a fine stream constantly from one of the faucets. If there is a strong head of water in the upper stories, open the kitchen faucet wide at night, and drain all the pipes through the house above, shutting off the water from the street for a few minutes during the operation. In this way, the house pipes, being empty, cannot freeze; and the water, turned on again, will maintain a constant circulation from the main to the faucet, which, as before stated, should be left partially open. There is usually a stopcock located near the kitchen sink, which can be turned so as to prevent the water re-ascending above the kitchen floor. If the house is warmed with a furnace, and stands between other occupied houses, the chances of the pipes in the walls being frozen is very slight; but if the house next door is empty, and the pipes are carried up on the wall through which no heated chimneys run, then freezing is quite probable.

When a pipe from the street freezes, the range fire should be at once extinguished, as otherwise the water back will either blow up, or be burnt out: in the former case serious damage is possible. Last winter, the plumbers dug up the streets, and built fires over the supply pipes, and went through other operations, which generally resulted in a bill of from eighty dollars to one hundred dollars. At the present time, if an invention, which we recently examined prove as useful as appearances indicate, the cost of such proceedings will be greatly reduced. The apparatus is a small steam boiler, heated by a pan of charcoal beneath it. The hot water—not steam, as in this machine a constant supply of water against the ice is found to thaw the same quicker, paradoxical as the fact may appear—is forced into a small rubber tube, the end of which has a metallic tip, and around which stout copper wire is spirally wound. This wire is held in a coil in a rotating wire cage, and freely unwinds as it is pushed into the pipe. When the end meets the ice, the pushing by hand is stopped, but is continued by an ingenious spring arrangement. By the spiral wire the tube is literally screwed into the ice, which is softened and melted before it by the continual stream of hot water issuing from the end of the pipe.

We might add that there is still an excellent field for invention in other devices of the same description; and at the same time we might suggest, to inventors already in possession of similar patented apparatus, that now is the time to bring them to the notice of the people.

THE ANALYSIS OF COW'S MILK.

The universal complaints as to the quality of the milk sold in cities, which is almost universally diluted with water, make the diffusion of knowledge on the subject of great importance to the public health.

There is an instrument used called a lactometer, which is nothing but an hydrometer, such as is used to ascertain the strength of distilled liquors, etc.; but for use in milk it is specially graduated from 1,000° to 1,050° or thereabouts, and it indicates the specific gravity of water, in which it sinks deepest, at 1,000°, and that of the heaviest milk at 1,032°. The specific gravity of milk may vary from 1,026° to 1,032°; if it is less than 1,026°, it is certainly diluted with water, and if above 1,032°, it has been thinned of its cream, as the presence of cream makes the average gravity of the milk lighter. Therefore, if milk is skimmed and watered both, the lactometer gives no satisfactory indication; and it is surprising that the instrument has not been rejected by practical persons long ago.

Unfortunately, there is no test by which the quality of milk can at once be correctly determined. The comparative transparency may be considered to be a better test than the gravity, as it will show if the milk has been skimmed, as well as if it has been diluted with water, but its indications

are only approximate. A better way is to let the milk settle, at a moderate temperature, in a tall cylindrical glass; in 24 hours the cream will have collected on the top to the thickness of one fifteenth part of the height of the milk. If the milk is pure; if the milk has been skimmed or diluted, the cream layer will have less thickness. This operation, however, takes 24 hours before any result can be arrived at; besides, it indicates only the quantity of the butter, and not the proportions of the other ingredients, nor the presence of adulterants; so that a regular chemical analysis is the only reliable method.

The best analytical method is that of Brunner, which takes only 25 minutes to accomplish. The milk is placed in a glass vessel, and the gross weight of milk and glass is ascertained with a good balance; then 60 or 90 grains of the milk is poured into a shallow metallic capsule of about 2½ inches diameter, the exact quantity being determined by ascertaining the diminution of weight of the glass vessel and its contents. Then 450 grains of pure fine quartz sand is added, which, however, must have been cleaned from dirt and fine powder by rubbing in a sieve; and the sand and milk are mixed with a small spatula, so that the milk is absorbed and the whole appears like a uniformly moist sand. Then the capsule, with sand and spatula, is again weighed, and evaporated on a water bath at 212°, being continually stirred; after fifteen minutes, the capsule is removed and cooled, and the loss of weight ascertained. It may be well to heat the capsule again for 5 minutes, so as to see if any further loss of weight can be observed; but this will rarely be found to be the case. The loss will be the amount of water contained in the milk, and this must be no more than 78½ per cent. Good cow's milk contains from 77 to 78 per cent of water; and if more than 78½ per cent, say 79 per cent, is found, it is certain that the milk has been watered.

But as refinements in the art of adulteration may have taught the addition of solids, such as sugar, boiled starch, etc., the next test is to correctly ascertain the amount of butter. For this purpose, 300 grains of the milk is mixed with half its weight, 150 grains, of charcoal powder, previously cleaned from dust in a sieve; the mixture is dried by moderate heat (from 150° to 160° Fah.), and then placed in a glass tube about 2 feet long and of ¼ inch diameter, drawn out at its lower end to a narrow opening, which is closed with a plug of cotton, to prevent the charcoal from falling through. The tube is then suspended in a vertical position, and about 450 grains of ether, or of sulphide of carbon, is poured in; this will flow out at the bottom, charged with all the dissolved butter. To secure a complete dissolution of the butter, the ether is poured back through the charcoal in the tube once or twice, and finally 450 grains pure ether is added in small portions, to wash away the remaining butter-charged ether; and at last a mixture of 1 part ether and 3 parts alcohol is passed through. All these fluids are collected together and evaporated in a porcelain dish, and the butter obtained is measured by weight. It should not be much less than from 3½ to 5 per cent of the milk employed; for 300 grains of milk, it should be from 10 to 15 grains. But milk will vary as to butter perhaps more than as to other ingredients; and it may be considered certain that a proportion of butter of 2 or even 2½ per cent indicates certainly that the milk has been skimmed, while a proportion of 3 per cent leaves it doubtful whether the milk is pure or has been tampered with.

When the amounts of water and butter in the milk are found to be normal, it is scarcely necessary to ascertain those of the casein and milk sugar, the tests for which are not so simple. The quantities should be nearly 4½ per cent of casein and 4 per cent of milk sugar. The other ingredients are chiefly calcium phosphate, 0.23, and potassium chloride, 0.14 per cent; and phosphates of magnesium and iron, with chloride of sodium, are each present in quantities of 0.04 per cent or less.

It is evident that, if adulterants have been added to conceal the dilution with water or the skimming, the above described analysis will show them, either by an excessive quantity of dry residue or by a deficient quantity of butter.

DAUGHTERS PLAYTHINGS.

Another factory for the manufacture of toy torpedoes has exploded. The circumstances of the disaster are of no moment to any one except the unfortunate victims, and the owner, who is fortunate in escaping similar mutilation. Notwithstanding the average boy's devotion to snap and bang, it may be questioned whether the pleasure afforded by playthings of the explosive sort is anything like a sufficient recompense for the risk attending their production, storage, and use. It has been suggested that the sale of such things should be prohibited and their possession made punishable by fine. The suggestion is sensible and timely. The Centennial year, with its intensifications of Fourth of July fervor, is upon us, and the popular demand for fireworks threatens to be excessive. It would be a good thing for the country at the beginning of its second century to put away such childish things, and adopt a less dangerous mode of manifesting the spirit of jubilation, political or other. Surely our inventors ought to be able to devise a simple contrivance to serve as a substitute. It is worth trying for, as a public benefaction as well as for the millions that are in it!

The lagging of steam pipes was lately considered by the *Société Industrielle de Mulhouse*, France. The president, M. Forey, acknowledged that cork was a good non conductor of heat, but it was costly. The most efficacious covering, says M. Forey, consists of straw laid lengthwise, about 1 inch thick, round the steam pipes, tied with string, and covered with tarpaulin or cloth tarred after fixing.

ON November 15, 90 miles of new railways were opened in Italy, including that from Tuoro to Chiusi.

IMPROVED VERTICAL WOOD-BORING MACHINE.

We recently published an engraving and description of a wood-boring machine of English manufacture. The apparatus was a good representation of superior English workmanship, and therefore the improvements included in its construction may be fitly contrasted with those embodied in the latest similar machine of American make, of which we now give an excellent engraving. The points of difference show, we think, a preponderance of advantages on the side of our own production, of which the reader can judge for himself by comparing the description of the English machine already published with that which follows:

The American has a frame strongly constructed of a hollow column, heavily braced by I-shaped web ribs, and a broad base, well calculated to resist jarring and trembling. The table is also strongly made, and is adjustable to any angle or position. It can be raised and lowered by means of a rack and pinion, turned on its axis, and can be tightened at any length by a simple turn of the handle, which closes a long split bearing. The table proper can be inclined at different angles, and the upper part may be moved out or in, revolved, and adjusted. A cone pulley of three steps enables the operator to run the machine at three different speeds, for large, medium, or small sized machine augers. It has a commodious self-returning treadle, which requires very little power to bring the auger bits to the necessary depth.

Holes can be bored, at any angle, from $\frac{1}{4}$ of an inch to 3 inches diameter, and from $\frac{1}{4}$ of an inch to 12 inches depth. An adjusting stop on the connecting rod gauges the depth of the hole. The rests on the table can be adjusted for straight, square, oval, circular, and bent work. The idler pulleys (which are frequently a source of trouble in such machines) do not need re-adjusting for different heights of the countershaft from the machine. The manufacturers direct special attention to the facility with which a number of holes, with variations of angle, can be accurately bored. In the slots of the radius brace one or two stops can be inserted in such a way that the table can be swiveled from a horizontal plane to either side; and, as the table slides forward and backward, and can be turned on its axis, it is obvious that, in a piece of timber, a number of holes can be bored which differ in angle and place without moving the work about. The machine is adapted for boring short as well as long pieces of material, and will do the work, it is claimed, with great ease and rapidity. The countershaft with cone pulley, as shown in the engraving, may be set on the same floor with the machine, or attached to the ceiling, so that the belt may pass from either side, in an inclined direction or perpendicularly. The tight and loose pulleys are of 9 inches diameter, $2\frac{1}{4}$ inch face, and should make 250 revolutions per minute.

The machine obtained the first premium at the Cincinnati Industrial Exposition.

Patent applied for through the Scientific American Patent Agency. For further particulars address the manufacturers, Messrs. Bentel, Margedant & Co., Hamilton, Ohio.

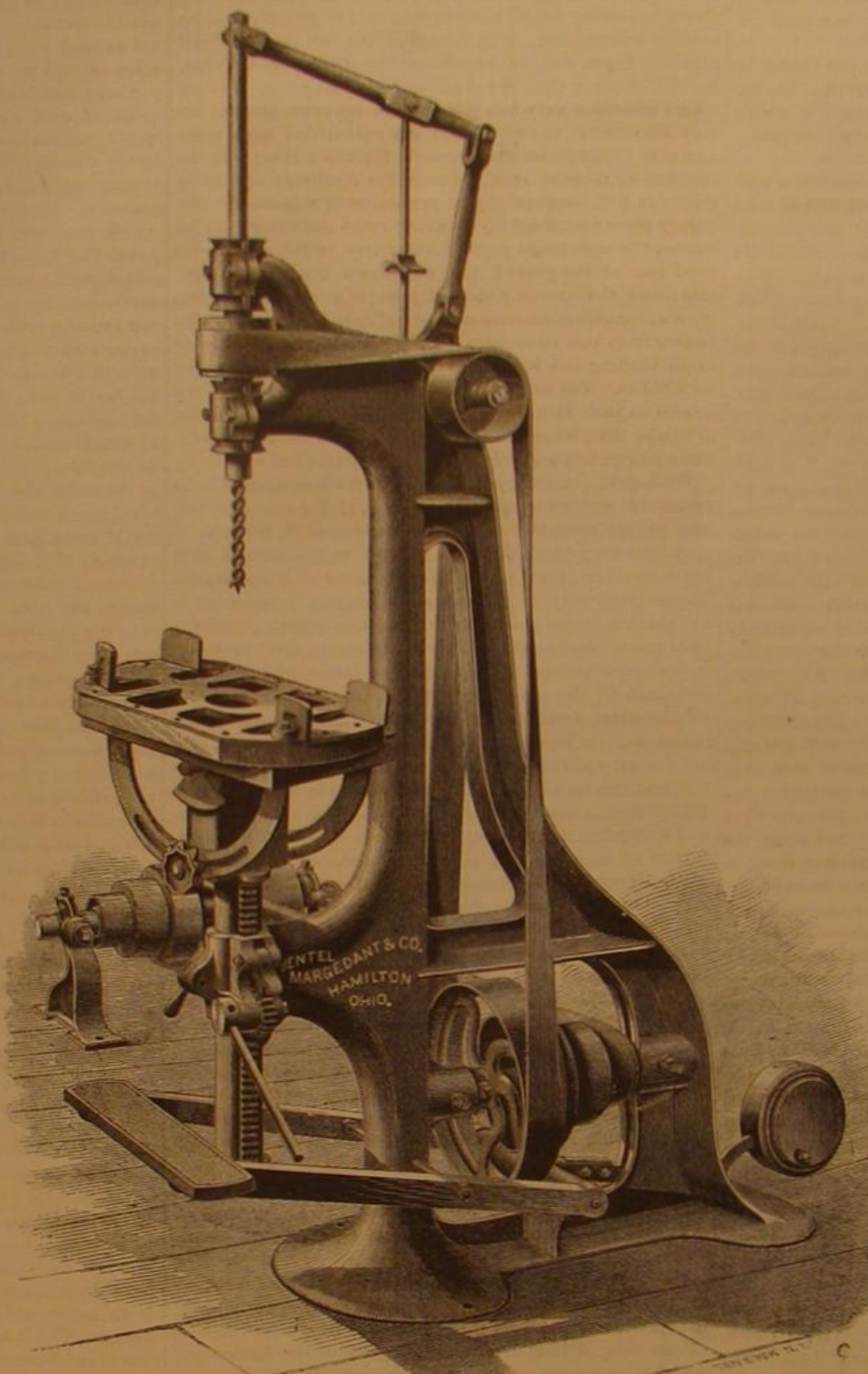
IMPROVED SHOW CASE.

There exists, at the present time, among those who purpose exhibiting goods at the coming Centennial, an increasing demand for simple and portable devices adapted to holding articles while displaying the same to good advantage. It is probable that there will be a very large number of small exhibits, in the shape of the handiwork of individuals or of specimens and samples of various productions, which must be well protected from possible handling. For neat show cases, after the style of construction of that here illustrated, there should be a ready market, as many exhibitors will find it no small convenience to be able to box up their show cases with their goods, and thus be assured that their display will be well secured and arranged.

The advantages of the invention, which is represented in perspective in Fig. 1, are that it is composed of a number of easily detachable pieces, which allow of its being packed into small compass, and which, when set up, form a strong case, the joints of which cannot work loose through the effects of dampness.

As shown in the sectional views, Figs. 2 and 3, the posts, A, are attached to the bottom of the case by screws,

and in their sides grooves are formed to receive the ends of the panes of glass. On the under side of the top and on the upper side of the bottom are fastened small strips, which also have grooves to receive the edges of the glass, and besides serve to brace the posts in position. The top is also attached to the posts by screws, and by removing it the glass may be easily disengaged, the doors which are hinged to the rear part of the bottom taken off, and the whole case thus separated into several portions. The device thus constructed, it is claimed, may be more cheaply and easily made than

**VERTICAL WOOD-BORING MACHINE.**

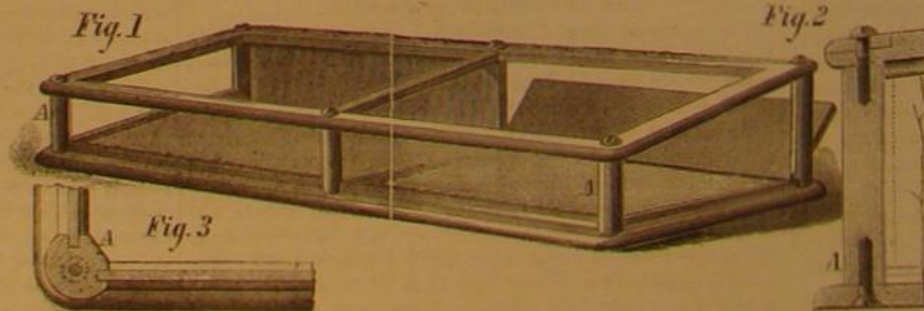
those not constructed to take apart. The case may be made of any shape—upright, octagon, or round. The posts and strips can be produced in long pieces, like molding, and polished and finished before being cut. The bottom may be molded with a "frizzer," and the top made with machinery similar to that used for manufacturing sashes. The case may be taken apart and cleaned or repaired without disturbing the contents. If preferred, instead of screws being used to connect the top and bottom to the posts, poles may be made through the latter, and bolts passed through and

ble, and change it; but don't let any uneasy desire to get along fast, or a dislike of your honest calling lead you to abandon it. Have some honest occupation, and then stick to it; if you are sticking types, stick away at them; if you are selling oysters, keep on selling them; if you are at the law, hold fast to that profession; pursue the business you have chosen, persistently, industriously, and hopefully, and if there is anything of you it will appear and turn to account in that as well as or better than in any other calling; only, if you are a loafer, forsake that line as speedily as possible, for the longer you stick to it, the worse it will "stick" you.

Animal Intelligence.

A retriever dog, whose owner was working in the garden of the Bath Institution, lately killed a favorite cat, a frequenter of the same grounds. Having committed the unprovoked murder, the dog deliberately took the cat in his mouth, carried it some distance, dug a deep hole behind some bushes, and, after depositing the cat therein, carefully replaced the earth; and had he not been observed, there would have been no evidence of the crime. Shortly after, the dog lost his life by poison, probably a

penalty for the offence. In the neighborhood of Bath, a gentleman possesses a pair of carriage horses, one of which evinces more than ordinary intelligence when his own ends have to be served. If the horse hears, even in the distance, the very first movement of a mowing machine, he connects the sound with fresh grass, and at once taps with his hoof at the boarding of the stall to summon the coachman for a supply. At first this is done

**HASENRITTER'S SHOW CASE.**

set up with fancy nuts outside. This would give a still stronger joint.

Patented August 31, 1875. For further particulars regarding sale of patent or portions of same, address the inventor, Mr. Robert H. Hasenritter, Hermann, Gasconade county, Mo.

An alloy for locomotive whistles which will give a good clear sound is made of copper 80 parts, tin 18, and antimony 2.

gently, but if time passes he imperatively demands attention, or it is doubtful if the stable would contain him. The coachman lives adjoining the stable, and, much to his discomfort, the horse sometimes has imaginary wants during the night, and repeats the same process; and at whatever hour this occurs, the coachman is under the necessity of getting up to attend to him.—*Nature*.

SCIENTIFIC AND PRACTICAL INFORMATION.

SOUND MADE VISIBLE.

A sound writer, called an opeldoscope, is a new invention. On the end of a two inch tube is pasted a piece of thin rubber or tissue paper. In the center of this is fastened a piece of looking glass, one eighth of an inch square. Hold this end in the sun and the other end in the mouth, and sing or speak in it. The ray of light reflected from the mirror falling a white surface describes curves and patterns differing for every pitch and intensity, while the same conditions give uniform results.

BROMOFORM IN COMMERCIAL BROMINE.

Reyman found a specimen of bromine to be contaminated with 10 per cent of some foreign substance boiling from 176° to 329° Fah. He found it to consist largely of bromoform, and he recommends to test every specimen of bromine for bromoform. Too small a percentage of bromine in water saturated with bromine (as well as the characteristic odor of bromoform, which is particularly strong when the bromine is mixed with a solution of iodide of potassium), and the separation of iodide, which can be decolorized by hyposulphite of soda, are sure proofs of the presence of bromoform in bromine.

PRINTING INK THAT CAN BE BLEACHED.

The ordinary printing ink, as our readers well know, is made from the finest kind of carbon, namely, lamp black, mixed with oil, and is proof against air and all bleaching agents. The only method by which it can be removed from the paper on which it has been printed is mechanical. In the manufacture of white paper from old newspapers, the difficulty of removing the ink is considerable. We learn from *Dingler's Journal* that Kircher and Ebner have invented a new kind of iron ink for printers' use, which resembles our writing inks. Iron is dissolved in some acid, such as sulphuric, muriatic, or acetic, and one half of the solution oxidized by nitric acid, after which the two portions are mixed and the black proto-sesquioxide precipitated by means of soda or potash. This precipitate is filtered out, well washed, and mixed with equal parts of a solution of tannic and gallic acids, which produces a beautiful blue black or pure black pigment. This pigment is well washed and dried, and then mixed with linseed oil varnish, forming an excellent ink for letter press as well as for lithography, wood cuts, and steel and copper plate printing.

Paper printed with this ink can be bleached by putting it into a bath of pure water to which 10 per cent of caustic soda or potash has been added. It is left there 24 hours; then put into a rag engine, cut fine, the pulp thrown on a cloth and allow to drain, washed with clean water to which 10 per cent of hydrochloric, acetic, or oxalic acid has been added, digested 24 hours, and again used for making paper.

HYDROSULPHITE OF SODA IN THE INDIGO VAT.

Dr. Reimann, in his *Fürber Zeitung*, gives the following account of his observations on the use of the new hydrosulphite of soda indigo process, during his tour through Belgium. At Verviers it is in successful use, effecting a large saving of indigo. In Simonis's dye house, 13 lbs. of indigo are saved on every 40 lbs. Peltzer has had like success. The only disadvantage is that the process is patented in France, Belgium, and the terms on which the patentees allow dyers to use it are exorbitant. It has not been patented in Germany, and dyers there are free to make use of it, reaping the whole advantage without any expense, and yet it seems not to be in use there.

CAVING OF A COAL MINE.

At Wilkesbarre, Pa., recently, the walls of a large coal mine caved in. Fortunately the miners were notified of approaching trouble, and all escaped. Huge boulders are said to have been thrown out of the mouth of the tunnel by the compressed air as if they had been pebbles, and the shock of the crash was like an earthquake. The hollow chambers echoed the dismal sounds, and, taken altogether, the scene was one calculated to intimidate the heart of the hardest miner in the land.

Where to Look for Arsenic in Cases of Poisoning.

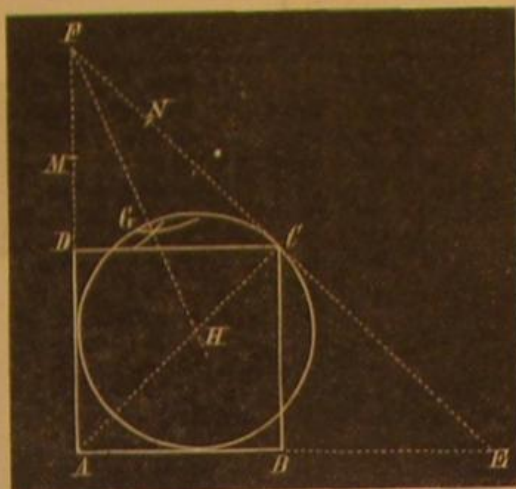
Observations of great toxic importance have lately been made by Sciosuboff (*Soc. Ch.* August, 1875) with reference to the distribution of arsenic in the tissues of animals in cases of poisoning. Contrary to general belief, he finds the arsenic specially condensed in the nervous tissues. The experiments were made with dogs, rabbits, and frogs. Dogs bear large doses of arsenic readily, taking without difficulty fifteen to eighteen times the quantity which, weight for weight, would be fatal to man. A bulldog took for thirty-four days gradually increasing quantities of sodium arsenite in his food, rising from 0.075 grain to 2.2 grains a day. The results of the poisoning were acute and quite marked. Calling the amount of arsenic found in 0.22 lb. of muscle 1, that in the same weight of liver was 10.8; brain, 36.5; spinal cord, 37.3. A dog of 24½ lbs. weight was killed by subcutaneous injection of sodium arsenite, in 17 hours. The arsenic from the brain gave a decided reaction, that from the spinal cord was less, while in the liver and muscles only traces could be detected,

A GEOMETRICAL PROBLEM.

A correspondent recently proposed a neat little geometrical problem, which has been investigated with interest by several correspondents. We give the problem and solution in full.

Problem.—A square being given, it is desired to draw a circle passing through an arch and tangent to the two opposite sides.

Let $ABCD$ be the square, and let the circle be required to pass through the angle, C , and be tangent to the sides, AD and AB . Draw the diagonal, CA ; it is evident that the center must be in this line, as every point in it is equidistant from the sides, AD and AB . Draw a line perpendicular to AC , and produce it until it intersects, through C , the pro-



longations, AE and AF , of AD and AB . We have then a triangle, FAE , of which the sides, AF and AE , are equal, and in which we have only to inscribe a circle, according to the well known rule of bisecting the sides. The line, AC , bisects already the right angle in A , and by bisecting the angle at F , by the arcs at G , drawn from the points, M and N , as centers, on the line, FG , we obtain (by the intersection of this line with the line, AC) in H the center of the circle, of which HC will be the radius. The circle drawn with this radius will of course pass through the angle, C , of the square; and being the inscribed circle of the triangle, AEF , it will be tangent to all its sides, and therefore to AD and AB , the sides of the square, $ABCD$.

AN ADDITION TO THE NEW CHROMATROPE.

BY HENRY MORTON, PH. D.

Since writing the notice of the new chromatope which appeared in your journal for November 27, I have made a modification in one of the disks, which gives a very pleasing effect and considerably increases the range of illustration of the instrument.



Taking the disk already described as illustrating Dr. Young's theory of color, and which consists of six sections, two each of red, green, and violet, I stopped them out by pasting over the glass a piece of black paper cut out in the manner shown in the accompanying engraving. The letters outside represent the colors of the adjacent sectors, R for red, etc., and the shaded portions are those where the glass is uncovered, the solid black indicating the opaque paper.

When the disk, so prepared, is rotated in the usual way, we have the following effect: In the center we have a circle of white produced by the union of all three colors; next to this a circle of red, the green and violet being here stopped out; next to this again a circle of yellow produced, by the union of red and green, the violet only being here obscured; then a circle of green, then one of blue, then one of violet, and lastly one of purple.

A similar method may be applied to the demonstration of the fallacy of Sir David Brewster's theory, which assumes red, yellow, and blue as the subjective primaries.

Pneumatic Telegraph Tubes.

The Western Union Telegraph Company is about to lay pneumatic tubes between the main office of the company and the Broad Street office in this city. Already the pipes and valves have been completed, and the engine is under way. If the weather proves favorable, it is the intention to have the tubes in working order by January 1, 1876. There will be two tubes, each of which will consist of a lead pipe having 2½ inches inside diameter, encased in iron pipe having an interior diameter of 3 inches, the latter being designed as a protection to the lead. The cylinders of the air pumps for compressing and exhausting the air in the tubes have a diameter of 35 inches. Messages from the main office will be dispatched by means of compressed air through one of the tubes, while those to be returned to the central office will pass through the other tube by exhaust air, the engine, pumps, and valves all being placed in the central office. The carriers are made of gutta percha, covered with felt cloth, the forward end being sufficiently enlarged to fill the tube and thus prevent the passage of air in either direction beyond the carrier. It is estimated that the time occupied in sending a message from the central office to the office in Broad street, distance about ½ of a mile, will be about 25

seconds, while the arrangements will be such that one carrier, if necessary, can immediately follow another.

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

A thin film of tin may be applied to iron wire, to give the same appearance of silver. The wire is first placed in hydrochloric acid, in which is suspended a piece of zinc. It is afterward placed in contact with a strip of zinc in a bath of tartaric acid 2 parts dissolved in water 100 parts, to which are added tinsalt 3 parts and soda 3 parts. The wire should remain for two hours in this bath, and then be polished.

The following will give a good idea of the relative strength of various substances: Made from the best steel, a rod ¼ inch in diameter will sustain before breaking 9,000 lbs.; soft steel, 7,000 lbs.; iron wire, 6,000 lbs.; good iron, 4,000 lbs.; inferior bar iron, 2,000 lbs.; cast iron, 1,000 to 3,000 lbs.; copper wire, 3,000 lbs.; silver, 2,000 lbs.; gold, 2,500 lbs.; tin, 300 lbs.; cast zinc, 160 lbs.; cast lead, 50 lbs.; milled lead, 200 lbs.; box or locust wood, 1,200 lbs.; toughest ash, 1,000 lbs.; elm, 800 lbs.; beech, cedar, white oak, pitch pine, 600 lbs.; chestnut and maple, 650 lbs.; poplar, 400 lbs.

A useful rule for converting the weight of one metal into another is as follows: Wrought iron into cast iron, multiply by 0.928; into zinc, by 0.928; into steel, by 1.010; into brass, by 1.082; into copper, by 1.144, and into lead, by 1.468.

The following may be used for reckoning the shrinkage of castings in inches in a foot, except where otherwise noted: In locomotive cylinders, ⅛ inch; pipes, ⅜ inch; girders, beams, etc., ⅜ in 15 inches; engine beams and connecting rods, ⅜ in 16 inches; in large cylinders, say of 70 inches diameter, 10 feet stroke, the contraction of diameter is ⅜ inch at top; ¼ at bottom; in length ⅜ in 16 inches. In thin brass, the shrinkage is ⅜ inch in 9 inches; in thick brass, ⅜ in 10 inches; in zinc, ⅜ in a foot; in lead, ⅜; in copper, same; in bismuth, ⅜; and in tin, ⅜.

Molesworth gives the following rules for warming and heating buildings by steam: When the external temperature is 10° below the freezing point, in order to maintain a temperature inside of 60°, one superficial foot of steam pipe is needed for each 6 superficial feet of glass in the windows; the same for every 6 cubic feet of air escaping for ventilation per minute; the same for every 120 feet of wall, roof, or ceiling; 1 cubic foot of boiler is required for every 2,000 cubic feet of space to be heated. A one horse power boiler is sufficient for 50,000 cubic feet of space.

An easy way to drive screws into hard wood is to file a flat about ¼ inch long on the side of the screw beginning at the point. This cuts the wood and forms a thread in the same way that a tap does. The screw follows and holds well.

Dies for use in stocks should be made as follows: Supposing the dies to be for use on bolts of an inch diameter, first fit them to the stocks, then place between the faces a piece of ⅜ inch steel; fasten the whole in the stocks and drill a hole the proper size for a tap of the correct pitch, but 1½ inches in diameter. Then tap the hole with a 1½ hub or tap having a thread on it of the requisite pitch, taking care to give the dies a full thread; then cut out the clearance places, etc. Dies made thus will cut steadily, easily, and true, and are not liable to break. The advantage of this plan is that the dies will cut in the center of their width, the sides of the threads serving as a guide at the very first cut taken, which would not be the case were they cut by an inch hub or tap.

Condensed Beer.

Mr. Lockwood describes, in the *Journal of the Society of Arts*, his patent solid or condensed beer. Beer is taken at its best condition; its alcohol is separated and saved by a method of gentle distillation *in vacuo*, and the residue is condensed in a vacuum pan, like milk; when finished, it is enclosed in hermetically sealed packages, the alcohol first being added to it again, and acting as a preservative. The fermentation, which was present in the beer when it was taken, is suspended by the heating, and the condensed beer remains sound in this condition, apparently for any length of time, as some exists that has now been kept for nearly two years. When re-made by adding water, it is not wort, but real beer, having all its flavor and alcoholic strength, and lacking only effervescence, which can be quickly imparted by reviving the suspended fermentation for a short time in order to develop sufficient carbonic acid gas to give it the required briskness; or it is fit to drink immediately, if charged with carbonic acid gas, like aerated water.

"The Times" on Sewer Gas.

The New York *Times* gravely objects to the plan of ventilating sewers by connecting them with the draft of furnaces. The remedy is "obviously defective," it avers; "if for no other reason, from the fact that under certain conditions a furnace does not bake and thus disinfect this air."

Consequently "each furnace would be an ingenious machine for scattering through the house the most deadly gases. And though, when in full blast, the heat of the furnace would destroy their morbid properties, yet on a mild day, with a low fire, we should have sewer gas, pure and simple, through the whole house."

For ingenious misapprehension, the paragraph we have quoted could scarcely be surpassed. It seems incredible that one could be so dull as to suppose that an eminent "scientific authority" would propose to supply our hot air chambers from the sewers; but the *Times* seems to have achieved that distinction: which shows how needful it is to be explicit in making even the most simple and self-evident propositions. Had the high scientific authority taken the precaution to stipulate that the sewer gas should pass into the fire and not into the air pipes, the opposition of the *Times* might not have been aroused.

IMPROVED SCROLL SAWING MACHINE.

Another one of those small and comparatively inexpensive machines, which are so useful to amateurs and for general light woodworking purposes, is illustrated in the annexed engraving. It is a new foot-power scroll saw, the advantages of which are principally to be found in an improved and simplified construction.

The table is provided with a horizontal rear extension to which the reciprocating saw frame, A, is pivoted. The arrangement of the frame will be readily understood from the illustration. The connecting screw rod, at its rear end, serves to draw the front extremities of the arms apart, thus tightening the saw clamped therein. To the rear of the extension, a curved arm, B, is attached, which carries a plate conveniently located for holding the oil can and necessary tools. Arm, B, has a slotted recess at C, which serves as a guide for the upper bar of the saw frame. A band spring may be interposed between said bar and the arm, to assist the upward motion of the frame and prevent the contact thereof with the upper part of the recess. Beneath the table is a short arm, D, and a slot therein guides in similar manner the lower bar of the frame. This arm is extended downward and is forked to hold the shaft, E, of the gear which receives motion from the wheel and treadle shown. A small fly-wheel on shaft, E, assists the rotation of the same, and the crank disk and rod on the front end form the connection with the saw frame, and impart reciprocating motion to the same. The arrangement of the legs with the table is obvious from the illustration, and forms a rigid and substantial support. The machine is adapted for fret sawing, and for the cutting out of brackets and similar ornamental wooden articles.

Patented through the Scientific American Patent Agency. For further information relative to sale of royalties or of patent, address the inventor, Mr. Jerome H. Plummer, 1,276 Pacific street, Brooklyn, N. Y.

Activity is Not Always Energy.

There are some men whose failure to succeed in life is a problem to others, as well as to themselves. They are industrious, prudent, and economical; yet after a long life of striving, old age finds them still poor. They complain of ill luck. They say fate is always against them. But the fact is that they miscarry because they have mistaken mere activity for energy. Confounding two things essentially different, they have supposed that, if they were always busy, they would be certain to be advancing their fortunes. They have forgotten that misdirected labor is but a waste of activity. The person who would succeed in life is like a marksman firing at a target; if his shots miss the mark, they are a waste of powder. So in the great game of life, what a man does must be made to count, or it might almost as well have been left undone. Everybody knows some one in his circle of friends, who, though always active, has this want of energy. The distemper, if we may call it such, exhibits itself in various ways. In some cases the man has merely an executive faculty, when he should have a directive one; in other language, he makes a capital clerk, for himself, when he ought to do the thinking of the business. In other cases what is done is not done either at the right time or in the right way. Energy, correctly understood, is activity proportioned to the end.

IMPROVED SAW FILE GUIDE.

The annexed engraving represents a new apparatus for guiding the file, during the operation of filing saw teeth, in such a manner that exactly the same pitch and bevel shall be imparted to each tooth. This is done by suitable indicating devices below described, which also admit, on the saw being refilled, of forming the teeth with the same pitch and bevel as in the beginning.

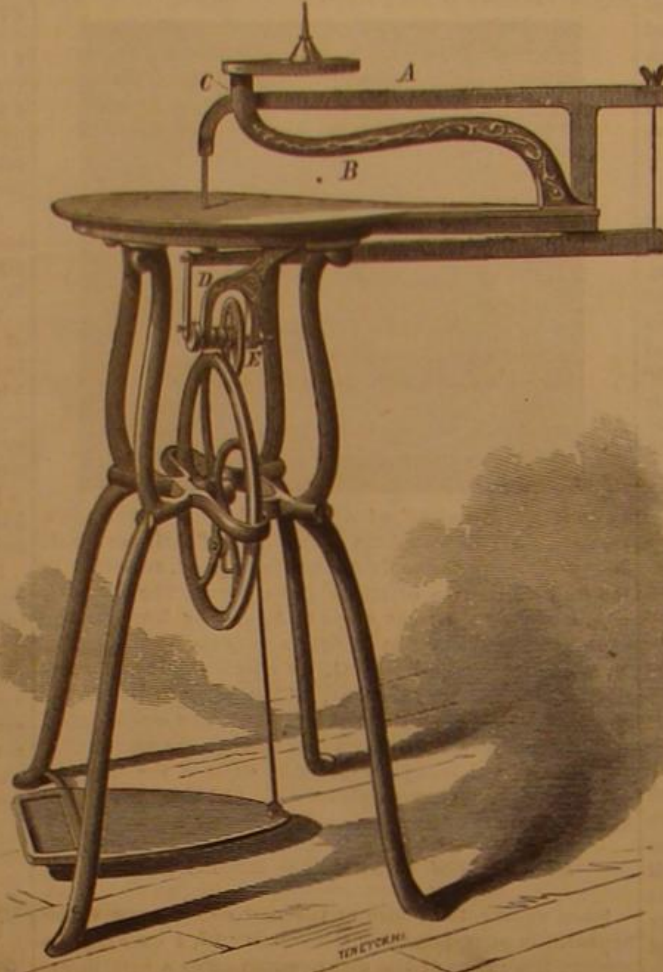
The saw is secured in a wooden clamp as shown, and held in a vise. The clamp has grooves on each side and extending its entire length, these serving as guides for rods on the lower part of the frame or saddle, A. The latter may be freely moved along the grooves, and is by them maintained in uniform position as regards the saw.

The sliding frame holds a graduated circle, B, by means of lugs on one side and a set screw, C, on the other. The guide rod, D, passes through apertures in the circle as shown. It will be seen that the latter can be adjusted so that any mark on its periphery coincides with a fixed mark on the frame, and thus the file, which is connected with guide rod, may be set so as to impart any desired bevel to the teeth, this being denoted by the graduations on the circle. The file is supported in the arms attached to the guide rod, its end being inserted in a hole in one and a screw clamp holding it to the other. By loosening the screw, the file may be turned so as to give any desired pitch to the saw teeth. At E is an indicator of simple construction, which shows the pitch at which the file is set, and thus

allows of easy resetting to the same inclination at any future time, as when using a new file or another corner of the same tool.

By some changes in a part of the device, this guide is made applicable to circular saws, in which case the guide rods, sliding in the grooves of the clamp, are made of proper curve.

The invention is quite simple; and we believe it will prove a very useful and handy implement for mechanics, since by its aid the not very easy operation of saw-filing is greatly simplified. In fact it is only necessary to set the guide at the proper pitch and bevel, and leave an apprentice or boy to do the manual work.

**PLUMMER'S SCROLL SAWING MACHINE.**

Patent now pending through the Scientific American Patent Agency. For further information, address the inventor, Mr. Elias Roth, New Oxford, Pa.

New Use for Rats.

Rats are not generally supposed to be of any particular use in the economy of Nature, unless it be to eat up refuse, make a noise, or haunt the subterranean cavities of large cities. A telegraph inspector in England has, however, upon a recent occasion, proved that the rat as an operator in case of broken wires may be turned to good account. It was necessary, says the *Popular Science Monthly*, to overhaul a cable of wires inclosed in iron tubes. A certain length of the cable had to be taken out of the tube, and the men commenced hauling at one end, without having taken the precaution to attach to the other a wire by which it might be drawn back after inspection and repairs. The question arose how the cable was to be restored to its proper place. The inspector invoked the aid of a rat catcher, and, provided with a large rat, a ferret, and a ball of string wound on the Morse paper

ret was then put in, and off went the rat again, until he sprang clear out of the flush box. One length of the cable was thus safe, and the same operation was commenced with the other; but the rat stopped short a few yards from the pipe, and boldly awaited the approach of the ferret. A sharp combat ensued, but after sundry jerks at the string the combatants separated, the rat making for the other extremity of the pipe, carrying the string through and relieving the inspector from his anxiety.

The Electro-Magnetic Mallet.

Dr. Edwin T. Darby, in a paper read before the Pennsylvania State Dental Society, states that the priority of invention of this useful implement belongs to Dr. William G. A. A. Bonwill; but a contest is pending between this gentleman and Mr. George F. Green, who claims the priority. The practical uses and value of the instrument are set forth by Dr. Darby as follows:

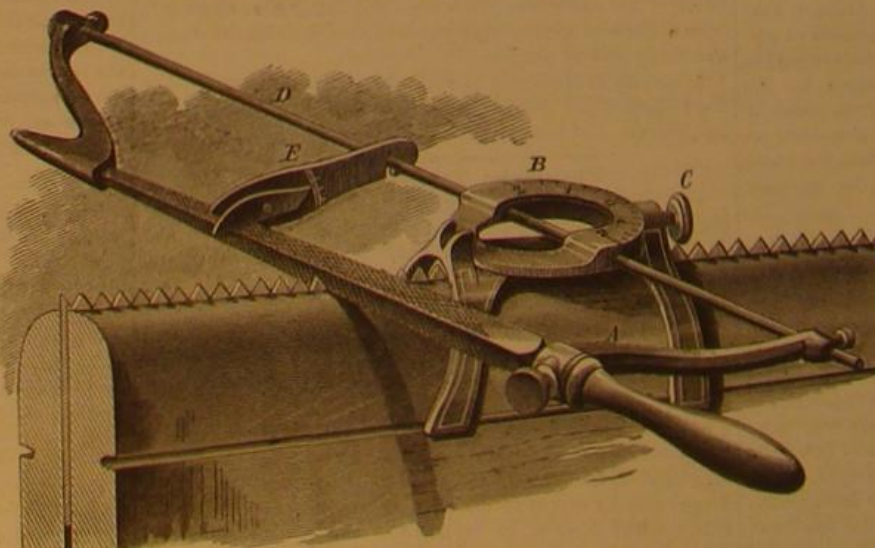
"It is purely automatic in its action. Its power or force is entirely distinct from anything physical or individual, except the will of the operator and the touch of his educated finger. No more physical force is required to manage it than would guide a pen or hold a pencil. The dentist may stand or sit at his chair hour after hour, and feel no greater fatigue than would naturally result from restrained position or concentrated thought. One who has not used it, nor become thoroughly accustomed to it, can little understand the vast amount of physical force others are saving themselves by its use. It was my fortune to obtain one of the first, nearly or quite four years ago; and although great improvements have been made upon it since, I look back upon those four years of comparatively active duty, feeling that I should at times have given way, and perhaps been obliged to abandon my practice, but for the assistance which the electric mallet has rendered me. So great is my appreciation of it, and so confident am I of its great value, that I fear, were I obliged to discontinue its use, I should fall far below that standard which, as we justly claim, should characterize the operators of the present day.

"Nor is a labor-saving instrument only: it is a time saving invention. Seneca taught that time is the only thing of which it is a virtue to be covetous. Too lightly, as a rule, do we estimate the value of time in our operations; our field for usefulness is limited. Our course or stadium has its bounds at no distant future; and he who is most successful, who accomplishes most for himself and for those who seek his services, is he who knows best the value of each moment, and systematizes his work and adds to his appliances such things as help him to expedite his operations—never sacrificing quality for quantity, excellence for rapidity. The length of time required to thoroughly pack the gold in most cavities is lessened at least one half by the aid of the electric mallet. I profess not to have acquired that degree of manipulative skill that enables me to fill all cavities with lightning-like rapidity, but in the great majority of instances one eighth of an ounce of foil can be thoroughly consolidated in from 60 to 70 minutes. The inventor, I believe, professes to do the same in 30 or 40 minutes. The instrument when in use makes more or less noise, and the sensation upon the tooth is peculiar, and suggests pain, if it does not actually produce it. One of the best arguments in proof of its painlessness is the fact that our patients not unfrequently go into a deep sleep and awake to find the operation nearly or quite completed. The blow produced by the electric mallet is sharp and quick, and does not jar the tooth like the hand mallet or the Snow and Lewis automatic. The operator must be skilled in its use, otherwise he may allow the mallet to strike the filling several times in the same place, whereas but one blow is needed. My own experience and observation has been that less injury to the tooth and lining membrane has followed the use of the electric mallet than formerly attended the use of the hand mallet or even hand pressure.

"The instrument as now made requires little or no adjusting, and with care may be used for years without the least expenditure for repairs. The total loss per week is not more than ten or fifteen cents; and if the battery is thoroughly cleansed once in ten days, which may take fifteen or twenty minutes' time, and can be done just as nicely by an office boy or student, it is all that is required in that direction. I know of no better battery than a three or four celled Bunsen, with well amalgamated zincs. They can be used for years by simple replacing a zinc which may in time become eaten, or a carbon which may have gradually dissolved. More easily managed than steam or water power, electricity has made its way into our profession, and is daily performing for those who use it a service

which entitles it to a rank among the most useful of our motors."

AQUAFORTIS, applied to the surface of steel, produces a black spot; on iron, the metal remains clean.

**ROTH'S SAW FILE GUIDE.**

drum, he repaired to the opening in the tube. The flush boxes were opened, and the rat, with one end of the string attached to his body, was put into the pipe. He scampered away at racing pace, dragging the twine with him until he reached the middle of the pipe, and there stopped. The fer-

COMPOUNDING STEAM ENGINES.

The controversy as to the possible economy of compound engines has been long ago settled; and the advantages of the additional cylinder and piston to be operated by the steam exhausted from the first engine, have been proved beyond any doubt. But the economy is not derived, as some of our correspondents seem to think, from using steam twice; for whether the steam passes through one cylinder or forty, the difference between the pressure of the steam at its entrance to the first cylinder and its final exhaust into the atmosphere is the sole power which the engine can exert. The low pressure, larger cylinder added to an engine, while it discharges its steam at a lower tension, creates a certain amount of back pressure in the first or smaller cylinder; and there is, therefore, no positive gain of power in a compound engine. But the larger cylinder enables that little understood and most important property of steam, its elasticity, to be much utilized; so that it may be said that the additional cylinder is equivalent in result to a very effective cut-off.

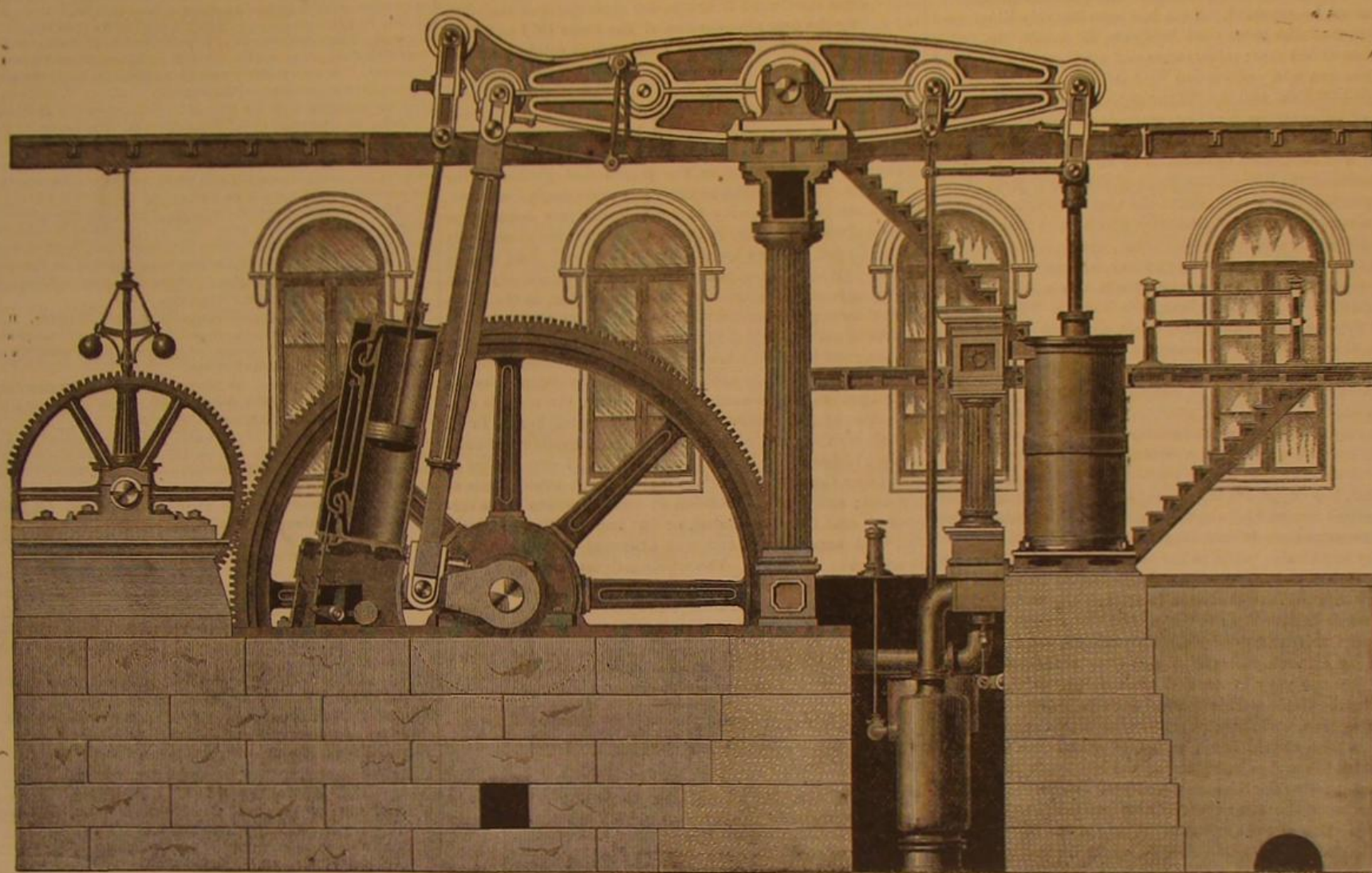
valuable to the manufacturers of gas, either as an enricher or a substitute for coal gas. The time is not very distant when a large majority of the gaslight companies now using coal exclusively will use some petroleum in connection with it to increase its candle power, and to enable them to more completely utilize all the gas-making power of coal; but this result has been much retarded by the mistaken notion that the addition of a petroleum vapor to a coal gas was all that was necessary. We speak of this now because the attention of the whole gas-making fraternity has just been again called to the subject of petroleum gas, in the discussions of the American Gaslight Association at its recent meeting in New York.

We know from correspondence with many gas manufacturers in different sections of the country that nothing but a fear of being drawn into large expenditures for new plant, without positive guarantee of success, prevents the introduction of petroleum gas. We have no axe to grind in furthering the interests of any special process, but for the benefit

ever. He says he has been to Vermont and learned the art completely. He suggests that \$5,000 shall be deposited by each party, the winner to donate that amount to some designated charitable institution. Now, Doctor, down with your ducats.

A Gastronomic Curiosity.

"We dare say that there are a great many people who, if asked whether they could or would partake of so toothsome a dish as a broiled quail on toast once a day for a month, would stare at the questioner in astonishment and express an earnest desire to be afforded the opportunity. And yet we can positively venture the assertion that not one person out of a thousand would continue the diet for a fortnight. This is not because of the quantity of meat, because any one's ordinary dinner aggregates an immensely larger amount, nor is it due to a surfeit of one particular kind of food, for roast beef might be eaten every day for a year with relish. The difficulty lies in the flavor of the meat. Delicious as it is as



COMPOUNDED BEAM STEAM ENGINE.

A great many engines in England have recently been converted into compound engines, and the methods of doing this are numerous, and their merits are widely discussed. A novel arrangement, designed by Messrs. J. Bagshawe and Son, of Batley, Yorkshire, England, is represented in the annexed engraving, and there are several features in it which deserve notice. One is that the change involves the addition of a high pressure cylinder, the engine being of the condensing type. The cylinder is 13 inches in diameter and of 56 inches stroke; and it is so inclined that its piston is parallel with the connecting rod when the crank is exerting its maximum power. The old cylinder was 23½ inches in diameter and of 46 inches stroke. Other advantages claimed for this system of compounding are the attainment of great steadiness in working, and an almost complete avoidance of strain on the foundations. It is stated that, since the additional cylinder was added, the engine has been run with no caps on the bearings which carry the beam on the pedestal; and no deviation from regularity in working could be detected, the two pistons, by their contrary motions, keeping the whole engine steady.

Petroleum Gas.

The attempt to manufacture a good substitute for coal gas from petroleum has been made by at least a hundred different persons within the last five years, as the records of the Patent Office prove. That nearly all these attempts have been made with no knowledge of the chemistry of gas-making is equally apparent from the processes for which patents have been claimed: most of them being based upon the well known fact that atmospheric air, when passed through petroleum, especially the more volatile parts of it, becomes saturated with its vapor, and burns readily with a clear bright light. Most of these inventors seem to have concluded that in reaching this result they have produced a substitute for coal gas, and their inventions have been pushed into the attention of both the consumers and the manufacturers of gas with much energy. We have no desire to condemn their processes, which are excellent in their place, but it is a mistake to imagine that a simple carburetted air is

of the petroleum trade we wish to see the best process adopted. This we feel certain must be a process that yields, not a vapor—easily condensable and rapidly deteriorating by passage through long stretches of pipe—but a fixed gas, not more liable to these objections than the average coal gas. It must also be a process that utilizes the maximum gas-producing power of the petroleum. The quantity of gas and its candle power which it is possible to get from a given quantity of petroleum can be ascertained with as much exactness as the same things concerning a ton of Westmoreland coal, and it will be found far easier to reach the maximum in using petroleum than in using coal.

But while seeking in this way for the best process, care should be exercised not to adopt one that claims to do too much. We have seen statements of the results obtained by some processes in which the gas claimed to have been made from given quantities of petroleum would actually weigh more than the petroleum itself. We should look with distrust on such processes.

"There is nothing that succeeds like success," and this is the last and best test that should be applied to a petroleum gas process. If one can be found already in successful operation, which has met and overcome the objections which theory forgets but practice discovers, that is certainly the best one to adopt.—*American Manufacturer.*

Practical Spiritualism.

Dr. E. P. Miller, an intelligent physician of this city, has become an avowed and ardent advocate of the "spirituality" of the Eddy tricksters of Vermont. The doctor is so certain of the heavenly power of one of the Eddy female performers that he has publicly offered a challenge or test exhibition, under a wager of \$5,000, that her "manifestations" are genuine, and agrees to leave the matter to the decision of a committee of twelve persons, to be mutually chosen by himself and the acceptor of the challenge. Mr. W. Irving Bishop, of this city, has accepted the challenge, undertakes to prove that the woman is a fraud, and further, agrees to reproduce all the "materializations" and "manifestations" that she may produce, without any spiritual assistance what-

an occasional delicacy, if it be eaten daily for ten days or thereabouts, it becomes excessively nauseating. The flesh seems to acquire a rank and bitter flavor; and if the diet be persisted in, the stomach revolts and rejects the food. Why this should be so, we have never heard scientifically explained; but it is probably due to some medicinal effect of the meat which shows its results, through regular dosing, just as do some kinds of physic, which, if taken once or twice in small quantities, are imperceptible to the system, but which, if administered regularly in the same amounts for lengthy periods, act powerfully on the constitution.

Be this as it may, an individual named O'Donnell, who lives in Madison, Ind., has brought himself into notice by accomplishing the hitherto unparalleled feat (on a wager) of eating thirty quails in as many consecutive days, and this without any inconvenience or disgust. The case has attracted some attention from the medical fraternity, and sundry individuals are making Mr. O'Donnell's marvelous stomach the subject of extensive bets. It is now reported that he is to undertake the delectable task of repeated and prolonged meals of raw oysters and brown sugar: a process which might fitly terminate in a gastric malady which would annihilate the much abused stomach and its owner at the same time.

Milk Diet.

"I find by experience," says Dr. E. N. Chapman, "that lime water and milk is not only food and medicine at an early period of life, but also at a later, when, as in the case of infants, the functions of digestion and assimilation have been seriously impaired. A stomach taxed by gluttony, irritated by improper food, inflamed by alcohol, enfeebled by disease, or otherwise unfitted for its duties, as is shown by the various symptoms attendant upon indigestion, dyspepsia, diarrhoea, dysentery, and fever, will resume its work, and do it energetically, on an exclusive diet of lime water and milk. A goblet of cow's milk, to which four tablespoonfuls of lime water have been added, will agree with any person, however objectionable the plain article may be, will be friendly to the stomach when other food is oppressive

against the defendants until the filing of the bill of particulars, affidavits, and from a comparison of the evidence. I am satisfied, for the purposes of this hearing, that the Kilburn invention embraces all substantial elements and combinations of the Whitney invention, and that the Whitney invention antedated that of Kilburn; but upon the state of facts exhibited in the record in this case, after the complainants have committed for so long a space of time to the manufacture and sale of the Kilburn machine without enforcing their rights by proceedings at law or in equity, they have lost the right to invoke the summary process of the court by an injunction *pendente lite*, but must await the decree of the court upon a final hearing, when the rights of the parties can more accurately be determined. In the meantime, putting a stop to a manufacture, which, commenced after the sanction of the court, would be without interruption. The complainants do not show any adjudication establishing the validity of their patent, nor, as against the Kilburn patent or these defendants, do they prove any such public acquiescence or exclusive possession, or any such diligence on their own part, as would entitle them to invoke the *faciatis remedium* of a preliminary injunction.

Motion for preliminary injunction overruled.

Dice and Pratt for complainants.

D. H. Merriam and T. J. Woodward for defendants.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From October 26 to November 18, 1875, inclusive.

ALLOY.—O. Holden, New York city.
AUTOGRAPHIC PRINTING.—T. A. Edison, Newark, N. J.
BLIND HOOK PULLEY.—N. Thompson (of Brooklyn, N. Y.), London, Eng.
BOILER FLUE.—L. B. Halsey et al., New York city.
CARBURETTING AIR.—E. J. Dorschbach, Pittsburgh, Pa.
CARDING FEED APPARATUS.—G. S. Harwood, Boston, Mass.
CAR SPRING, ETC.—W. H. Porter, Bridgeport, Conn.
DETACHING HORSES.—J. W. Glover, Mount Savage, Ky.
DIETETIC FOOD.—C. Morfit (of Baltimore, Md.), London, England.
ELECTROMAGNETIC MACHINE, ETC.—D. F. Kimball, New York city.
EMBOSSED LEATHER, ETC.—R. Lee (of Philadelphia, Pa.), Huddersfield, Eng.
ENGINE, ETC.—C. C. Wolcott, Washington, D. C.
EXCAVATOR.—P. H. Stryker, New Brunswick, N. J.
FARE REGISTER.—G. Lander, Pittsburgh, Pa.
FILTER, ETC.—F. C. Hobbins, Philadelphia, Pa., et al.
FLOODWAYS.—J. H. Morrell, New York city.
FOG HORN.—F. Brown, New York city.
HARVESTER.—S. Johnston, Brockport, N. Y.
HOSE PIPE COUPLING.—A. J. Morse, Boston, Mass.
HULLING GRAIN.—G. L. Squier, Buffalo, N. Y.
HYDRAULIC DREDGE.—W. H. Newton, Chicago, Ill.
KNITTING MACHINERY.—C. J. Appleton, Elizabeth, N. J.
LAMP.—L. A. Presby, New York city.
LIFE-SAVING GARMENT.—T. Richards, Cleveland, Ohio.
MOTOR.—G. W. Manson, Washington, D. C.
ORGAN.—A. T. Rousseau, Boston, Mass.
PADLOCK.—W. Ott et al., Brooklyn, N. Y.
PRESERVING MEAT.—J. M. Webb et al., New York city.
PRINTING PRESS.—A. E. Redstone, Oakland, Cal.
PRINTING PRESS.—F. W. Griffith et al., New York city.
QUOITS.—A. H. Cramp (of New York city), London, England.
RAILWAY VEHICLE.—H. D. Faulkner, New York city.
RAW HIDE SHOE TIP.—National Boot Tip Co., Boston, Mass.
ROWING GEAR.—W. Lyman, Milledale, Conn.
SEWING MACHINE.—A. S. Dinmore, Boston, Mass.
SPARK ARRESTER.—D. R. Proctor, Gloucester, Mass.
STEAM PUMP.—J. W. Blake, Jersey City, N. J.
STOP VALVE.—J. S. Long, Brooklyn, N. Y.
VENTILATION AND WATER SUPPLY.—J. H. Morrell, New York city.
WARPING MACHINE.—O. H. Moulton, Lowell, Mass., et al.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED REED ORGAN.

George Blatchford, Mitchell, Canada.—This inventor constructs a resonant chamber, in combination with an organ. The seat of the chamber commences at the front of the instrument immediately under the key board and key frame, and extends backward in proportion to the width of the instrument, with a back elevation proportionate to the elevation of the organ. The advantages claimed are an improved quality of tone; the tone is more easily harmonized with the human voice; greatly increased volume of sound; it removes or prevents that disagreeable quality of tone which so often characterizes reed organs.

IMPROVED MOTH TRAP.

Benjamin F. Daniel, Quincy, Fla.—Above the lower bee entrance is a sliding cover through an angular orifice, in which the moth enters after the bee entrance is closed. The insect is led by a tube into a compartment from which there is no access to the hive. The upper bee entrance is similarly arranged. This device is cheaply made, and claimed to be efficient and useful.

IMPROVED PIANOFORTES.

Ernst Gabler, New York city.—Two patents are here included. The new feature in the first invention is an improved agraffe bar, by which the sounding of the strings at the bridge of the wrest plank is obviated, a more prolonged, clear, and bell-like ringing tone obtained, and a rigid locking of the agraffe bar throughout its length by the pressure of the string plate and strings is produced. The bar is interposed between the wrest plank and the plate, and retained in rigidly fixed position by the plate as produced by the pressure of strings thereon.

The same inventor has also patented an isolating agraffe for grand and square pianofortes, by which the same results are obtained, and the annoying influence of the action of the hammers prevented from being transmitted to the string plate and wrest plank, while, at the same time a rigid connection of agraffe and string plate without screws is obtained.

IMPROVED REVERSIBLE LOCK BUCKLE.

Lyon Lewine, Brooklyn, N. Y.—This device is a buckle for trunk straps which holds the strap tightly until the latter is released. This is done by turning a disk with a key, thus freeing a pin against the straight edge of which the strap binds.

IMPROVED SUSPENDER.

William Stokes, New York city, assignor to himself and Henry Heath, Brooklyn, N. Y.—In this device the ordinary button strap passes through a slot in a metal case, and acts on a follower sustained by a spiral spring therein. The invention will probably be found more durable than the usual elastic webbing.

IMPROVED BRAIDED JEWELRY.

William W. Alden, Providence, R. I.—This inventor proposes a new style of gold jewelry, which he produces by braiding wire of any shape in cross section, by suitable machinery. He claims that very elegant ornaments can thus be cheaply and expeditiously manufactured.

IMPROVED CARBOY.

Alexander H. Fatzinger, New York city, assignor to himself and James McFarlane, North Bergen, N. J.—Many serious accidents have been caused by the breakage of carboys holding acids or corrosive chemicals, through careless handling. To obviate this danger, the above inventor has devised a carboy box, having a neck guard with corner recesses for securing the detachable lid, provided with vertical corner pieces. The carboy is carried by folding handles, that are retained in horizontal or vertical position along the enclosing box by suitable bearing strips. When the carboy has been carried to its place of destination, or the contents emptied, the handles are swung down in vertical position along the box, so as to be out of the way.

IMPROVED TYPE-WRITING MACHINE.

Lucien S. Crandall, New York city.—The new features of Mr. Crandall's ingenious machine consist, mainly, in a vibrating platen and paper feed arranged in connection with a series of type bars. The latter are provided with more than one type, and operated by oscillated finger levers in such a manner that, according to the backward or forward motion of the same, two adjoining types are printed on a common center. These centers may be increased in proportion to the type by definite vibrations of the platen, produced by suitable mechanism. The latter is very simple and ingenious, and its manipulation would seem to be easy.

IMPROVED APPARATUS FOR DRAFTING TAILORS' PATTERNS.

Friedrich H. Ulrich, New York city.—This invention is based on the normal anatomical proportions of the different parts of a body, and includes a system of measuring that indicates the deviations from the normal form, the measures to be plotted by a series of squares corresponding to the proportions of the body. There is also an apparatus with graduated and adjustable parts, for defining and drafting said measures.

IMPROVED ELECTRIC GAS LIGHTER.

Octave A. A. Rouillon, Brooklyn, N. Y.—This consists of a couple of platinum wires for closing the circuit and producing the sparks for lighting the gas. The wires are corrugated or notched in any manner, and at the same time are so contrived that the act of bringing them in contact causes such movement of one on the other that the current is broken and closed several times by the passage of the roughened surfaces. By this means, numerous sparks are produced, making an efficient lighter.

IMPROVED PAPER WEIGHT.

Eduard Dressler, Gablonz, Bohemia, Austria, assignor to Alfred J. Ostheimer, Philadelphia, Pa.—This invention consists in a paper weight formed of a glass block having a rounded concavity in its lower side. The effect of the concavity is to refract the rays of light, and thus cause a picture cemented beneath to appear in relief.

IMPROVEMENT IN BELLOWS ATTACHMENT FOR ROCKING CHAIRS.

Edgar E. Sell, Charleston, S. C.—This is an ingenious way of making the motion of a rocking chair produce a current of air which fans the occupant, thus keeping him cool at the expense of little exertion. The device mainly consists of two bellows, the broad ends in opposite directions. Above these are bars, which are attached to the rockers. Rocking forward compresses one bellows, and rocking back the other; and suitable tubing conducts the draft to the operator.

NEW TEXTILE MACHINERY.

IMPROVED LOOM SHUTTLE CHECK AND BINDER.

Seth Tebbetts Hurd, Gonle, N. H., assignor to himself and Thomas Sanderson, Lawrence, Mass.—This invention relates to a shuttle binder and other devices which serve as a substitute for the ordinary shuttle box; also, to the picker rod and to new connections between the binding finger shaft and the dagger shaft. Drawings are necessary to convey a clear idea of this mechanism. It will doubtless, however, be found as useful as it is ingenious.

NEW HOUSEHOLD ARTICLES.

IMPROVED CLOTHES POUNDER.

Ezra Crowell, Belfast, N. Y.—This inventor improves the device patented by him December 23, 1874, by making the piston hollow, with an opening in its side and perforations in its lower head, and providing it with a movable band, having a corresponding opening in its side, to adapt it to operate as an automatic soap applicator when the machine is in use.

NEW AGRICULTURAL INVENTIONS.

IMPROVED TOOL FOR BENDING BALE HOOKS.

Benjamin R. Springsteen, Schodack Landing, N. Y.—This is an improved tool for manufacturing, in rapid and convenient manner, the wire hooks used by farmers for baling hay, straw, etc. It is used for twisting the wire blank, and is provided with a raised shaping piece, and bending jaws back of the same, which are pivoted to a base plate that is hinged to the main piece, to be swung over the raised part for imparting the final hook shape.

IMPROVED ADJUSTABLE SACK HOLDER.

Henry W. Clark, Red Bluff, Cal.—This inventor improves upon the device patented by him July 27, 1875, so as to render the semi-circular spring that receives the edge of the sack easily removable, to be replaced by one larger or smaller in accordance with the size of the sack.

IMPROVED HORSE POWER.

George W. Gordon, Beverly, Ohio.—The improvement relates to the construction of a winding drum with teeth, in combination with a lever and rod for adjusting the drum to bring it into or out of engagement with an arm or arms projecting from a rotary shaft to which the horse can be constantly traveling, so as to avoid the delay and labor of stopping and starting.

IMPROVED GRAIN DRILL.

James C. Daman, Elk Point, Dakota Ter.—The upper ends of the plates which govern the discharge openings for the seed pass out through holes in the hopper, and are secured to a shaft, so that by rocking the latter the discharge openings may be opened and closed. Upon one end of the shaft is placed a pawl, which is secured in place adjustably. The engaging end of the pawl is held down upon the teeth of one of the other of two ratchet wheels by a spring. One of the ratchet wheels is made smaller than the other. The larger ratchet is designed for feeding oats, barley, and the other larger grains, and the smaller ratchet for feeding wheat and other smaller grains. When the machine is in use, spring plates open wide enough for the desired quantity of seed to pass out, and then close and yield enough for the pawl to pass a tooth of the ratchet wheel. The feed with either ratchet is regulated by loosening the set screw and adjusting the shaft to give the plates an opening sufficient to pass out the desired amount of seed. An index is marked upon the pawl and shaft, to gauge the desired amount of seed to be dropped.

IMPROVED HORSE HAY RAKE.

William H. Iyer, Margaretville, N. Y.—The dischargers or clearers, for forcing the hay out of the rake teeth when the latter are raised, are reinforced in their connection with the axle by metal supports, to prevent the breaking of them at the junction with the axle. The rake head is pivoted to the axle at the top and in the vertical plane of the axis of the wheels, and the teeth are arranged so that the points run directly under the connection with the axle, and are thereby more accurately gaged by the wheel to uneven ground.

IMPROVED REVOLVING DROPPER.

John Johnson, Perry, Ill., assignor to himself, William T. Smith, and Thomas H. Ward, of same place.—This is an improved dropper for reapers, so constructed that it may be revolved from beneath the cut grain, to allow it to drop to the ground without being disarranged and tangled. The mechanism for this purpose is new and ingenious, and mainly consists of a vibrating apron and revolving double apron in connection with suitable levers and holding devices.

IMPROVED FURNACE FOR DESTROYING INSECTS.

William F. Woolsey, Breckenridge, Mo.—This furnace destroys insects by burning them with a heated furnace in a furrow plowed in the ground around the field from which the insects seek to escape, the furnace being drawn while heated along the furrow, in which the insects have been arrested in their escape by the furrow being contrived, in form and condition of its surface, so that they

cannot get out after getting in. The furnace consists of a little boat-shaped sheet metal contrivance formed in cross section to correspond with the form of the furrow, and provided with a fire grate, draft, and escape passages, and also with a deflector in the upper and middle portion to cause the heat to act on the sides, so as to throw it off upon the sides and bottom of the furrow to the best advantage as the furnace is drawn along the furrow.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CAR COUPLING.

Thomas A. Watson, Bentonville, Ark.—In this device there is a drawhead with coupling link secured thereto, to be coupled by the sliding pin of the opposite drawhead. The latter is provided with a forward curved arm, and is dropped by the contact of the same with the drawhead. The curved and spring-acted arm rests on a shoulder of a top extension of the drawhead, and slides in a slot of the same.

IMPROVED GAS APPARATUS.

John H. Eichholz, Brooklyn, N. Y., assignor to himself and Horace A. Green, N. Y. city.—The aim here is to supply a simple, cheap, and efficient small portable apparatus for the manufacture of illuminating gas of hydrogen and the vapor of hydrocarbon substances, to enable consumers to find ready and cheap apparatus for making their own gas. The device consists of a furnace and oven made of a sheet metal case and fire brick lining, in which are retorts for the oil in one set, and another set for steam, contrived in a simple way, for graduating the heat to the different substances, according to the progress of the work.

IMPROVED FLUID METER.

Berthold Huber, Brooklyn, N. Y.—This is a fluid meter composed of a circular flexible pipe and a roller, the roller being pushed around on the pipe by the fluid in passing from the inlet to the outlet, and serving to indicate each pipe full of fluid. It includes a contrivance of the pipe so that the roller may travel on a level way all around, and an arrangement of the roller by which to connect the recording mechanism in a simple way.

IMPROVED CAR COUPLING AND BRAKE.

Frank M. Campbell, Crow Wing, Minn.—This is a novel arrangement of self-coupling apparatus, also contrived for uncoupling without attention from the attendant, in case a car falls through or flies the track; and it also consists of a brake contrivance so connected with the aforesaid coupling that the brakes are let free by the coupling, and thrown on the wheels by a spring whenever the coupling disconnects.

IMPROVED GOVERNOR AND CUT-OFF FOR STEAM ENGINES.

Martin D. Miller, Oswego, Kas., assignor to himself and James T. Pierson, of same place.—A hollow revolving and reciprocating valve having spiral ports is placed in a case having similar ports, through which steam passes to the slide valve. The stem of the valve is suitably connected by gearing with the engine, and is also swiveled to a rack which by a pinion is governed by a friction gearing on the governor spindle. On the latter is a frame, carrying rollers which move on a concave plate through which the spindle passes, and which operate in such a manner that on the least change of motion of the engine the friction gearing is thrown into engagement and the valve thus suitably regulated.

IMPROVED COMPOUND FOR LINING MACHINE BEARINGS.

Lebbeus W. Lathrop and Theo. A. Weber, New York city.—We have recently examined the practical working of the new lubricating material, anti-frictionate, which we mentioned in one of our articles on the late Fair of the American Institute as being there exhibited. The substance is principally finely pulverized graphite, which heretofore has been mixed with other materials and formed into a mass, from which linings were made for the boxes. A recent improvement on the invention now does away with any compounding of materials, except in the cases of journals subject to the action of oil or water, and for ordinary use substitutes sheets of cloth and paper, to the surface of which pure graphite is attached by prepared glue. These sheets are cut into the required shape, and are fitted into the boxes as a lining. We have seen counter-shafting and machine tools thus fitted running at ordinary speeds, and spindles traveling at very high numbers of revolutions. No signs of cutting were visible, and the bearings were either cold or showed a barely perceptible warmth. The invention is cheaply made and applied, and apparently does all that is accomplished by more expensive solid lubricants, which require the drilling of holes in the boxes, and which are not, as a rule, proof against water or oil. Boxes exhibited to us which had been in use for several months showed a smoothly polished surface and no signs of wear within. The manufacturers are the Lathrop Anti-Frictionate Company, of 408 Bleecker street, New York city.

IMPROVED WATER WHEEL.

Samuel C. Lyons, Bennington, Vt.—In this device the buckets are curved to pass the water readily upward, and are provided at their upper ends with outwardly extending lips, to which an inverted conical rim is attached, which encircles the upper edge of the case. A top wheel is seated loosely on a support of the wheel shaft, and has arc-shaped buckets, so that the unspent power still remaining in the water may be utilized by setting the auxiliary top wheel in motion.

IMPROVED COMBINED COMPRESSION AND SWING COCK.

Willis L. Brownell, Brooklyn, N. Y.—This inventor proposes to improve the construction of the ordinary swing cocks by providing them with a screw or compression valve, to permit the shutting off of the water independently of the swing faucet, to prevent the said cocks from leaking.

IMPROVED CAR COUPLING.

James C. Mitchell, Lancaster, N. H.—When the cars are run together, the end of the entering coupling bar pushes back a coupling plate, which, as soon as the head has passed its lower edge, swings forward, so that the shoulder of the head may rest against the rear side of said edge and sustain the draft strain. The front side of the plate which is pivoted in the drawhead rests against suitable shoulders inside the latter.

IMPROVED WASTE PIPE TRAP.

Thomas Hudson, Brooklyn, N. Y.—This is an improved valve attachment for stench traps, the object of which is chiefly to allow instant admission of air to supply the smallest vacuum created by the tendency of traps to siphonic action, and to prevent the gurgling sound frequently produced in the common stench trap. An adjusting weighted valve is arranged in a vent in the trap, which is held closed by the weight, but opened by the formation of a partial vacuum.

IMPROVED STAGE PLANK AND CARRIER.

William S. Booth, Baton Rouge, La.—This is a frame on which a number of rollers are mounted. By suitable mechanism the rollers are rotated, thus carrying along any object which may be placed on a stage plank above them.

IMPROVED STEAM WHISTLE.

Henry B. King and Christopher McKiernan, Paterson, N. J.—The new feature in this device consists in inserting a detachable plate in the throat of the whistle, in which a gage is arranged for governing the amount of steam or air used.

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Alden Engine, 3 cyl. Com. Balance Piston, doubles power of Steam! Circulars free. Farrelly Alden, Pittsboro, N.C.

I have several valuable patents on gang edgers and ripping machines, lath machinery, log-turners, &c., and would like to arrange with a party to manufacture and sell them in the Southern and Eastern States. Address E. C. Dicey, Grand Haven, Mich.

Correspondence Solicited.—Letters Patent were granted to Joseph E. Wilson, of Brazoria, Texas, on Nov. 9, 1875, for "Improvement in Screw Propulsion." Superior canal and river boats and ocean vessels can be thus constructed.

Every Inventor and Mechanic should have a copy of the "Indexed Diary." Price \$2, by mail. See notice in "Scientific," Dec. 18, page 393. Agents wanted. Address Erie Publishing Company, Erie, Pa.

Wanted—Steel Springs 1/4x3/4 in., ranging from 15 inches in length. Onawa Iron Works, Onawa, Iowa. Mfg Patent Universal Boiler Tube Expander.

Brass Foundry and Finishing Shop for Sale low. Rare chance. H. English, Wilmington, Del.

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Notes & Queries.

A. K. will find directions for bronzing brass castings on p. 283, vol. 31.—F. J. can put a gold lacquer on tin by following the directions on p. 130, vol. 32.—J. F. will find directions for frosting glass on p. 264, vol. 30.—R. N. will find directions for stereotyping on p. 363, vol. 30.—M. J. L. will find full directions for cleaning and coppering iron on pp. 90, 139, vol. 31. The book he mentions is published by Spon, 446 Broome street, N. Y.

(1) F. W. J. says: I have drawings of a punching press, intended to punch a hole 1/4 inch in diameter, through sheet iron 1/4 inch thick. I do not think it will be powerful enough to do the work, and I would like to know what pressure is required. A. The pressure required will be about 2,500 lbs.

(2) C. H. asks: What size of boiler is needed to run a slide valve engine with cylinder 1/2x1 1/2 inches? Kerosene is to be used for heat. Should the boiler be horizontal or vertical? A. Make a vertical boiler, 6 inches in diameter and 10 inches high.

(3) W. B. G. asks: Is there a proper speed for a turbine wheel of any given diameter, a speed at which it will do its maximum work with minimum of water or fall? How is such speed determined? What is the probable percentage of effective work which can be got from each unit of theoretical total power exerted by an ordinary wheel? Other things being equal, and the head of water the same, I suppose the power of a wheel to be as the vent space between the inner edges of the buckets, that is, with buckets equally spaced the comparative vent spaces will give comparative power of the wheels. By what rule can I ascertain the foot pounds of power exerted by a wheel of given amount of vent space (or of bucket surface) under a given head of water? I am working center vent 4 feet turbine wheels, in scroll cases and with gates of an area not half that of the venting space between the buckets. It seems to me that the gate first, and the case afterwards, throttle my power so that I get very much less than the same wheel would give me if gate and case were so large that every bucket would be acted upon alike by a solid column of water, and the wheel thus allowed to use as much as its venting spaces would pass? Is this so? A. Your questions cover pretty much the whole theory of turbines, and we could not answer them satisfactorily in our limited space. You will find the theory put in considerable detail in Rankine's "Treatise on the Steam Engine," Fairbairn's "Machinery and Mill Work," and Weisbach's "Mechanics and Engineering."

(4) J. V. says: It is argued that working two steam fire engines with a line of hose attached to each, and the other ends of the hose being attached to the arms of a Y, and both discharging from a nozzle 1/4 inches in diameter, screwed to 50 feet of hose fastened to the third arm of the Y, the pressure in the 50 feet of hose into which they are both working is nearly double that in either of the other hose pipes. I claim that pressure is about alike in the whole. Am I right? A. We think you have the right idea.

(5) H. M. H. says: I am building an ice-box, inside box 1 inch in thickness, composed of black walnut, and lined with zinc. The outside of this box I wish to cover with felt, 1/4 inch in thickness. The outer box is to consist of 1 inch in thickness of black walnut. Would this make a good family ice box? A. An air space of 2 inches thickness between the outer and the inner box is as good for the preservation of the ice as would be a packing with some filling like powdered charcoal or other material, but the space must be thoroughly airtight. Place the ice near the top, and the articles to be preserved lower; provide means to catch the drip from the ice—a sheet of zinc, perforated from below with holes to pass air down but not water, will do—and set a small pipe in the bottom to carry off the water. Make the lid of the box to contain an air space as well as the sides.

(6) Z. D. asks: If a man raises vertically a weight of 1,000 lbs., with the uniform velocity of 10 feet a second, by means of a cord and pulley, what would be the tension of that cord? In other words, what stationary weight would give the same tension to that cord, if fastened to a fixed point? Friction and weight of rope are not taken into account. A. Under the conditions stated, the tension of the cord would be about 1,500 lbs.

(7) J. K. says: I wish to build an ice house to hold about a carload. I read your directions on p. 251, vol. 31, but the house will only hold

8 tons. Could I make the interior, instead of 6 feet square, 12 feet square? A. When ice is well packed, the larger the mass the better it can be preserved from melting; a 12 feet cube has been known to keep two years. 2. What percentage is the melting in an icehouse constructed as stated? A. The percentage of melting will depend upon the climate, the length of the warm season, and the location of the house in regard to prevailing warm winds; but can be brought to a minimum by careful attention in opening and closing the doors, and regard to light, ventilation, and good drainage. 3. We can gather ice only 1 or 2 inches thick. Would it pay to fill the icehouse, and then use some freezing mixtures, as stated on p. 330, vol. 33? A. If you can procure ice 2 inches thick, you have only to store it in the coldest weather, pour water upon it as you store it, and it will freeze together in one solid mass.

(8) A. W. C. Jr. says: 1. I have a boat 20 feet long by 7 feet 6 inches beam, drawing 15 inches of water, and an engine 3 inches by 5 inches stroke. Is the engine large enough for the boat? It is a vertical engine, fitted with link motion. A. Yes. 2. What size of propeller do I require to drive the boat 6 or 7 miles an hour in still water? A. Twenty-two inches in diameter, and of thirty inches pitch. 3. Of what dimensions should the boiler be? A. Thirty inches diameter, 3/4 feet high.

(9) F. L. says: I wish to ask some questions about an hydraulic air compress. 1. In the case of a supply pipe supplying water to the cylinders, does it make any difference in the power whether the supply pipe is larger or smaller, if the head and the size of the cylinder and piston remain unchanged? My impression is that the only difference whether it is 1 inch or 2 in diameter is that the machine would work faster with the large pipe. A. There would be no essential difference. 2. Does Keely get any greater pressure by having his supply pipe so small? A. The way he produces his pressure is carefully kept secret. 3. If the pressure on the lower piston is 2,000 lbs., what pressure per square inch would the air compressed in the air cylinders have? A. The pressure of the air per square inch would be equal to the pressure on the piston in lbs. divided by its area in square inches. 4. Given a cylinder and piston, say 10 inches in diameter, with 1,000 lbs. weight on the piston, the cylinders being set upright and filled with water, with a hole 1 inch in diameter at the bottom connected by a chamber by a pipe, with what pressure or force would the water issue from the inch pipe? Would it be 1,000 lbs. per square inch, or only the amount of 1,000 lbs. divided by the square inches in the area of the piston? A. The same as the pressure on the same area of the piston. 5. Would compressed air let in on the surface of the water (the top of the cylinder being closed) produce the same effect as if the pistons were present? A. It would, with the exception that some of the air might be absorbed by the water.

(10) J. P. C. asks: 1. Will a 10x10 inch cylinder with 60 lbs. steam turn a two-blade propeller of 4 feet diameter and 10 feet pitch, with 18 inch blades, 150 turns in a minute, or would it be advisable to use one of 8 feet pitch and make 200 turns? The boat is 33 feet on the keel and of 11 feet beam; she is 5 feet 6 inches deep. A. It would be better to reduce the pitch still more, and run the engine faster. 2. Would the boiler require more heating surface for the latter than the former, and how much for each? A. You should have a boiler with about 300 square feet of heating surface in either case.

(11) H. L. C. says: 1. I am building a small engine of 2 inches bore and 4 inches stroke. What material will wear the best for a cylinder, brass or cast iron? A. Brass will be best. 2. Will an upright boiler of the following dimensions be sufficient to work the engine up to half a horse power? Boiler is to be 12 inches in diameter and 30 inches long, set in an iron jacket 30 inches in diameter, with the firebox under the lower end of the boiler, and a spiral flue to carry the heat around the boiler before it could reach the pipe. This would leave 10 inches above the fire for a steam chamber. A. We think the boiler is of sufficient size. 3. Would it be safe to set the boiler down low, so as to leave only an inch or two above the fire? A. Yes.

(12) S. B. asks: What will remove stains from uncolored leather (saddle flaps) without injuring the leather? The stains are probably grease. A. Try a little warm naphtha.

(13) E. H. J. asks: How can I remove grease from a sealskin cap, which has worked into the fur by contact with the hair? A. Try a little warm naphtha or benzole.

(14) A. M. & S. ask: With what can we mix white paint for marking numbers on woolen clothing? The ordinary paint rubs off in the course of manufacture. A. Try the following: Macerate (in a mortar) oxide of zinc with sufficient gum dammar and turpentine to give the proper body. This, we think, will obviate the difficulty.

(15) J. M. B. asks: 1. Is the racing of marine screw engines attended with any considerable loss of fuel? A. Yes. 2. Is there a governor in use, which secures uniformity of motion in screw engines? A. We think not. 3. Do different depths of immersion cause the screw to race, or is it caused by its being lifted partly out of water? A. By being lifted partly out of the water.

1. Can as fine castings be made of bronze as of type alloy? A. No. 2. Are molds of plaster of Paris as suitable to cast small bronze work in as dry sand molds? A. Yes.

(16) A. M. says: A friend and I have an argument which we have agreed to leave to you for settlement. I claim that the ordinary 3-ported slide valve cannot be lapped so as to use steam expansively for more than 1/2 the length of the stroke (that is, steam to follow piston 1/2) without putting another valve on the back of the main valve, or

putting another valve on a separate seat. My friend claims that the common single slide valve can be lapped and made to cut off at any portion of the stroke predetermined on, and can do it just as well and not spoil the exhaust as with the auxiliary valve; only, of course, it cannot be altered when once set. Which of us is right? A. You are.

(17) E. E. R. says: I notice that Mr. Sawyer, referring to Professor Tyndall's experiment, says that a person, on putting his ear close to the bar, can hear a click when the circuit is opened or closed. Now I have a line of telegraph of about 40 feet in open circuit, run by 2 cells of Lockwood battery. The wire is No. 12, copper. By placing my ear near either instrument, I can plainly hear the click when the circuit is broken, but not when it is closed. Why is this? A. Place the instrument on a sounding board. We think you will then be able to hear the click on closing circuit. With proper conditions, it can be distinguished both on opening and closing circuit.

(18) H. B. asks: What book could I get, to obtain information in electro-motive power? A. "Electricity and Magnetism," by Fleeming Jenkin, is an excellent little book.

(19) J. T. McL. says: The electricity produced on an engine, by the friction of a cross belt 100 feet long and 3 feet wide, is considerable. By holding one hand up within a foot or so of the belt, and with the other touching a gas jet with a copper wire, we can easily light the gas, even if the wire is held an inch from the jet. In some conditions of the atmosphere, it is very painful to walk bareheaded under the belt, although it is some 12 feet or more from the floor. A number of persons have received great relief from rheumatic and neuralgic pains and nervous headache by standing under this belt on zinc or glass plates. The question is this: Can I, with copper or other wire, collect a part of the electricity from the belt and convey it a quarter of a mile so as to utilize it? A. Yes, but it will cost more to do so than to generate electricity where it is wanted. An example of this phenomenon was illustrated in our issue of May 9, 1874.

(20) W. H. H. says: Some time since I ordered some short timber to be placed on some joists in my shop, and left. When I returned, I found it all placed on two joists; and I took one third off. Twenty-four hours afterward the joist broke. Why did it not break when all the timber was on? A. Time is an element to be taken into consideration in overcoming the strength of the fibers of timber. Two thirds of the load in this case was sufficient to break the joist in 24 hours after one third had been removed; but a much shorter time would have sufficed to break it with the whole load upon it.

(21) L. H. C. asks: Is there anything known which will ignite common burning gas by contact, besides, of course, electricity and fire? A. There are methods, other than those you mention, known to chemists, by means of which ordinary coal gas may be ignited. They are, however, without exception, open to so many objections that they are of little practical value. Metallic platinum, when finely divided, commonly called platinum sponge, has the property of condensing gases upon its surface. Thus, if a stream of pure hydrogen, or even carburetted hydrogen, be made to impinge on the surface of a little bulb of this sponge, its combination with the oxygen which it finds there causes the ball to grow red hot, and thus ignites the gas.

(22) J. B. L. says: I have made the telescope described in your paper about 18 months ago, and find it well worth the money and time taken to make it. Recently, while looking at the moon, I noticed that the edges, especially on the side towards the sun, had a wavy appearance, such as heat makes in ascending through air. A warm and cool layers of air in the atmosphere bend the rays of light from their true course. Thus it is that high powers cannot be used except on very rare occasions.

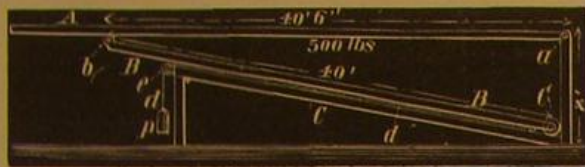
(23) M. E. C. says: We have a private telegraph line, 800 feet long, using No. 16 copper wire for double the entire distance, that is, using no ground wires. We have three offices, the wire in each entering the upper stories of the house and passing, by means of wire insulated with cotton and wax, to the lower floors. Is it perfectly safe to use it without lightning arresters? Our line is completely insulated with regard to the earth, and therefore I should think that it would not attract lightning. A. Lightning arresters are employed principally to prevent the wire, forming the coils of the instruments, from being burnt off. The line does not attract lightning at all. If, however, a discharge occurs in the immediate neighborhood of one end of the line, and the opposite end is very much nearer good ground (gas, water pipes, etc.), part of the discharge will follow the wire on account of the low resistance of such a route. In such a case, the line might be dangerous.

(24) L. G. S. says: Is the greater power of of the lenses produced by the shaping and polishing of the glass only, or is it also the result of a chemical process in manufacturing the glass? A. It is only the form of the lens that gives it its power. A convex lens makes objects appear larger; a concave one makes them look smaller.

(25) A. F. H. asks: Will you suggest a cheap and simple method whereby I may be able to grind lenses suitable for a microscope of high power, also others suitable for use in a telescope? A. There are two kinds of glass used, one very heavy, called flint, the other light, called crown; and with the proper combination of these, the lenses are made achromatic. Any text book of natural philosophy or optics will give you the proportions; and much valuable information may be gleaned from the last four volumes of the SCIENTIFIC AMERICAN.

(26) J. P. says: I herewith send you a piece of a porous cup. Can you tell me of what substance it is made? It is the best porous cup that I have ever used, as it offers but very little resistance to the galvanic current. A. The clay in the sample appears to be that ordinarily used for porous cells. The cup was very thin and not over-baked, which accounts for its low resistance. 2. There is a deep red cement used for coating the inside of glass cylinders for electrical machines. Can you tell me how it is made? A. The best sealing wax is much used for the purpose.

(27) C. N. W. says: A is a ladder weighing 500 lbs., pivoted at *a*, and having a lever or prop, B, hinged to it at *b*. This prop has a wheel, *c*, attached to its lower end, which runs up an inclined plane, C (inclined 1 in 5 or 8 feet in 40 feet). The power is applied at P through a rope, *d*, which runs over a pulley, *e*, and thence down the in-



cline, *e*, and is attached to the lower end of the prop, B. What power will be required to raise the ladder? A. You do not send sufficient data, but we will explain the method by which you can make the solution. It will first be necessary to find the pressure exerted at the point, *b*; next find, by the principle of the lever, the force that, acting in the direction of the prop, will balance this pressure; and finally, by the principles of the inclined plane, determine the relation between this force and the weight on the cord, *d*.

(28) D. R. B. asks: Is there anything that will settle or precipitate dirt in flowing varnish? I am using a varnish that has a good luster, but after it has flowed, it appears to be speckled with fine dirt. A. Thin the varnish down and filter through a small plug of cotton wool.

(29) A. H. R. says: I have a small piece of quartz rock, supposed to contain silver. Will you tell me some way to test it? If the rock is pounded up fine and treated with nitric acid, thoroughly stirred up, and salt be added, and then the solution be washed, put on to white paper, and exposed to the sun, would it turn dark if it contained silver? A. Grind the rock into an impalpable powder, and digest for some time with nitric acid. Filter the solution through good, clean, white filter paper, in order to remove the undissolved residue. If the solution contain silver, upon the addition of a solution of chloride of sodium (common salt), a heavy, white, floccy precipitate of chloride of silver will form, which will shortly subside, when the excess of liquid may be decanted and the precipitate washed with clean cold water. On exposure to light, this precipitate will soon change to a dark color.

(30) C. D. B. asks: What cheap substance can I add to Venice turpentine to destroy its odor without injuring its healing properties? A. We do not think this could be accomplished without altering the chemical properties of the body to some extent.

(31) C. H. D. asks: 1. In what form is nitrogen generally applied to the soil? A. Generally in the form of compounds containing ammonia and ammoniacal salts, such as urea. 2. Is there any way to ascertain approximately the proportions of nitrogen and phosphoric acid which would be required per acre in a field where cereals are intended to grow? A. Yes. An analysis of a fair sample of the soil would determine what was requisite. 3. What properties does air-slaked lime supply to the soil? A. It decomposes part of the organic constituents of the soil, and renders them suitable for assimilation by the plants.

(32) C. asks: Is there any chemical composition by which the skin may be darkened permanently, without any injurious effect? A. We do not know of any compound that will accomplish this.

(33) E. M. L. asks: Are the following proportions right for a small steam yacht? She is 30 feet long by 8 feet beam. The machinery is composed of an engine with a 5 inch cylinder with 6 inches stroke. She has a 32 inch screw of 4 feet 2 inches pitch. The boiler is 5 feet high by 30 inches in diameter, and has a low crown sheet with 56 two inch tubes, and is supposed to be an 8 horse boiler; but we can hardly keep steam to supply the engine. What is wrong? A. You do not send enough data to enable us to form a very definite conclusion. The proportions are very fair. If you could attach an indicator to the engine, and measure the water evaporated by the boiler, you can soon detect the trouble.

(34) T. J. H. asks: At what time in the year should I cut timber for wagon lumber, etc., so as to prevent the worms from getting into the lumber? A. The proper time for felling trees is that in which the largest quantity of hard and durable wood can be obtained as free from sap as possible. Timber is felled during the cold months, when the natural juices are most inactive, and the tree, in a measure, dormant. To properly season the wood, it is necessary that it should be exposed for about a year to the influence of dry air.

(35) C. S. asks: How can I find the power of a turbine water wheel? A. By experiment only. Which is the best to use with a windmill 12 feet in diameter, a circular or a straight saw, to saw wood? A. A circular saw.

(36) T. A. L. asks: If I take two locomotive springs of like dimensions, and give one 1 inch more set than the other, what effect will it have in regard to strength? A. The former spring will be stronger.

(37) J. V. asks: Why cannot I weld sleigh shoe steel? I can weld cast steel with good success. A. Probably from inexperience.

(38) J. W. B. asks: 1. Is there any difference in the power of an oscillating and a balance valve engine, if both engines are of the same size? A. It depends on the workmanship. 2. Is there any way to change the motion of an oscillating engine, as simple as the link motion? A. No, none so effective. 3. Are the drive wheels on locomotives keyed to the axles? A. Yes.

Has the mariner's compass the same polarity under water as it has above water? A. Yes.

(39) D. C. B. says: I have an hydraulic ram in operation, working at 8 feet head, by 1 1/4 inches feed and 3/4 inch discharge, throwing water through 300 feet of pipe, 50 feet high. When first put in operation, it worked well, but occasionally the water runs slowly until very little is obtained through the discharge pipe. The ram appears to labor very heavily, making a loud vibrating noise in the dwelling house where the water is delivered, even when it is throwing very little water. When it delivers its proper amount, there is only a sharp click heard from the valve. When working properly, the ram delivers over 1,000 gallons per day of 24 hours: when laboring heavily, with the loud vibrating noise, it only delivers about 100 gallons in the same time. What shall I do to remedy it? A. The trouble probably arises from the valves getting choked at times.

(40) J. A. S. asks: How are gun springs tempered? A. The springs are heated to a blood red, then kept covered with oil and held over a slow fire until the oil on them blazes freely all over the spring.

(41) J. R. says: 1. I assert that steam can be used expansively to advantage where you do not need the full power of the engine. I have an engine of 30 horse power and only require 15 horse power. Cannot I save steam by using it expansively, that is, by cutting off the steam when the piston has travelled one half or two thirds of its stroke? A. Yes. You are right. 2. Is it necessary to have the exhaust port larger than the steam port when you use the exhaust to create draft? A. Yes.

(42) J. G. W. asks: Can a left hand screw thread be cut with a right hand die, by taking one half of the die and a piece of copper, and cutting it? A. No.

(43) M. F. S. says: A friend asserts that, in belting directly on the face of an engine fly wheel, the most power is obtained from the wheel. He says also that the centrifugal force is greater at the face, and of course is transmitted to the belt, and concludes by saying that it is the best known way to belt from the engine. My claim is that, if the belt were driven from a smaller wheel on the same shaft, that the engine would not vary so much when work was thrown on or off, and the engine would not be strained so much, and consequently would run more easily. My theory is that the leverage is much greater in the fly wheel, and the weight is at the end of leverage, and will overcome the shorter leverage of the belt wheel, thereby causing the engine to run with less strain, allowing the fly wheel to check sudden jerks caused by work thrown on. Your decision will be gratefully received. A. Since you both agree to drive from the fly wheel by belting, the engine will be, with the same speed of belt, more powerful with the small fly wheel.

(44) J. N. T. asks: Please give me recipes for bright red and white paints, for painting the outside jacket and heating pipes of a dwelling house furnace. A. Use a paint made of red and white lead.

(45) R. F. G. says: I have a saw mill in which the engine cylinder is 8x16 inches, and the fly wheel 4 feet in diameter. The weight of fly wheel is about 400 lbs. I intend that it would improve the power to get a larger fly wheel, say about 600 lbs. in weight. Am I right? A. No. It would not improve the power.

(46) E. O. asks: What tools are necessary for making a small 2x4 inches engine, the cylinder being already bored? A. A lathe, a vise, and a few hand-turning tools, drills, scrapers, and files.

(47) W. W. K. says: On a recent examination of our steam boilers, we find a substance covering the tubes, braces, and the whole interior of the boilers. It resembles black wax, and comes, we presume, from allowing our exhaust steam to enter the claters from which we feed our boilers. How can we prevent the destructive effects of this deposit? We notice that the braces are already being corroded by it. A. The deposit must be analyzed before a preventive can be recommended.

(48) H. H. F. asks: How can I bore a long tube in a slightly taper form? A. A very slight amount of taper may be obtained by keeping the tube very cold at the commencement and gradually increasing the temperature up to 200° Fahr. as the boring proceeds.

(49) R. A. C. says: It appears to me that the most natural and effectual way to brake a car would be by gravitation, that is, by throwing the weight of the body of car, by means of toggle joints, on each wheel, the lever running diagonally across the bottom of the car to a bar of iron running up center, under bottom of car, from end to end, to the windlass on the platform. It could be so constructed that, when the engine is reversed and the cars are pushed together, the pressure can be utilized and brought to bear upon the wheels, so that a rolling motion can be changed into a sliding one immediately. Some of my friends maintain that a car would not be stopped so quickly with all the wheels instantaneously stopped as it would if their speed were partially impaired. Has

such a brake device as I mention ever been tried? A. Your plan is quite old in idea, and not practically useful for railways. The same effect can be produced by any continuous brake that is sufficiently powerful.

(50) F. H. M. asks: 1. Our school building is heated by steam. I put a check valve on the boiler, to prevent the water from backing up when the steam is shut off from part of the rooms. The valve retards the flow of water back to the boiler, and the arrangement does not heat so well. Can I not put a slender spiral spring under the valve to counterbalance its weight, and obviate the difficulty? A. Yes. 2. I have taken the valve out, and since that I have discovered several bad leaks in the steam joints. Why did they not leak before the valve was taken out, when we had greater pressure of steam? A. They were probably then not so much worn.

(51) C. B. C. asks: In turning cast or wrought iron, which can be driven at the highest speed without using oil or water? A. Cast iron.

(52) H. S. M. says: 1. I am building an engine to use steam at 500 lbs. pressure per square inch. Will the temperature of such steam be too high for brass or composition connections and valves? A. No. 2. Would it be safer to use malleable iron? A. No. 3. Which will stand the highest temperature without crumbling, yellow brass or gun metal? A. Gun metal.

(53) J. B. L. says: I am running an 18 foot overshot water wheel and an 8 foot driving wheel. If I increase my driving wheel to the size of water wheel, will it increase my power? A. No.

(54) A. asks: How is the fine color on case-hardened iron, such as on gun trimmings, obtained? A. Case-hardened iron does not present a fine color.

(55) H. W. S. says: I have an engine lathe of 16 inch swing and 5 feet bed. Is it possible to run it by foot power to turn cast iron cylinders not over 5 inches in diameter? A. No. It is impracticable.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

G. B.'s and J. M. R.'s minerals have not been received.—H.—Nos. 1, 3, and 4 are siliceous rocks, containing oxide of iron, but not in profitable quantity. No. 2 is carbonate of lime.—J. A. Y.—No. 1 is manganese. No. 2 is coral replaced by silice. No. 3 is ennerite. No. 4 is cyathophylloid coral. No. 5 is millepore coral. No. 6 is an imperfect fossil replaced by carbonate of lime. No. 8 is stilbite. No. 7. Send a larger fragment.—W. B. H.—It contains 85 per cent metallic lead, and will pay to mine if there is enough of it.

J. A. S. asks: 1. How are laminated steel guns made? 2. How are stub twist guns made? 3. How are Damascus gun barrels made?—A. F. asks: Why will a stick of timber 50 feet long and 1 foot square, sag more, whole, than when sawn into two inch plank?—S. T. S. asks: How are artificial limbs covered with raw hide?—D. H. S. Jr. asks: 1. What is the greatest depth of snow through which the most powerful locomotive can propel the best snow plow, at a uniform speed, on a level straight track? 2. What is the greatest feat which has been accomplished by a snow plow propelled by any number of locomotives?—H. M. T. asks: How do dairymen skim milk in large quantities?—J. K. says: I want to raise a certain weight. I put, on a stationary surface, a wedge 3 inches long by 1 1/4 wide at the large end, and 1 1/4 wide at the small end, the taper all being on one side, and the other side straight. I move the wedge by means of a screw 3/4 inches in diameter, with 10 threads to the inch, with a crank 4 inches long. What weight can I raise by exerting a force of 50 lbs. on the lever?

COMMUNICATIONS RECEIVED.

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

On Crossing the English Channel. By G. W. P.
On the Hydro Pneumatic Puzzle. By R. H. A., and by W. H. P.
On the SCIENTIFIC AMERICAN. By S. S. B.
On the Dioptric Light. By W. C. G.
On the Hoosac Tunnel. By F. W. G.
On Spark Arresters. By C. F. P.
On Pumping Water into Mains. By J. A. R.
On a Problem. By G. D. R.
On Laying Out a Square. By H. B. N., by C. E. B., and by J. W. D.
Also inquiries and answers from the following:
G.—C. K.—T. C.—W. M. T.—C. D.—E. A. P.—A. T.—T. B. M.—H. T. B.—J. H.—H. N.—F. W.—A. Q.—J. F. S.—B. O. S.—W. S.—J. S.—T. T.—J. T.—C. C.—I. L.—E. P.—L. P.—J. G. F.

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 inquiries analogous to the following are sent: "Who sells miniature steam engines? Where can simple galvanic batteries be bought? Where is the best apparatus for projecting the spectrum on a screen? Where can steam engine indicators be obtained?" All such personal inquiries are printed, as will be observed, in the column of

[OFFICIAL.]

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Vol. XXXIV.—No. 2.
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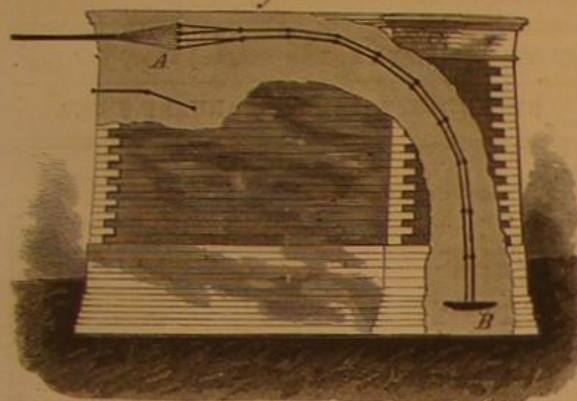
NEW YORK, JANUARY 8, 1876.

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THE NEW YORK ANCHORAGE OF THE EAST RIVER BRIDGE.

Located in New York city, and on the block bounded by Cherry, Dover, Roosevelt, and Water streets, a huge pile of massive masonry, during the past summer, has been rapidly reared. Work upon the structure has been arrested for lack of money and by the setting in of winter, principally from the former cause; and until the opening of spring, it will remain in its present condition. Early summer will, however, find it finished, if New York city responds in furnish-

Fig. 2



ing the money for its share of the cost; and the day on which its final stone is laid will mark the completion of the last of the four great monuments which are destined to sustain the wire network of the suspension bridge which will join the metropolis and its sister city, Brooklyn.

The building of the immense piers, which stand sentinels on the two banks of the East river, has been energetically pushed forward during the year just closed. The tower on the Brooklyn side is entirely finished, save the few cap stones, which cannot be added until after the cables are in place; the summit of the New York pier has reached a height of two hundred and eight feet, leaving thirty feet yet to be erected. The anchorage across the East river, in Brooklyn, is practi-

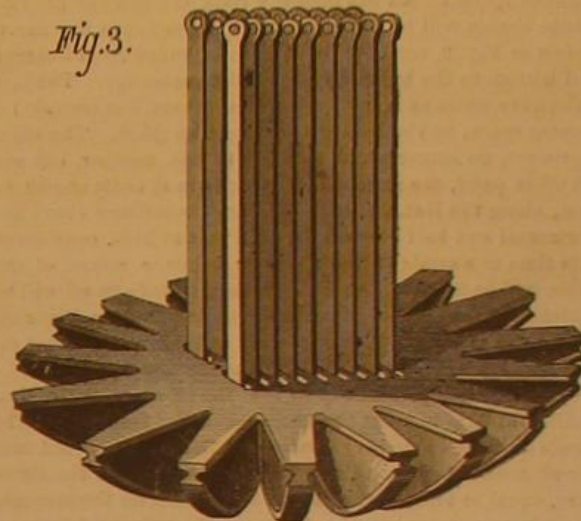
cally finished. The New York anchorage is the great structure to which we refer in our initial paragraph, and which is represented in completed state in the largest of the engravings given herewith.

The reader, even if not versed in engineering technicalities, will, without doubt, understand the object and uses of these colossal heaps of stone termed anchorages, from the name alone. Upon them falls the greatest pulling strain of the weight of the enormous wire structure and the traveling weight it is to sustain, since the piers, though withstanding of course a portion of the load, serve primarily to elevate the bridge to the proper height above the river. Hence the object sought in the construction of the anchorages is extreme solidity and strength, sufficient in fact to enable them to undergo a stress six times greater than that to which, by any chance, they can possibly be subjected. The two structures, located necessarily at each extremity of the bridge, are practically alike, the difference being slight variations in dimensions to suit their respective sites. The New York anchorage is, however, situated in the heart of the business portion of the city, and without doubt will attract a greater share of public attention. For this and other reasons, the following article is devoted to its description.

On the 7th of May, 1875, the pulling down of the warehouses and old rookeries, which covered the ground on which the masonry now stands, began. So rapidly was the work prosecuted that three months later found an excavation, in some places twenty-one feet deep, finished, and 500,000 lineal feet of yellow pine timber foundation in place. This substratum of wood consisted of four layers, placed relatively crosswise, and interspersed with concrete, the whole measuring four feet in thickness. On this was laid the first course of stone, which covered an area 129 feet long by 116 feet 4 inches in width. The material used is a good quality of limestone, obtained from along the Hudson river, parts of New Jersey, and the vicinity of Lake Champlain. As soon as two courses had been set, preparations were made for placing the anchor plates. Of these there are four, each an enormous mass of cast iron weighing twenty-three tons and made in spider shape, having sixteen radial arms, as shown in Fig. 3. The contract requirements as to the metal were that it should bear a strain of 500 lbs. to the square inch, on

a test portion resting on bearings $4\frac{1}{2}$ feet apart. Each plate was cast in a single piece, at Wilmington, Del. To transport such a heavy mass from the pier to the anchorage was a difficult operation, but it was accomplished by suspending the plate by strong bolts from beams of pine extending between two platform cars which traversed tracks laid in the streets. The usual jack screws supplied the lifting power.

Fig. 3.



From the longitudinal section, Fig. 2, the position of the plates, one of which is shown at B, will be understood. All are located in the rear of the anchorage, two meeting on the center longitudinal line, and one being disposed at each side. Each plate is embedded in concrete in the third course of stone, the second course being somewhat thinner immediately beneath, so as to form a species of socket. Through the apertures left in the center of the plates, the first set of bars for the chains is placed. Each chain consists of ten sets of links, and two chains lead from each plate. The corresponding links of each pair of chains contain together about nineteen bars. This will be better understood by reference to Fig.



THE NEW YORK ANCHORAGE OF THE EAST RIVER BRIDGE.

3, in which one row of vertical bars make the first link of one of the pair of chains, and the other row of similar vertical bars the other. Each bar at each end has a perforated circular head. The apertures in these heads, when the bars are in place, are in a straight line, so that pins may be put through said holes and also through the openings on the heads of the bars of the next link, when the latter are placed in suitable position, thus connecting the two links and forming a joint. Similarly pins are run through the apertures of the heads, which, in the lowest link, come below the anchor plates, and thus confine the chain to the latter. The heaviest pin used, as above mentioned, measures 7 inches in diameter, and the bars which constitute the links are 18½ feet in length, and vary in area of cross section from 27 to 31 square inches, according to position. The iron of which they are made has a breaking strength of 50,000 lbs. per square inch.

After the bars which form the first links were in place, the laying of the masonry was continued, and four courses of blocks of granite were built up above the plates, each stone weighing about ten tons. Then the limestone work was resumed, and this, with appropriate granite trimmings, will be continued through the forty courses, and to a total height of 89 feet. As the masonry rises, the links of the immense chains will be added, and the latter led in the curve shown in Fig. 2, until they will have extended from the rear and bottom to the top and front of the anchorage. The last links have twice as many bars as the others, but occupy no greater space, as the bars are only half as thick. The bars, moreover, no longer stand parallel to one another, but are set off in pairs, the members of which are at acute angles, so that, along the last pin, half the bars are inclined above the horizontal and half below. To each pair of bars, considered this time in a straight line above or below, a strand of the cable will be attached, so that nineteen strands in all will be fastened to the ends of two chains leading from each anchor plate; and as there are four plates, so there will be four cables, which will convey the strain to the masonry.

A glance at Fig. 2 will show that the effect of the cables, pulling at A, is to upset the anchorage on its front edge. The strain on each cable is estimated at 1,833 tons, or 7,332 tons for all four. Against this is the dead weight of the structure, equal to 44,000 tons. There is, besides, on the masonry a resultant pressure on the joints of the imbedded links of 2,267 tons; and to meet the pressure at each of these knuckles, a heavy plate of iron is interposed, backed with a large granite block. The strain on each anchor plate is 1,352 tons.

The general aspect of the structure is excellently shown in the large engraving. It decreases in size toward the top, the area of the summit being 85 feet 3 inches in width by 117 feet in length, and the surface slopes to the rear at the rate of 3 feet in 100. Through the interior of the pile are two arched passages, in front 61½ feet high and 23 feet wide, in rear 23 feet 7½ inches high by 14 feet wide, the difference in size being due to the upward slope of the surface of the ground to the rear. At the present time the structure is 44½ feet above tide, or 35 feet above Water street.

As soon as the New York anchorage is finished, the large unobstructed area of its summit, as well as that of its companion structure in Brooklyn, will be occupied by the machinery for spinning the wire cables, which will be one of the most interesting mechanical features of the whole enterprise. The first cord will probably be thrown across the river sometime next June, and from that time forward the building of the wire portion of the bridge will, it is expected, be vigorously prosecuted.

A NEW USE FOR THE EAST RIVER BRIDGE.

It is a well known fact that, owing to the rapid increase in size and population of the city of New York, the water supply is insufficient to meet all demands. The daily consumption is on an average something over 100,000,000 gallons, a much larger quantity in proportion to the population than is the case with either Paris or London. There is no question but that at the source, the valley of the Croton, into which the watersheds of Putnam county and vicinity direct their streams, there is an abundance of water. The difficulty is found in the aqueduct, which is a brick tube 53 3/4 square feet in area of cross section, and which is called upon to supply pipes aggregating 57 feet. The friction of the fluid in the smaller tubes and the approximate cessation of drafts on the reservoirs between midnight and morning alone prevent absolute deficiency in the ten days' supply which the Croton Bureau is obliged to keep constantly on hand. The new aqueduct, of which, we understand, the preliminary surveys are begun, will without doubt cure the difficulty; but in the meanwhile a large part of the built-up portion of New York, including the exclusively business section, suffers severely from a lack of water for fire purposes.

How to provide for this want is just at present a mooted question; and among the various plans proposed is one by Mr. A. W. Craven, ex-chief engineer of the Croton Aqueduct, which consists in constructing large storage reservoirs in the lower part of the city and keeping them filled with sea water by powerful pumping engines. The principal objections urged against this project are its expense and the fact that the reservoirs themselves might not be wholly free from danger in case of an extensive conflagration in their vicinity. It seems to us, however, that both of these objections might in a measure be obviated by using as the tanks two enormous ones which are now built and lying empty, and of which no one, so far as we are aware, has hitherto suggested any means of utilization. We mean the hollow towers of the New York pier of the Brooklyn bridge. This immense structure contains within it two watertight cavities 120 feet in

depth, or rather in height above the ground, and 13 by 19 feet in cross section. An approximate calculation of the contents gives about half a million gallons to each; or in both together, over one million gallons of sea water might be stored. It is not assumed, of course, that the supply from these could or would be utilized for up-town districts, and there supply is not so much needed; but it would, in case of a conflagration, offer a valuable addition to the present deficient water facilities down-town, among the warehouses and shipping of the city. Similarly the interior of the Brooklyn pier would offer a reservoir for water for protecting the valuable storehouses and shipping in its vicinity. The height of the head is fully 60 feet above the tallest buildings, excepting, of course, the very lofty structures recently built by the Western Union Telegraph Company and the Tribune, and a few other fire-proof structures, and therefore the water could be led under a heavy pressure directly to any story.

ELECTRICITY AS AN EXECUTIONER.

The revolting scenes accompanying the execution of several criminals in this vicinity are well calculated to bring to public notice the disadvantages of hanging as a mode of capital punishment.

The teachings of Science are heeded and sought for in the building of prisons, in the management and care of convicts, and in every modern correctional system; and yet in so simple and easy a process as the extinguishing of human life, they are utterly ignored.

The most certain and painless death known to Science is caused by the lightning stroke, or by, what amounts to the same thing, the electric shock. When a powerful discharge of electricity is received in the body, existence simply stops, and the reason is obvious. Helmholtz has proved that, for any vibration which results in sensation to reach the brain through the nerves, one tenth of a second of time is required. Furthermore, time is also needed for the molecules of the brain to arrange themselves through the effect of that vibration, through the motions and positions necessary to the completion of consciousness, and for this an additional period of one tenth of a second is expended. Consequently, if, for example, we prick our finger with a pin, it takes two tenths of a second for us to feel and recognize the hurt. It can easily be conceived, therefore, that if an injury is inflicted which instantly unfits the nerves to transmit the motion which results in sensation, or if the animating power is suddenly suspended by an injury to the brain before the latter completes consciousness, then death inevitably follows with no intervention of sensibility whatever.

Now a rifle bullet, which traverses the brain in the one thousandth of a second, manifestly must cause this instant stoppage of existence, and proof of this is found in the placid faces of the dead, and in the fact that there is nothing more common than to find men lying dead on battle fields, shot through the brain, but with every member stiffened in the exact position it was in when the bullet did its work. But a rifle ball is slow beside the electric shock. Persistence of vision impresses a lightning flash on the retina for one sixth of a second, but its actual duration is barely one one-hundred thousandth of a second.

The effect of the shock on the system is excellently described by Professor Tyndall, who, while lecturing before a large audience, inadvertently touched the wire leading from 15 charged Leyden jars, and received the whole discharge through his body. Luckily the shock was not powerful enough to be fatal; but as the lecturer regained his senses, he experienced the astonishing sensation of all his members being separate and gradually fastening themselves together. He says, however, that "life was blotted out for a sensible interval," and he dwells with much stress upon the opinion that "there cannot be a doubt that, to a person struck by lightning, the passage from life to death occurs without consciousness being in the least degree implicated. It is an abrupt stoppage of sensation, unaccompanied by a pang." So much for the death which, by suitable alteration of the law, we would have substituted for slow strangulation. The next point is its practical accomplishment.

Instead of building a gallows and providing rope, the sheriff, advised by a competent electrician, would procure a powerful Ruhmkorff coil and a heavy battery. These instruments would rarely need replacing, and would last indefinitely for other executions. The battery and coil should be of sufficient strength to deliver an eighteen inch spark. In case of their being more than one person to be executed, all of the condemned would be conducted with all due ceremony to the place of execution, the left hand of one man handcuffed to the right hand of his neighbor, and the conducting wire fastened to bracelets on the disengaged wrists of both criminals, if only two are to be hanged, or to the wrists of the outer men, if more than that number are to suffer. The culprits being seated so as to be seen by the legal witnesses, the sheriff presses a button. The current is instantly established from the coil, passes through the bodies of the men, and all is over. With a competent electrician, who might be a member of the police force, and specially charged with the duty, there would be no possibility of mistakes. The same ignominy which attaches to the gallows would be transferred to this mode of destruction, while the peculiar death by lightning, which, among the ignorant of all nations and ages, has been the subject of profound superstition, would without doubt, through its very incomprehensibility and mystery, imbue the uneducated masses with a deeper horror.

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VOLUME XXXIV., No. 2. [NEW SERIES.] Thirty-first Year.

NEW YORK, SATURDAY, JANUARY 8, 1876.

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IS INSURANCE A BENEFIT?

It is difficult to conceive of a more horrible tragedy than that perpetrated by the author of the recent dynamite explosion on the wharf of the steamer Mosel at Bremerhaven; but the scores of people there killed and wounded would form but a small proportion of the total number of victims had the fearful design been carried out as it was planned. The object was to gain a heavy insurance which had been effected by the projector of the scheme on the vessel; the means, a powerful explosive in connection with mechanism, the study and invention of which shows the deliberate nature of the crime. There was a train of clockwork which could be set to run noiselessly for ten days; then a lever weighing thirty pounds would crash into a box of dynamite. The fearful explosion which prematurely happened on the wharf would have taken place in the hold of the vessel in mid-ocean, and not a soul on board would have survived to tell the tale. The man, Thompson, who conceived this diabolical crime, has cheated justice by committing suicide, but it is said that he has denounced his accomplices, and for these the rigid German law will show little mercy.

Amid the universal execration which this atrocity has called forth, little attention has been given to the incentive, perhaps for the reason that it is one for which crimes have over and over again been committed. Sooner or later, we think, however, it must become a question of serious consideration whether the present system of insurance, against loss or casualty in any form, does not, as a temptation to the depraved as well as a cause of negligence by all, outweigh its advantages to the community in general.

Mr. Plimsoll's recent keen denunciation, in Parliament, of some British shipowners, for their inhuman cruelty in sending men to sea in old and unseaworthy vessels, covered this among other points. Ship after ship has left English docks, loaded almost to the water's edge, and built of green or rotten timber, which, when the vessel worked in a rough sea, must have opened at every seam. Ship after ship has never been heard from after leaving port. The owners cared nothing, for they risked nothing: if the vessel made the voyage in safety, they pocketed their profits from her cargo; if she sank, they pocketed their profits all the same from the insurance companies. Morally, if not legally, it cannot be contended that these merchants are not as criminal as the wretch who has just killed himself. More criminal, we think, for they, for the most part, are wealthy and educated gentlemen, the other an ignorant vagabond. They, in other matters at least, possess refined moral sensibilities; he was apparently destitute of any such quality; and yet the incentive to crime in both cases was identical, and the object, the insurance money, brings all to a common level.

A few weeks ago the Deutschland, a steamer of the same line as that on which the explosion took place, was totally wrecked on an English sand bank. As usual there was a lack of life-saving apparatus, and scores of people were drowned. We say as usual, because the same has been the case with the Ville du Havre, the Atlantic, and the Metis, and in other marine casualties of late years. Why are not efficient means of safety provided, when the same, in almost endless variety, are in existence? It is no injustice to impute to the companies, who thus fail in their plain duty, the influence of the insurance money again. Why should they, they may ask, protect their ships, why encourage inventors to devise or test new appliances for that purpose, when the loss of the vessel does not carry with it any loss to the company's treasury? By similar reasoning, of what use are protections against fire to a building which the owner knows he has insured just a little above value, no matter if it is a crowded tenement? Of what use are safeguards on steam generators? And why not employ patched and leaky boiler sheets so long as the boat or building is insured?

No one knows better than do the insurance companies of the repeated arsons, and attempts at arson, that are committed in order to realize the insurance money on buildings. The records of almost any criminal court will show a startling prevalence of these crimes, which even the life imprisonment penalty, affixed thereto by the laws of some of the States, does not seem materially to check. On being notified of a loss, the policy of an insurance company is not to seek proof that it was the result of fraud, but apparently to assume that fact as true, and to throw the onus of proving to the contrary on the loser. This is a natural enough course, and the legitimate consequence of the frequency with which the companies have been victimized; but it goes to strengthen what we have said above. Again, we have a fire marshal in this city, charged with the express duty of tracing the origin of every fire, and armed with all the powers of the law to help him. His official existence is simply an official recognition of the prevalence of incendiarism; and the records of his office likewise will show that that crime, which in malignity is by the law deemed next to wilful murder, is rarely committed save with the object of realizing insurance. Its very prevalence compels people to insure, for a fire is not always confined to the single building in which it originates; and in burning his own structure, the criminal equally endangers that of his neighbor, and the latter must protect himself against such peril.

Argue the question as we may, the insurance system is defective, begetting either carelessness or crime. The struggle for wealth is too close and too bitter to expect mankind to guard against what seems to be, and what is, to his selfish self, an already guarded contingency, when an expenditure of money is involved thereby. If it may be predicated of the best of us that, Nero like, we will fiddle when our property goes to destruction through our carelessness, knowing that we lose as little as did the heathen Emperor, then it may equally be assumed that those not possessing our moral re-

straints will as coolly set designedly in motion the same course of events.

To advocate the abolition of all insurance would be, we are well aware, to strike at great interests; but it does not seem impossible that in the main the community would thereby be the gainers. "An ounce of prevention," says the old saw, "is worth a pound of cure." Query: Would not the extreme care that we should take of our property, and indeed of all our interests (involving, as many do, the well-being of other people) more than compensate for the loss of the very often doubtfully gained "pound of cure" for misfortunes thereto, which the insurance system offers?

MR. EDISON'S ELECTRIC DISCOVERY.

On the evening of Thursday, December 16, Mr. Edison brought his discovery, of what he supposes to be a new force, before the Polytechnic Club of the American Institute. Dr. Beard gave a very lucid account of the phenomena, observed by himself as well as by Mr. Edison; and he pointed out in what particulars the new spark is similar to some forms of electricity and in what it appears to differ from the various known forms of that force. Like a true scientist, he pointed out that only such phenomena as every competent experimenter is able to verify at any time are worth consideration; and he spoke of the sources of illusion and delusion which misled Reichenbach, and afterwards others who asserted that they had verified his alleged discovery of the so-called odic force.

Some writers who gave the first reports of Mr. Edison's discoveries to the daily papers, with more enthusiasm than discernment or knowledge, said that, in their opinions, there was identity between Mr. Edison's discovery with the so-called results of Reichenbach's experiments. But the difference is that in the first case we have a reality, and the experiments have results which any one can see and verify; while in the other case we have alleged results which nobody can see but the mediums, so that all belief in the reality of Reichenbach's phenomena rests exclusively on outside testimony.

Dr. Beard also pointed out a feature to which we referred in an article in our issue of December 25, namely, the dissimilarity of the experiments of Reiss, with what he calls weak sparks, and Mr. Edison's discovery. They differ in origin as well as nature. Reiss' experiments were made with static electricity, while Mr. Edison obtains his results from the contact breakers of electromagnets. Dr. Reiss' weak sparks have polarity, while those of Mr. Edison show none, and in that respect the latter differ from all other known forms of electricity: at least neither Dr. Beard nor Mr. Edison have been able to discover any trace of polarity, but, as this is only a negative proof, and we do not know what future investigations may reveal, it is as yet premature to give a decided opinion.

After considering Dr. Beard's elaborate and masterly exposition of the phenomena thus far observed, and seeing the experiments which Mr. Edison kindly exhibited before the members of the Polytechnic Club, with his apparatus of three vibratory sounders, charged by six chromic acid battery cells, we see no reason to change the opinions we have already expressed: That, after all, the phenomena may be due to a peculiar form of induction. They prove that the inductive power of a coil, when charged or discharged by a sufficiently strong voltaic battery, extends all around to a distance of one or more inches, and can not only induce currents in other coils, but also in straight wires or, better, in metallic bars, kept within the range of this influence, which influence may be called an inducing atmosphere surrounding the coils. Dr. Beard also appears inclined to the view that the phenomena are due to electricity; while Mr. Edison differs from him on this point, and is strongly inclined to consider the phenomena to be due to a new force, as distinct from electricity as light or heat is. Mr. Edison would rather prefer to consider it as a new form of heat or light than of electricity, and gives, as his principal reason for this view, the absence of polarity, which absence exclusively belongs to heat and light, while electricity without polarity is (to use one of Herbert Spencer's expressions) unthinkable. We fully agree with him in this respect; and according to Mr. Edison's invitation, we will assist him in a new course of experiments, laying the results before our readers at an early opportunity.

MECHANICAL DRAWING.

The following is from the introductory chapter of "LESSONS IN MECHANICAL DRAWING," by Professor C. W. MacCord, given in SUPPLEMENT No. 1:

There is probably no other acquirement which so perfectly combines pleasure with profit as skill in drawing. Even regarding it as an accomplishment only—a source of pleasure and nothing else—this is of so refined a nature, and so elevating in its tendencies, that no better recreation can be suggested; and leisure time could hardly be put to a more commendable use than the cultivation and exercise of this art.

The ability to make drawings, of any kind or in any manner, is an unfailing source of delight and honest pride to its possessor; but a feature of greater importance and more widely extended interest is its great and varied usefulness: he who can draw correctly, even if roughly, wields a language clearer, more direct, and more nearly universal than any expressed by words. And it is useful to every one, without exception—of whatever age, of whatever position in the social scale, of whatever occupation; there is not a single individual of either sex who would not be, both directly and indirectly, the gainer by an acquaintance with this graphic tongue, which is here considered in its most comprehensive sense.

Naturally, mechanical drawing is of the most varied and

extensive utility in pursuits of a mechanical nature; in these it becomes not merely an aid, but a necessity, to the greatest proficiency: not only to the professional draftsman in the office, who makes it his sole occupation, but to the molder in the foundry, the pattern maker at his bench, the blacksmith at the forge, and the fitter and finisher at vise or lathe. All these, in order to execute designs intelligently, must be at least able to read drawings, and would be, surely, none the worse workmen if able to make them also; so, too, of the carpenter, the stonemason, and the brick layer: while the boiler maker, in laying out his plates, the tinsmith, the coppersmith, or the worker in sheet iron, cannot call himself master of his craft unless he has some acquaintance with the art of mechanical drawing.

And yet there are thousands engaged in these very pursuits, journeymen and apprentices, conscious of this, but still making no effort to acquire the knowledge which would be so useful to them; and this in spite of the fact that they waste in frivolous amusements, if nothing worse, time enough, if properly used, to become quite skillful with the pencil and the pen. In some cases this may be due to sheer laziness, or dislike to study; to these we have nothing to say, except that they must not be astonished if they find themselves surpassed by their more energetic comrades. But to the great majority, we are sure, this does not apply; and to them we shall try to render some assistance. Leisure time at evening may be pleasantly and profitably employed in the practice of drawing and the study of its principles, by young and old alike; for this is one of the things which it is never too late to learn, and we are disposed to think that many would make this use of spare hours if they knew just how to set about it. Besides the lack of instructions suited to their circumstances, we believe that two other considerations deter a great number from making a beginning are a false impression that a fine and costly outfit of instruments is necessary at the outset; the other, a consciousness that mathematical principles are involved, which are beyond the limits of their education. Now, it is certainly possible to spend a great deal of money in the purchase of instruments—in fact, the professional draftsman who wishes to execute all kinds of work with facility has need of a variety; but the appliances absolutely essential to the execution of even the most elaborate mechanical drawings are in reality few and simple, and one who is not familiar with the subject would be astonished to see what can be done with very few and inexpensive things.

And no one should permit himself to be frightened off by the second consideration. We do not deny that a knowledge of geometry would be of use, great use; but we do say that any one sufficiently intelligent to be a good apprentice at any mechanical trade can, if he will but resolutely try, so school his eyes and his hands that he can produce drawings which will be both creditable and useful to him. A child learns music, not by waiting until he understands the principles of acoustics and of harmony, but by the practice and continued repetition of exercises which train his fingers, and he is master of the mechanical difficulties before he knows what acoustics means. And so any one may begin mechanical drawing, as he began writing, in a mechanical way: "I dot my i because I was taught so, sir; which is the very reason why I make a round." By the exercise of a little faith he may at least follow the lead of another; and, once interested in his own progress, it will be strange if, by the exercise of a little common sense, he does not gradually gain an insight into the principles which underlie the practice.

Now, great progress may be made in the study of principles and methods, and much valuable practice had, without any instruments at all, by any one who has something to mark on, something to mark with, and the will to put this and that together. But free hand sketching, though of itself a valuable acquisition, and one by no means to be neglected by any draftsman, is not what is usually understood by mechanical drawing, in which, not relying on the unaided eye and hand, the measurements are made by scale, and the lines by rule and compass. Consequently, in order that the hints which we have to give in regard to such drawing may be of the greatest use to the greatest number, we shall begin with a description of the simplest, yet perhaps the most useful, of the instruments which the draftsman uses.

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Our many friends will be gratified to know that the issue of our SUPPLEMENT, on the 1st instant, was attended with the most gratifying success. We printed a very large first edition, but it was exhausted almost before the last sheets were folded. We were obliged to print a second edition immediately, which is now going through the press.

For the present we are electrotyping all the pages of the SUPPLEMENT, and can therefore meet any demand for the numbers, however large.

We will take this occasion to repeat the invitation given last week to Engineers, which extends as well to those engaged in other branches of Science and the Arts, namely: that the publication of the SUPPLEMENT supplies us with a greatly increased amount of space, devoted to the information and benefit of our readers. We shall be pleased to receive copies of working drawings and specifications of new mechanical or engineering works of specially interesting or notable character, which, when possible, we shall engrave and publish in the SUPPLEMENT; also papers and drawings upon other scientific subjects. Papers so sent to us will be preserved, and returned to the authors when desired, due credit being given on publication.

The "LESSONS IN MECHANICAL DRAWING," begun in No. 1 of the SUPPLEMENT, will be continued from time to time, and will afford, to all who desire to acquire this important art, the most varied exercises and the most careful instructions.

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THE KNOWLES STEAM PUMPS.

During the closing days of the Industrial Exposition recently held in Pittsburgh, Pa., a very interesting competitive trial was made of the various steam pumps exhibited. The tests were of a purely practical nature, no facilities being afforded for scientific determinations; but the results are,

failed at times during the test to keep the stream up to the required height. The Knowles pump consumed 52½ lbs. of coal, and kept the stream above the given point during the entire test. The other pumps also maintained the streams, but used greater quantities of coal than the Knowles, as follows: The Cooper (fly wheel) pump, 63 lbs.; the Niagara, 72 lbs.; the Blake, 62 lbs.; and the Hutchinson, 60½ lbs.; the Knowles, therefore, winning the contest.

We have obtained from Mr. Knowles the following information relative to some of the best and newest forms of pump, engravings of which are given herewith. Fig. 1 represents the No. 3 pump complete, with boiler. This machine is adapted to general purposes, especially for supplying buildings and railway tanks with water. It is of very simple construction, and includes an improvement in swing-

pecially adapted to fire purposes, and known as No. D D is shown.

The protection of large edifices, and especially factories

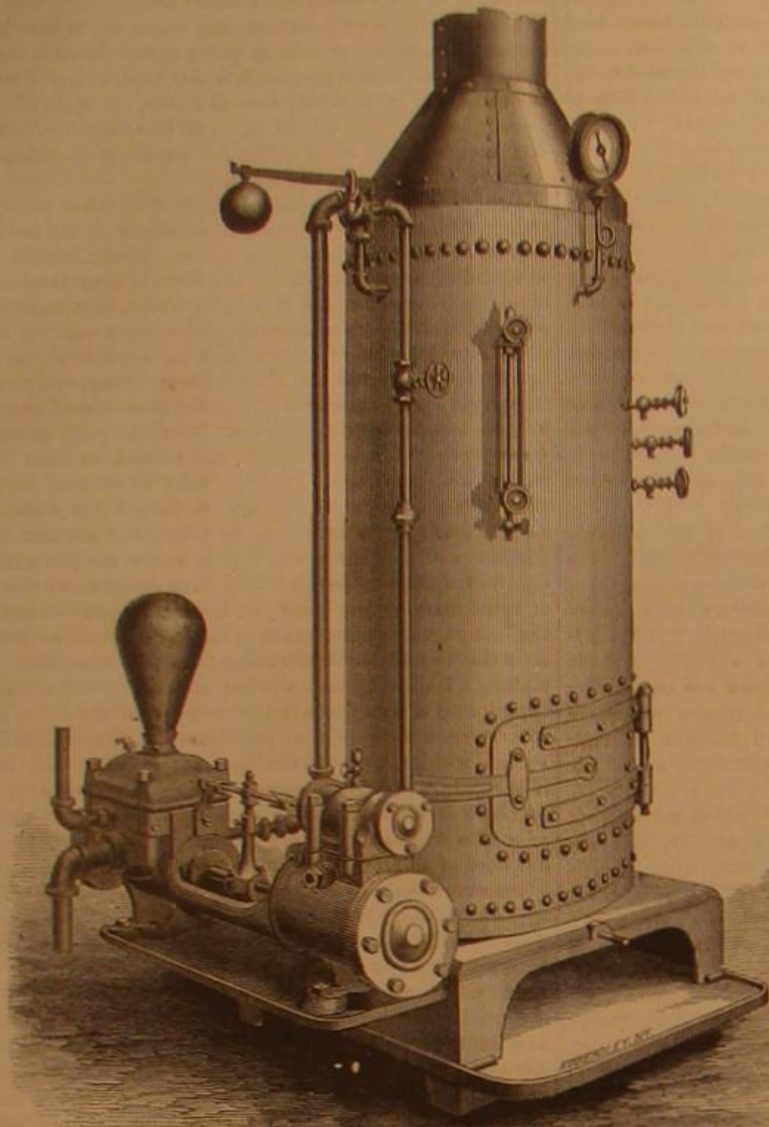


Fig. 1.—STEAM PUMP WITH BOILER.

nevertheless, valuable to engineers, as showing quite clearly the relative efficiency of the machines under conditions of actual use. The details of one of the last competitions, between the victor in the previous contests and the other dumps below named as entered, sum up, in general terms, the result reached. The Knowles pump had already proved its superiority as a fire pump, and had also come off best as against the Blake, Niagara, and Hutchinson machines, in the latter trial being tested at slow running, at working against a pressure of 60 lbs., at regular working speed (piston speed 160 feet per minute) against the same pressure and also being subjected to critical comparative examination by well known experts as regards advantages of construction, facility of repairs, and similar points. The decisive contest below mentioned was the result of a claim for the premium by the exhibitors of a machine constructed on the pulsometer principle, on the alleged ground that the latter was a direct-acting steam pump and would throw more water with the same amount of fuel than any other apparatus. The conditions of the trial were to throw a stream through a three quarter inch nozzle, to a given height, and hold it at the same point for three quarters of an hour. The start was to be made with two gages of water and 100 lbs. of steam pressure. The Knowles pump was selected by the judges as the competitor under this challenge, but subsequently exhibitors of other pumps were allowed to enter their machines in the same trial. We are informed by Messrs. Bailey, Farrell & Co., of Pittsburgh, who exhibited the Knowles pump, that the results were as follows: The pulsometer consumed 103 lbs. of coal, and

ing bolts, and a removable hand attachment, as represented in Fig. 2. The last mentioned device is useful for filling boilers when steam is down, washing decks, and for similar purposes. It is easily removed and applied.

Fig. 3 represents the pump arranged as an independent stationary steam fire engine. The capacity is only limited by the size of the machine, and it is claimed that steam can be raised and a stream of water thrown upon adjacent buildings in less than seven minutes from the time of lighting the fire under the boiler. In Fig. 4 a form of the pump es-

the pump has its own boiler, as above noted, and is isolated from the main structure, it is out of the reach of danger, and is always ready for immediate operation. Pipes may be laid from it, underground, to various parts of the works; or a single powerful machine, connecting with hydrants, reservoirs, ponds, or running streams, and capable of throwing from one to fourteen streams to distances of two hundred feet, might be employed to protect an entire village or town. The manufacturer informs us that the pump under examination will be guaranteed to project the above number of streams to the distance named, from hydrants or other sources situated a mile away.

The Knowles pump finds one of its most important applications in mines, and two different forms, used for deep mining, are represented in Figs. 5 and 6. Fig. 5 is a double-acting plunger pump, arranged with hand holes for affording immediate and easy access to the valves. The valve plates are entirely separate from any other part of the pump, and all the stuffing boxes are on the outside. The water passages are large, and the general construction heavy and strong. Fig. 6 is also a double-acting plunger pump with accessible parts. Its principal feature is the absence of joints in the water end, and the novel arrangement of valves by which not only the valve but also the valve seat is instantly removable by simply unscrewing the cap nut. These pumps are now working on lifts equal to 1,600 feet vertical column, without causing shocks or pounds of any description.

The first pump made by Mr. L. J. Knowles was produced in 1855, and patented at that time through the Scientific American Patent Agency; and two years later the manufacture

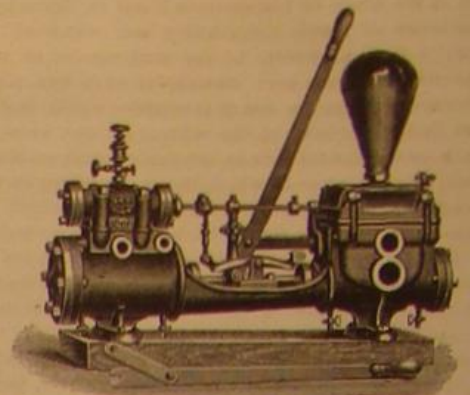


Fig. 2.—STEAM PUMP WITH HAND ATTACHMENT.

by steam pumping apparatus has been found by actual experience to be one of the best measures of safety. Where

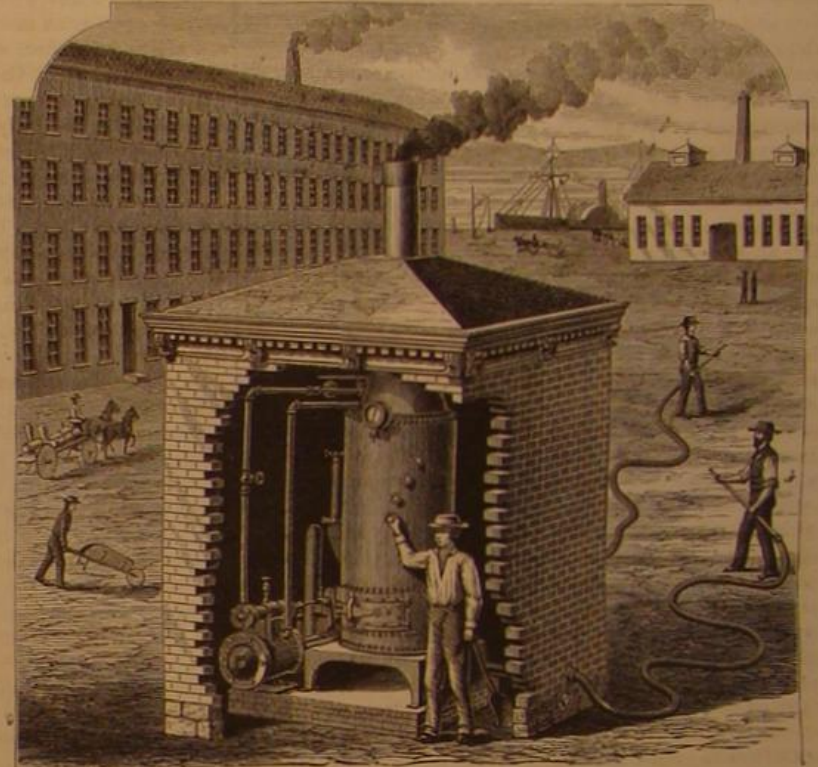


Fig. 3.—STATIONARY STEAM FIRE ENGINE.

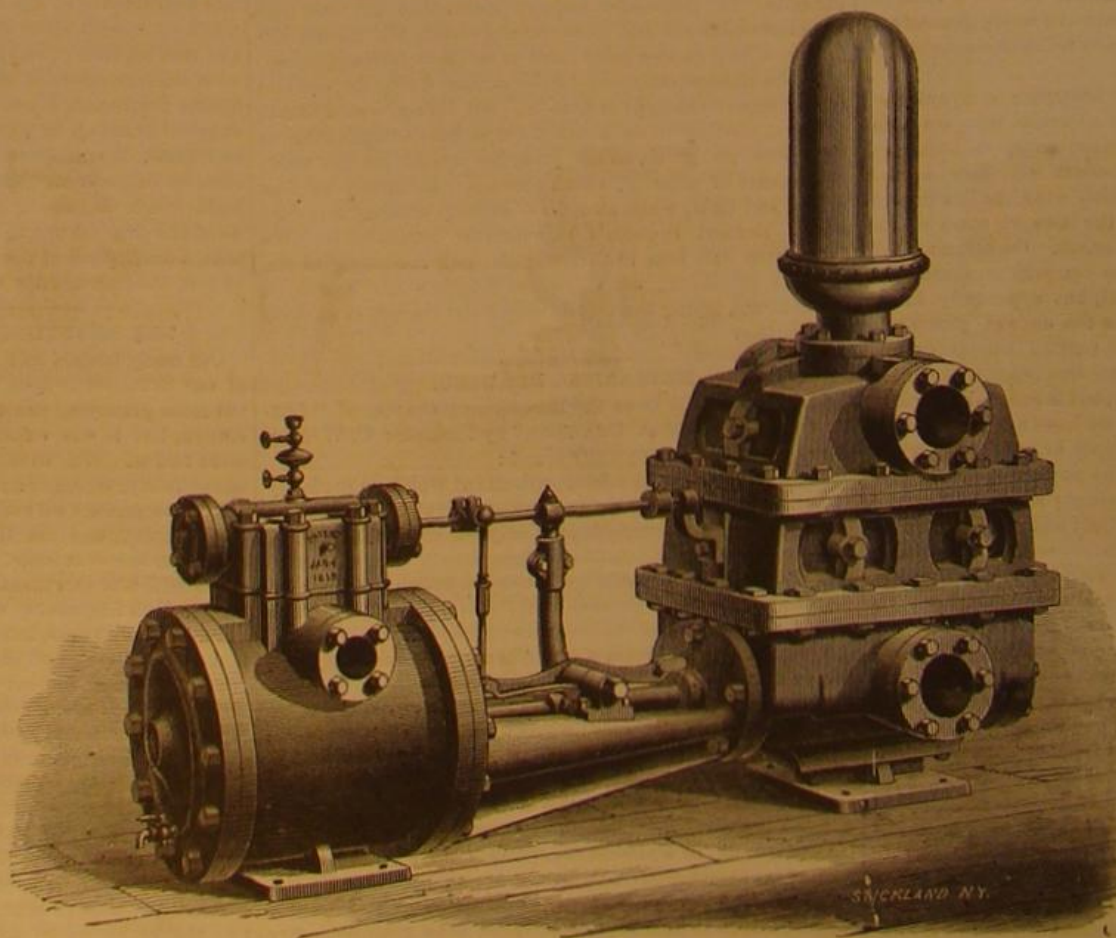


Fig. 4.—FIRE PUMP.

was regularly begun. The manufactory of these celebrated pumps is located in Warren, Mass., and was established in 1862, since which time it has been gradually enlarged until it now covers two acres of ground. The principal warehouses are at 92 and 94 Liberty street, in this city, and at 14 and 16 Federal street, Boston, with branch houses in Chicago and San Francisco. Upwards of five hundred different patterns of pumps are now made, ranging from the smallest sizes to pumping engines weighing from ten to forty tons each, and possessing a capacity, as demonstrated by actual tests, of supplying several millions of gallons of water daily, and of forcing the same to heights of hundreds of feet.

The New Force.

The new force claimed to have been discovered by T. A. Edison may be demonstrated in the following manner:

Upon an insulated table place an ordinary Morse key and an electro magnet, the coils of which are so wound that no magnetism is produced in its cores by the passage of an electric current. Use for an armature a piece of the metal cadmium, to one of which fasten a flat spring. The other end of the spring attach rigidly to a standard fixed on the table. Adjust the armature a short distance away from the core of the magnet. The standard is to be connected by wire to one end of a glass rod or tube, say two feet long. The other end of the tube connects by wire with a graphite point (a lead pencil will answer). Another graphite point is connected by wire to a gas pipe or other suitable mass of metal, not in contact with the apparatus; and the two points, in position similar to the arrangement for producing the electric light, may be placed in a box from which light is excluded, but with a hole in the top for observation. Place 10 or 15 Bunsen cells in circuit with the key and the coils in the usual manner. Now, if the key be closed, a spark of considerable brilliancy will be evolved from the graphite points, but possessing no continuity. If, however (the battery circuit remaining closed), any part of the connection between the gas pipe and the cadmium is broken, and contacts be made either slowly or rapidly between the disconnected points, the spark re-appears at each contact. It

is here that the phenomena are surprising, and apparently unexplainable. The graphite is not in the battery circuit, nor in any other. Moreover it is separated from the rest of the apparatus by the glass tube. This alone would seem to prove that the force is not electrical, at least as the term is generally understood; and when supplemented by the fact that the most delicate galvanometer and the chemicals most sensitive to the electric current fail to note its presence, this conclusion must be accepted. Many experiments have been made with a view of obtaining some definite knowledge, but nothing has been developed beyond the facts above stated, and in addition that, like electricity, the new force passes through or over some substances better than it does over others, and also that, as the resistance of one of its best known conductors is increased by length, the spark decreases in brilliancy.

The occurrence of this spark has frequently been observed by electricians while conducting experiments, but heretofore no attempt has been made to discover the cause or effect. Any theory upon the subject is, of course, at present only speculative, but it is not improbable that the phenomena are in some degree the physical manifestation of that mysterious magnetic power which is not obstructed by material obsta-

cles, and is weakened only by separation. This view is supported by the analogy existing between two demonstrated facts. First: When the new force is conducted through the human body from points attached to both sides of the neck, the spark is of a certain strength. When the connection is through the trunk, from hand to hand, the strength is greatly diminished.

Second: Substances which act as dielectrics offer no obstruction to the passage of magnetic power. The action of a magnet upon a needle is the same when separated by a thickness of glass or porcelain, as when separated only by a

animal, which he "took to be a buffalo or wild ox," but he saw no other traces of the animal. These statements are very wonderful, and before giving credence to them we had better await the publication of the official account of the voyage.

Pneumatic Telegraphy.

Pneumatic telegraphy has become quite an institution of the age. Scarcely a capital in Europe has failed to avail itself of its facilities to complete its telegraphic system. When stations lie together, close and thick, it is manifestly advantageous to connect them by mechanical means, so as to save, by the transport of the actual telegrams themselves, the multiplication of wires, apparatus, and clerks; and especially so when this can be done with a rapidity equal to that of telegraphy itself. Messages cannot be manipulated or written out at a greater rapidity than forty words per minute; so that, if it is possible to transport a telegram itself from one place to another in a minute, not only is speed of transmission obtained, but all sources of error are eliminated. In fact, the average initial delay occupied by messages on the shortest lines is about five minutes, so that tubes which can convey the messages bodily within this limit are economical and beneficial. The essential element of telegraphy is speed of transmission, and it is evident that, when cur-

rents of air can produce greater dispatch than currents of electricity, pneumatic tubes are preferable to wires. But apart from the question of speed of transmission, tubes are essentially economical in the employment of staff, for their use reduces the number of clerks required to a minimum. But of course there is a limit to their useful employment, and a point is reached when, from telegraphic and economical grounds, wires surpass tubes in efficiency and durability. The limit of length is about two miles, for at this distance telegrams exceed the five minutes interval allowed for their average transmission. Of course, where rapidity is of no consequence, this distance can be much exceeded; but, fortunately for the British public, the one criterion which its telegraphists have always endeavored to attain, especially since the transfer of its telegraphs to the State, has been swiftness of transmission, and it is to swiftness more than to any reduction in price that the marvelous increase of business is due. In five years telegrams in England have increased from six millions to twenty millions.

The first germ of pneumatic telegraphy was sown in the year 1810, when Mr. George Medhurst (who, because he lived in Denmark street, Soho, has always been called a Danish engineer) proposed and patented "a new method of conveying letters and goods with great certainty and rapidity by air." His proposal is so clear and interesting that it deserves extracting:

"If a light and hollow vessel is so formed as to fill the area of a tube, and to move freely through it, carrying papers not exceeding three ounces in weight, it will be driven through the tube with the velocity of 150 feet in a second by the pressure of nine ounces per square inch.

"And therefore a tube of uniform dimensions, being laid upon or under ground, from one place to another, without any sudden curvature, will form the means of conveying packets of letters with the velocity of 100 miles per hour, by forcing the air through the tube with a pressure of three ounces per square inch for every ounce weight in motion.

"And if there are two tubes of the same dimensions lead

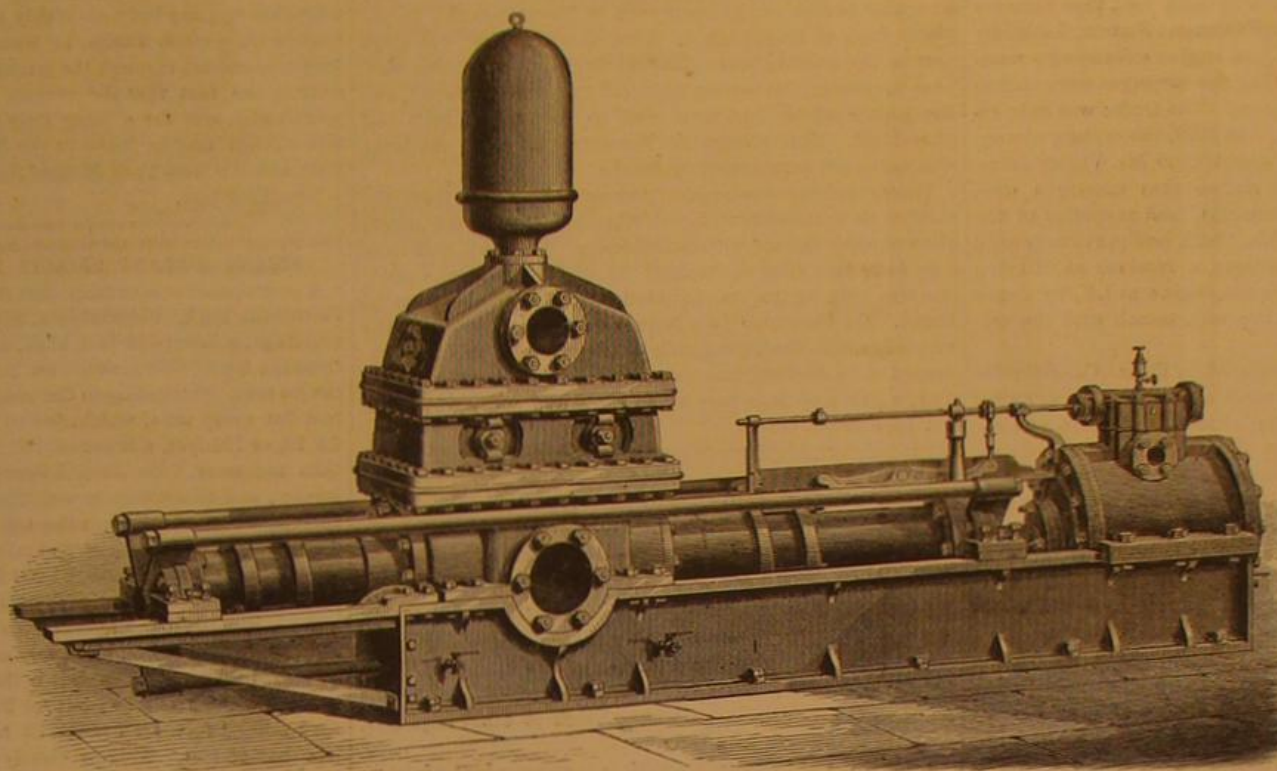


Fig. 5.—HORIZONTAL MINING PUMP.

distance of air equal to the thickness of the dielectric, and is diminished only by wider separation.—*Journal of the Telegraph.*

Remarkable Bird.

The London *Daily News* publishes an interesting letter from Mr. Smithurst, the engineer of the steamer which made the voyage up the newly discovered Baxter River, New Guinea. The river seems to be a magnificent one, and could evidently, says *Nature*, be made navigable to a considerable distance inland. The exploring party found the banks to consist mainly of mangrove swamps, though, near the end of the journey, high clay banks with *eucalyptus globulus* were found. Scarcely any natives were seen, though there

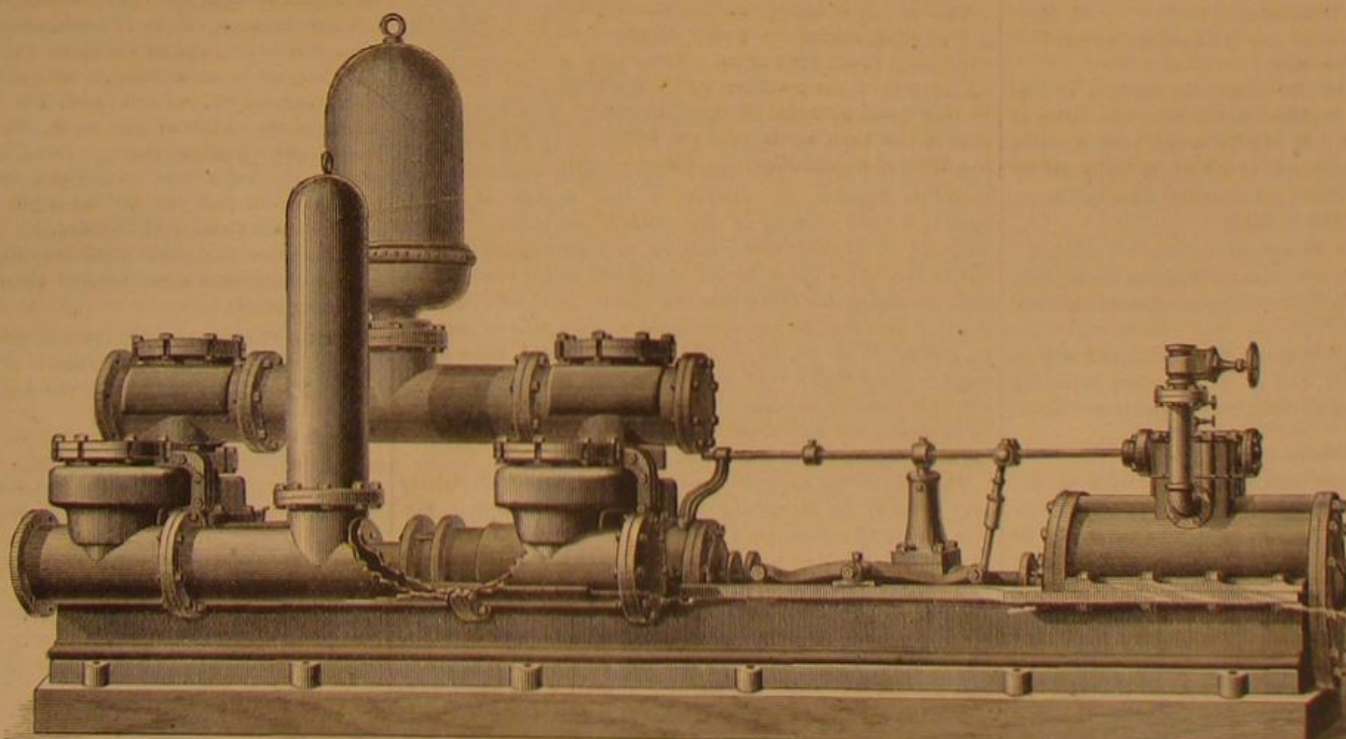


Fig. 6.—HORIZONTAL MINING PUMP.

were frequent signs of their being about. Mr. Smithurst refers to a very remarkable bird, which, so far as we know, has not hitherto been described. The natives state that it can fly away with a dugong, a kangaroo, or a large turtle. Mr. Smithurst states he saw and shot at a specimen of this wonderful animal, and that "the noise caused by the flapping of wings resembled the sound of a locomotive pulling a long train very slowly." He states that "it appeared to be about sixteen or eighteen feet across the wings as it flew, the body dark brown, the breast white, neck long, and beak long and straight." In the stiff clay of the river bank, Mr. Smithurst states that he saw the footprints of some large

ing from one place to another, packets of letters may be conveyed each way, at the same time, without a possibility of their clashing against each other; and many packets may be conveyed the same way, in the same tube, which can never approach each other, but will all proceed with an uniform motion and equal rapidity to their destination, where, the tube entering an airtight room, the packets will be deposited, and may be delivered or forwarded to the next stage through their proper tubes, commencing in the same room, and their progress can never be impeded by the seasons or the elements."

This proposal did not take practical form until 1854, when Mr. Latimer Clark laid down a 1½ inch lead pipe between the Electric Telegraph Company's Central Station, Lothbury (L.Y.), and the Stock Exchange. An engine exhausted a receiver at L.Y., and carriers containing the messages were sucked through from the Stock Exchange. The traffic was only required to flow in one direction. In 1858, the system was extended to Mincing lane, and about 1860 Mr. Varley introduced the use of compressed air, so that messages were drawn in one direction by a vacuum, and propelled in the other direction by a plenum. Mr. Clark had previously used a vacuum to work in both directions, a receiver at Mincing lane having been exhausted by the engine at L.Y., by means of a special pipe laid down in the same trench with the carrier tube.

In 1865 the system was introduced in Paris. Considerable modifications were made in its mode of working. Compressed air was used entirely, and the necessary pressure was obtained by admitting water from the mains into large air reservoirs. This tube served several stations, which were worked intermediately, like a line of railway, or a telegraph current, each station having its own store of power to propel or forward the carrier on to the next place. This mode of obtaining power was found wasteful and expensive, and it has been nearly entirely abandoned in favor of steam working at one end of the circuit.

About the same period (1865) a system was introduced in Berlin by Messrs. Siemens, who used two pipes, laid in the same trench, between the telegraph station and the Bourse, arranged in a circuit, through which a continuous current of air was always kept flowing in the same direction by a double-acting air pump, worked by a steam engine. This last mode of working was tried in London, but it has not proved successful, and it has been abandoned.

It will be seen how closely this system of Siemens' resembles that of Medhurst, and how curiously history works in a circle, for the vision of 1810 has become the stern fact of 1875. In all the places named the pneumatic telegraph has received considerable extension, and it has also been largely introduced in Vienna, where the Parisian system has been adopted.—*Telegraphic Journal*.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the objects mentioned. M. M.

Position of the Planets for January, 1875.

Mercury.

Mercury should be looked for after the middle of the month in the southwest, farther north than the point at which the sun is seen to set. It will be in the best position on the 28th, and can be recognized by its white light and by its nearness to Saturn. At this time, Mercury, Saturn, Venus, and Mars can all be seen in the evening.

Venus.

On the 1st of January, Venus rises at 9h. 8m. A. M., and sets at 6h. 32m. P. M. On the 31st, Venus rises at 8h. 45m. A. M., and sets at 7h. 47m. P. M.

Venus will be well seen all through the month, and will be very near Saturn on the 16th, and in conjunction with the moon on the 28th, at which time the planets mentioned above can also be seen.

Mars.

On the 1st of January, Mars will rise at 10h. 55m. A. M., and set at 10h. 21m. P. M. On the 31st, Mars will rise at 10h. 13m. A. M., and set at 9h. 43m. P. M. The moon will be near Mars (apparently) on the 2d of January, and again on the 30th.

Jupiter.

Jupiter is still unfavorably situated for evening observers. On the 1st it rises about 4 in the morning, and sets at 1h. 39m. P. M. On the 31st it rises at 2h. 18m. A. M., and sets at 11h. 56m. A. M.

Saturn.

Saturn rises on the 1st at 9h. 56m. A. M., and sets at 8h. 5m. P. M. On the 31st, Saturn rises at 8h. 7m. A. M., and sets at 6h. 25m. P. M.

Venus and Saturn will have nearly the same apparent position on the 16th, but will be nearer the horizon, and therefore not so conspicuous as were Mars and Saturn in November.

Uranus.

Uranus is in good position, and can be seen with an ordinary telescope. It is among the small stars of *Leo*, rising on the 1st at 7h. 48m. P. M., and on the 31st at 5h. 41m. P. M. On the 31st it comes to the meridian at 12h. 40m. (20m. before one in the morning) and is then 94° west of Regulus, and 3½° above that star.

Neptune.

Neptune rises at 0h. 35m. P. M. on the 1st, and sets at 1h. 47m. the next morning. On the 31st it rises at 10h. 38m.

A. M., and sets at 11h. 50m. P. M. It cannot be seen without a powerful telescope.

Sun Spots.

The report is from November 17 to December 17 inclusive. From November 5 to November 18 no spots were seen. The photograph of November 18 showed two going off; but before the next picture, November 22, they had disappeared. In the photograph of November 23 there appeared a group of spots on the western limb, a group on the eastern limb, followed by a single one, and, near the center, two very small ones. Clouds prevented photographing on November 23. The pictures of November 24 and November 25 showed only a regular motion of the spots seen on November 23. In the photograph of November 27 there appeared but one large spot on the western limb: the two single ones first observed, near the center, November 23, could no longer be found, and the group which had been seen on the western limb had passed off. The picture of November 29 shows the large spot going off, surrounded by faculae.

Photographing was much interrupted by clouds from November 29 to December 12; but when openings in the clouds allowed observations with the telescope, the sun's disk was seen to be free from spots until December 12, when a small one was seen coming on, but after that date it could not be found. On December 14 a large spot was observed on the very edge. In the photograph of December 17, this spot appeared to be divided into two, and, near the center of the disk, a group of four very small spots was seen, which had not been found before.

Correspondence.

Electricity a Mode of Motion.

To the Editor of the Scientific American:

I take pleasure in briefly meeting the objections of Mr. R. B. West, of Guilford, Conn., to my theory that electricity is nothing more nor less than a motion of the atomic particles of matter. As Mr. West, in his communication, clearly sets forth what may prove a stumbling block to other inquirers, permit me to quote it in full:

"In No. 23, Volume XXXIII, a correspondent advances the theory, if I rightly understand, that electricity is nothing more than motion in the form of an impact or repulsion, communicated from atom to atom, and decreasing in force with the increase in distance from the starting point. This would seem very probable if electricity were capable of being communicated only by direct metallic contact; but on the contrary, it will pass, with comparatively little resistance, through a space made practically devoid of matter; and an inductive disturbance is produced when there could be no possible communication of force. Electricity may possibly be something like an allotropic form of motion, but the definition of an atomic impact alone can scarcely be used."

Instead of entering upon a criticism of Mr. West's statement of facts, namely, that electricity will pass with comparatively little resistance through a (so-called) vacuum, I prefer, for the sake of the argument, to admit that he is correct.

The difficulty seems to consist in a lack of appreciation of matter itself. Mr. West seems to forget that it is impossible to render a space void of matter. What he conceives to be practically *nil*, as perfect a vacuum as can be formed, is really complete materiality, in which the atomic particles of what he conceives to be *nil* are in direct connection with the atomic particles of the metallic conductor, and therefore capable, in greater or less degree, of transmitting a force existing in the metallic conductor. I agree with Mr. West that there could be no transmission of electricity through a space devoid of matter; but it seems to me that, in raising his objection, he should have offered some proof of fact that he has discovered a space void of matter; or, failing to do so, he should have advanced some argument to show that a void is possible, and that, being possible, it is possible to transmit a force through it; otherwise, he is clearly not warranted in denying a material connection between one so-called conductor and another.

The concluding suggestion of Mr. West, that "electricity may possibly be something like an allotropic form of motion," I confess, puts me a long distance at sea. I am quite at a loss, for instance, to conceive of setting something in motion, and then, taking something away, having motion continue on its own account. I would like very much to witness a practical demonstration of that thing; or if that is impossible, to have somebody advance an argument showing that motion may exist independent of matter. It has always seemed to me a requisite of motion that something material shall move.

W. E. SAWYER.

New York city.

The Rattlesnake's Poison.

To the Editor of the Scientific American:

My attention has been attracted by a statement made in your issue of December 4, 1875, page 353. After showing the fallacy of certain stories which have been widely circulated in print, and by word of mouth, which have gained credence, regarding the toxic effect of the spittle of man when administered to venomous reptiles, and relating the incident of the boat, which contained a serpent's fang and was credited with so fatal a record, you state that the inventor of this story did not know that the rattlesnake poison is only active when freshly injected from the poison bag.

The story, is of course, improbable; but the error of your statement is very clearly shown by the following experiments by Mitchell with the venom of that reptile. He says:

that "it is difficult to conceive of the singular energy of the venom of the rattlesnake without carefully conducted experimental research, or of the tenacity with which its powers are preserved in the presence of violent chemical reagents and extremes of heat and cold. The dried venom retained its potency after two years of climatic changes; nor was its action in any degree changed by strong sulphuric and hydrochloric acids, ammonia, chlorine water, soda, or potassa. Freezing or prolonged boiling in no way impaired its deadly qualities." He used the venom after five years' keeping, and found it uninjured.

Dr. Weir Mitchell's reports of his exhaustive researches with this virulent body are richly worth perusal, showing as he does the precise manner in which it is so swiftly and fatally transmitted through the serous tissues, and conclusively settling the fact that the serpent cannot inoculate itself, a point which was for a long time disputed. His reports on this subject may be found in the *Smithsonian Contributions*, 1860, and the *New York Medical Journal*, January, 1868.

New York city.

HENRY S. WELCOME.

[For the Scientific American.]

SEEING DISTANT OBJECTS FROM ELEVATIONS.

A correspondent mentions that it is proposed to build, in Fairmount Park, Philadelphia, adjacent to the Centennial buildings, a tower 750 feet high, and asks if it is true that, from the top of this tower, New York city, 90 miles distant, can be seen. According to the rule that the horizon dips 8 feet for every mile, which, for 90 miles, would be a dip of 8×90 , or 720 feet, a tower of 750 feet high would be taller than necessary. He does, however, doubt if this rule is correct, and this doubt is well founded. If the rule were correct, we could see from the top of Mount Washington, 6,400 feet, to a distance of 800 miles, and from the highest mountain plateau on earth, 24,000 feet high, to a distance of 3,000 miles, almost one eighth of the circumference of the globe. Inversely, the tops of such mountains could be seen from similar distances, and every one knows that this is by no means the case. The fact is that the dip is only about 8 inches for the first mile; but for 2 miles it is nearly 2 feet, for 3 miles 4 feet, for 7 miles 30 feet, and for 11 miles not less than 88 feet. This is clearly shown in the engraving,



wherein the circle represents a section of the earth through its center, O. PI is the horizon of the point, P, and Rr, Ss, and Ii are heights from which the point, P, can be seen at different distances, Pr, Ps, and Pi. Without going into any mathematical demonstration, it is clear that the heights Rr, Ss, and Ii increase in a far greater ratio than the distances, Pr, Ps, and Pi; but in order to find the relation between the respective heights and distances correctly, a simple trigonometrical calculation is required, without which the solution of the problem is impossible.

ORP, OSP, and OIP are rectangular triangles, in which the angles at R, S, and I are the complements of those at O. Let the distance, PS, be 70 miles, about 1°; then the angle, PSO, will be 89°; and as the sides, PO and SO, of the triangle, PSO, are to one another in ratio as the radius to the sine of the angle, PSO, we will have: $SO : PO = \text{rad.} : \sin. 89^\circ$. As PO is the radius of the earth, 20,691,914 feet, we will have: $SO : 20,691,914 = 1 : 0.9998477$, from which $SO = 20,694,954$. From this we subtract the earth's radius, Os, leaving 3,040 feet for Ss, the height required to see the point, P, at a distance of 70 miles.

In the same way, other distances may be calculated, and we have condensed some items of these calculations into the following table:

TABLE OF THE RELATION BETWEEN HEIGHTS AND DISTANCES, SEEN ON THE EARTH'S SURFACE.

For 1', nearly	1 mile, the height is	8 inches.
" 2', "	" 2 "	" 2 feet.
" 3', "	" 3 "	" 4 "
" 6', "	" 7 "	" 30 "
" 10', "	" 11 "	" 88 "
" 20', "	" 23 "	" 338 "
" 30', "	" 35 "	" 760 "
" 35', "	" 41 "	" 1,036 "
" 50', "	" 58 "	" 2,116 "
" 60', "	" 70 "	" 3,040 "
" 80', "	" 93 "	" 5,430 "

These results are proved by experiment to be correct, as we shall find when traveling in mountainous districts and noting how far we can see. At the highest tops of the Highlands, on the Hudson river, near West Point, which do not reach 2,000 feet, we can, on a clear day, just get a glimpse of the highest buildings in New York city, using a telescope. The distance is only fifty miles; but at a height of 1,600 feet, objects 50 miles off are invisible. In order to see to a distance of 90 miles, the height necessary is about 5,000 feet; and if the Philadelphia tower is built to a height of 760 feet, objects at a distance of 35 miles only, less than half way to New York, may be seen. If, however, two towers were built, one in New York and the other in Philadelphia, each 1,200 feet high, from each a circle of 45 miles radius would be visible, and the top of the one would be just perceptible from the top of the other, by means of a telescope, if the atmosphere were exceptionally clear. X.

To prevent water freezing in the gas meter add glycerin. The proper proportion is one pint of glycerin to a gallon of water.

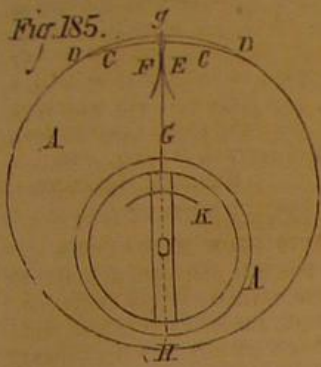
PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NUMBER XXXIX.

LINING OUT AN ECCENTRIC.

In measuring an eccentric to ascertain if it has sufficient stock to allow it to be cleaned up all over, it is not sufficient to measure the thickness of the outside diameter, and the size of the bore only, because those measurements do not take the amount of the throw into consideration, and we have therefore to proceed as follows:



In Fig. 185, A A represent an eccentric, into the bore of which, on the hub side, we place the center piece, and mark upon it the center of the hole. We then take a pair of compasses, and set them so that, when one point is resting in the center of the hole, the other point will reach to within about a quarter of an inch of the extreme diameter of the eccentric, as shown above by the line, C C. We then, with a pair of compass callipers, find the center of the line, C C, by resting the calliper leg of the same against the periphery of the eccentric, at one of the points where the line, C C, meets it; and then with the compass leg of the compass callipers, we mark the line, E; and repeating the operation at the other end of the line, C C, we mark the line, F. We next take a straight edge; and placing it so that its edge is even with the center of the bore of the eccentric and with the center between the lines, E and F, we draw the line, G g, upon which we may make our measurements as follows: After setting a pair of compasses to the amount of throw required by the eccentric, we place one compass leg in the center of the bore, and with the other mark (on the line, G) the line, K, which will represent, at its intersection with G, the center of the finished diameter of the eccentric, providing we mark off the whole eccentric true with the hole. Then we take a rule, and measure from the center, K, to the ends, H g, of the line, G, which ends should be equidistant from K, if the amount to come off the surface of the casting in the hole is to equal that to come off the outside surface. It very frequently happens, however, that there will be more to come off the eccentric on one side of the diameter than on the other, especially when the eccentric is put together in two halves; because, in facing up the two halves, preparatory to putting them together, and to make them bed well one to the other, it does not always happen that the same amount of metal is taken off each face. Again, the quantity so taken off is not always that allowed on the pattern for the purpose; so that, in practice, an eccentric casting rarely marks off true with its rough outline.

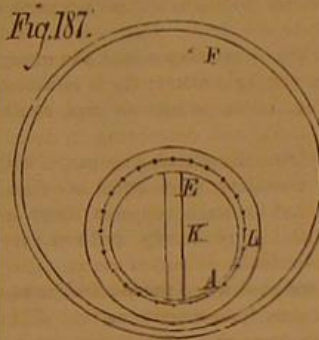
Here, then, arises the consideration as to in what direction we shall throw the lines. Shall it be to bore the hole true, or to turn the outside diameter true, with the casting? The latter plan is always preferable; because, if in turning up the outside diameter the first cut does not true it up, the tool point will scrape over the sand, after leaving the cut and before it strikes it again, to such an extent as to rapidly destroy the cutting edge, necessitating not only frequent re-grinding of the tool, but also that its cutting speed be very materially reduced. After having roughly ascertained, in the manner described (which process will take but a few minutes to perform), that there is surplus metal enough to clean up the eccentric, we may proceed to mark it out.

It is much easier to mark off an eccentric on its plain side than on the side on which the hub stands, because of the projection of the hub; and, furthermore, the marking for the hole and for the diameter can be performed at one operation, which is impracticable on the hub side. But if this plan is not adopted, it necessitates that, at the first chucking, either the hole only shall be bored, in which case there will be no face true with the hole, and hence no guide whereby to set the eccentric at the next chucking; or else, in turning off the outside face after the hole is bored, the marks for the second chucking will be effaced. The main consideration, however, is that there is only one way to chuck an eccentric to insure its being turned as true as possible; and the marking off must, therefore, be made to accommodate the chucking, the method and reasons for which are as follows: The eccentric must be chucked at the first chucking nearly true with the outside diameter, and with the plain face outwards, so that that face may be trued up. The next chucking must be that for boring the hole and for turning the hub and that face of the eccentric; and the third chucking will be done with the face of the hub bolted to the chuck plate by as many clamps as may be necessary to hold it, but none of them exerting any pressure save to clamp the face of the hub to the chuck, or rather to the face plate. By this method, the outside of the eccentric will be turned true with a face that has been turned at the same chucking at which the hole was bored; while the eccentric will stand sufficiently far from the chuck to permit of the strap being tried on when it is necessary. And, moreover, the skin of the metal will have been removed on three out of the four faces before either of the working parts (the bore and the outside diameter) is finished; and as a consequence, the work will remain true, and not warp in consequence of the removal of the skin. Furthermore, upon the truth of the last chucking only will the truth of the whole job depend; and if the face plate of

the lathe is a trifle out of truth, the eccentric will only be out to an equal amount. It is not an uncommon practice (but a very reprehensible one) to face off the plain side of the eccentric, and to then bore the hole and turn the outside diameter, with the plain face clamped in both cases to the face plate. The fallacy of this method lies in the fact that, by such a procedure, the eccentric will be, when finished, out of true to twice the amount that the face plate is out of true.

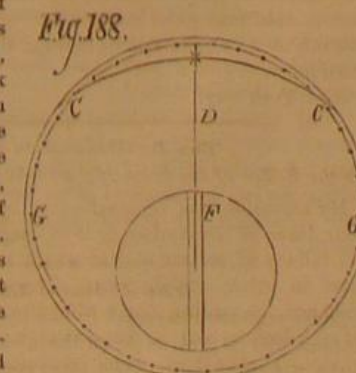
Taking all these considerations into account, we may mark off the lines for the hole and thickness of the hub, in the manner shown in Fig. 185, or we may adopt the plan shown in Fig. 186, which is perhaps the better of the two.

From the four points A, B, C, and D, we mark off, on the hub side of the eccentric, the center of its diameter, E; we then, setting a pair of compasses to the amount of throw required for the eccentric, mark off from the center, E, the line, F; then, with a pair of compass callipers, placed in each case with one end against the bore of the casting, we mark the lines, G and H, the junction of the lines, F, G, and H, being the required center of the hole. We therefore strike from that center, around the face of the hub, the line, I, and mark it lightly with a center punch, as shown. If, however, it should be found that there is not sufficient metal to allow the hole to be cleaned up if marked off true with the circumference, we must throw the hole a little in the requisite direction, endeavoring (for the reasons already stated) to keep the diameter of the eccentric as nearly true for the throw as possible. For instance, in Fig. 187, if we suppose that is an insufficiency of metal in the hole, at A (E being the center of the diameter of the eccentric, and K the amount of the throw), we first set a pair of compasses to the required radius of the diameter; and from the center, E, strike the circle, F, which will show the amount of metal required to be taken off the circumference of the work, and therefore to



what degree we are able to throw the hole to accommodate the scant spot, A. If there is more metal between the line, F, and the periphery than the spot, A, lacks, the eccentric will clean up, and we may mark off the hole, allowing it to just clean up, as shown by the circle, L. It is, however, best, on small eccentrics, to mark the circle, L, as large as the face on which it is marked will admit; because, the larger the circle, the less a slight want of truth in the chucking will affect the truth of the work. It will be observed that, in consequence of the centerpiece standing above the level of the face (to the amount of the height of the hub), the circle, F, in Fig. 186, would be too small if marked with the compasses set to the correct radius; but since the duty of that circle is to merely indicate the amount of surplus metal on the outside diameter, it will be sufficiently correct on ordinary eccentrics, to mark it as directed, making a slight allowance of increase in setting the compasses to draw that circle. If, however, it should happen that the quantity of stock is so scant as to make it questionable whether the work will true up; then the centerpiece may be lowered in the hole to the level of the surface of the metal on which the circle, L, is marked, and the compasses may be set to the correct radius.

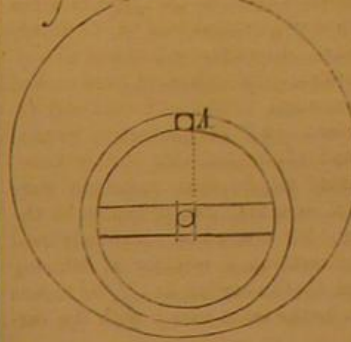
The hole being marked, no further marking should be performed until the eccentric has had both sides finished and the hole bored, when the diameter should be marked upon the plain side of the work, as shown in Fig. 188. After inserting the center piece, and marking off upon it the exact center of the hole, we mark the line, C C; and finding the center of its length, as already described, we strike the line, D; then we mark on the line, D, the amount of the throw, measuring from the center of the hole, and we thus obtain the center, F, from which we mark the circle, G G, which is only intended to be employed in setting the work, and need not, therefore, be made of any particular size. The marking will thus be completed, and it will be noted that the thickness of the eccentric and the hub, and the height of the latter, have not been dealt with at all, the reason for the omission being that it is entirely unnecessary to regard them, since (providing of course that there is spare metal enough to clean them up) they may safely be left to the turner, who may accommodate the amount taken off the



first side faced, according to the smoothness of the second cut, or a variety of other conditions which need not be here enumerated. If the eccentric has no hub, as is sometimes the case, it should be marked off as shown in Fig. 186.

After the turning is completed, the keyway or featherway may be marked off, as shown in Fig. 189. Placing the centerpiece on the hub side of the eccentric, so that the plain side may lie flat on the slotting machine table, and not require parallel strips or packing wherewith to chuck it, we mark off upon it the center of the hole in the eccentric; and

Fig. 189.



from that center, we mark a circle whose diameter must be equal to the required width of the keyway to be cut. Then selecting the location of the keyway, we describe there another circle of the same diameter. Placing a straight edge so that one of its edges is just even with one and the same side of each circle, we draw the line, A; and by repeating the operation on the other side of the circle, we shall have the sides of the keyway marked. To mark the depth, we make a fine centerpunch mark at the requisite distance from the bore of the eccentric, and then, using the square shown in Fig. 190, we place one of its edges parallel with the outer edges of the two circles, and the other edge fair with the center of the centerpunch mark, and scribe a line along the latter edge and across the width of the keyway, the operation being shown in Fig. 190, A being the square.

When, however, there are a number of keyways of the same width and depth to be marked, it is more expeditious to make the gage shown (together with its method of application) in Fig. 191, in which A represents the gage, being a piece of sheet iron about one sixteenth of an inch thick, the curved line being of the same curvature as the bore of the hole in the eccentric, and the projection, B, being of the required size of keyway. The ends, C D, are to be slightly bent (both in one direction), so that, while the projection, B, will lie on the face of the hub,

Fig. 190.

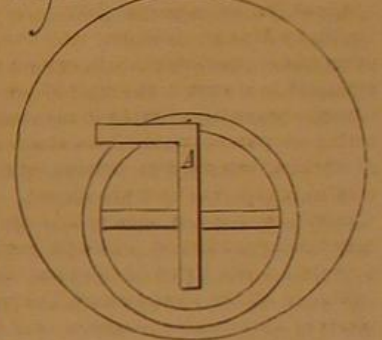
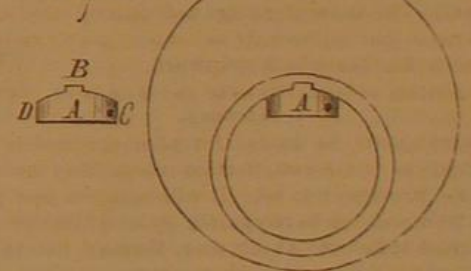


Fig. 191.



the ends, C D (being depressed), will contact with the bore of the hole of the eccentric, and thus serve to keep the gage true with the bore. The gage should be carefully marked out and smoothly filed true to the lines. The small hole, shown near C, is to hang up the gage by when it is not in use.

Quick Work in a Rail Mill.

Inter-Ocean says: "A few weeks since, the North Chicago Rolling Mill Company claimed the championship of the world in the manufacture of steel rails when they produced 1,010 rails in twenty hours. The Joliet mills laid themselves out lately with the following result: Between the hours of 5.50 p.m. on Monday, and 5.45 Tuesday morning, they turned out 603 rails. At 6.35 the day turn commenced, and at 5.45 p.m. had made 604 rails, thus accomplishing the wonderful run of 1,207 steel rails, weighing 53 lbs. per yard and 30 feet in length, in 17 hours and 25 minutes, and surpassing the work of the Chicago mills by 193 rails, with 2½ hours time to spare. The average time used for making each rail was 53 seconds, while the Chicago mills used 1 minute and 13 seconds. The Bessemer works of the Joliet Company also lead off with a run of 1,432 tons, while the biggest run made by any other mill was 1,317 tons, by the Chicago works last month. The boys claim that they haven't shown their best foot yet; and if anybody can equal this, they will go them a good deal better."

Wood for Docks.

A fact has occurred at Belfast, Victoria, which is well worth noting. In 1868 an auger was dropped in the bay there by one of the workmen employed on the jetty. Last Christmas, the tool was picked up on the beach near the mouth of the Moyne. The iron auger was encrusted with rust, sand, etc., and the iron partly destroyed, but the wooden handle (blackwood) was perfectly sound. In building jetties this fact would prove that iron bolts are not as durable as trenails of blackwood.

IMPROVED RAILWAY RAIL JOINT.

We illustrate herewith a new mode of forming the extremities of railway rails, so as to produce a joint which obviates the use of fishplates and offers the advantages of a practically continuous rail. The joint closed is shown in Fig. 1, and in Fig. 2 the parts are shown detached. The end of one rail, A, is made in the shape of a tenon to enter the mortice formed in the extremity of rail, B. The latter is made thicker at the parts through which the division is made, and also perforated with two slots, through which, and through similar slots in the tenon, the fastening bolts pass. In order to strengthen the rail, A, at the points where the tenon begins, the angles are curved, and fit against similar curved surfaces at the extremity of rail, B, as shown at C, in Fig. 1. The length of the slots is such as to afford abundant play for the rails to compensate for contraction and expansion, without disturbing the bolts.

By the use of this joint, it will be evident that the wheels of the vehicles never leave iron except when crossing switches, since, while passing over the joint, the tread of the wheel is on the tenon. This is made sufficiently strong to sustain any weight which may come upon it, even if no tie support it. The advantages of a continuous rail are found in the saving of wear to the rolling stock ordinarily due to jumping joints, as well as in the prevention of deterioration of the rails, which are rendered unserviceable through the battering down of their ends alone. It is claimed that the joint here illustrated is as strong as any other part of the rail, that rails made with it may be laid more easily and more rapidly than others connected only by fishplates, that it is as strong and as durable as the last mentioned mode of fastening while requiring two nuts less, and that it can be used wherever fishplates can be.

The rails, we are informed, are pressed or otherwise made into the necessary form by simple special machinery, at a low cost.

Patented through the Scientific American Patent Agency, November 9, 1875. For further information address the inventor, Mr. Geo. A. Mead, North Salem, N. Y.

IMPROVED FURNACE GRATE BAR.

A new grate bar is illustrated in the annexed engraving, which, it is claimed, may be manufactured at a low cost and with a smaller quantity of metal than is usually employed, and is of sufficient strength to meet all requirements, and will not warp, crack, or twist by heat. If all the inventor claims for it is maintained in practice, it is certainly a valuable improvement. The engraving shows the patterns for the three portions which constitute the device, separated in Fig. 2, and the complete bar in Fig. 1.

A is a series of long parallel bars, which are arranged in groups of three or four or more, and which may be made slightly convex on their upper face to insure a greater circulation of the air when the coal is heaped upon them. These bars are firmly held in place by transverse supports, B, each of which is provided with an opening, C, to allow an air circulation from one to the other. The scalloped bars, D, are arranged below the fire surface and connect with the transverse supports, B. They are formed with knife edges at E, to prevent accumulation of ashes upon them. The projecting flanges at the ends rest upon the ordinary wall of the furnace and furnish a substantial support for the whole.

Patented August 31, 1875. For further particulars regarding sale of State and county rights, address the inventor, Mr. Edward M. Erdman, Lykens, Dauphin county, Pa.

Simple and Compound Engines.

At the ordinary meeting of the Glasgow Association of Engineering and Shipbuilding Draftsmen, November, 1875, Mr. David Halley presiding, Mr. Robert Thomson read an interesting paper on "Simple and Compound High Pressure Condensing Engines." The object of the paper was to show that a simple high pressure condensing engine, using a high grade of expansion, was superior to the present more or less complicated compound engines. The subject, being one of paramount importance, naturally elicited an interesting and instructive discussion, in which many of the members took part, most of them failing to be convinced of the advantages that would take place by a return to the high grade expansion condensing engine, with a higher pressure of steam.

We would call the attention of the above association to the fact that several steamers are now plying between this city and New Orleans that are fitted with single high pressure engines, that they work with much satisfaction, and equal, if they do not surpass, in economy the best compound marine engines now in use.

Exporting the Soil.

A correspondent of the *Winstead (Conn.) Press*, writing in regard to a trip which he has recently taken to the West, says:

"Through Pennsylvania and in the valley of the A^l bany

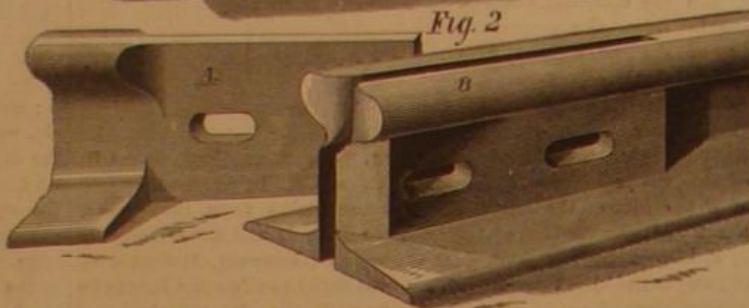
the stranger is struck with the appearance of good husbandry and general air of thrift on all sides. In the mountain region, he sees a country of different aspect and the evidences of other industries. This is the mineral region, the home of the coal, oil, and iron which bring so large an annual income into this State from abroad.

"Through Ohio, on the line of the Pittsburgh, Fort Wayne, and Chicago road, there is more level and uncultivated land than I expected to see. The same remark is applicable to a portion of northern Indiana. In Illinois, after leaving the flat prairies adjacent to Chicago, the Chicago, Burlington, and Quincy road runs through a seemingly continuous corn

Fig. 1



Fig. 2



MEAD'S RAILWAY RAIL JOINT.

field. Corn at the right of us, corn at the left of us, corn in front of us, corn in the rear of us, in easy swells and apparently interminable reaches, cross the State till we strike the Mississippi at Quincy. There are fruit, other crops, and stock, of course; but corn is the great staple, and the query arises where so much finds a paying market; for it is also a leading crop in other States in the same latitude and south of Illinois.

"If the present price shall be maintained, the crops will be remunerative; but this ceaseless production of corn, whether shipped directly or fed to hogs and sent away in that form, is exhausting the soil, very surely and not very slowly.

"Five years ago the farmers of lower Indiana had made this discovery, and were changing from hogs to cattle. This shows the depletion of soil in some measure; but to export crude products, like the cereals and provisions, is a bank-

the evening of November 21, without any yellowish tinge, and the position of axis somewhat doubtful from the indifferently state of the sky. Professor Heis's observations in December, from 1851 to 1870, place the mean position of the apex on the equator in R.A. 349°, or with about 82° elongation from the sun; this refers to the eastern arm of the phenomenon.—*Nature*.

Estimating the Horse Power of Steam Engines.

When steam engines were first introduced, they were largely used to take the place of the horses before employed or raising water from mines. Naturally, people ask, when buying an engine, how much work would it do, that is, how many horses did it represent. The early engine builders found themselves greatly at a loss when this question was first asked. They had at once, therefore, to determine how many horses an engine was equal to. The first thing was to find out how much a horse could do. The strongest English horses, the London brewers horses, were far above the very best that could be found elsewhere. They were found to be able to travel at the rate of 2½ miles per hour, and work eight hours per day. The load was pulling a 100 lbs. weight up out of a shaft by means of a rope. When a horse moves 2½ miles per hour, he travels 220 feet per minute, and of course, at this speed, the 150 lbs. would be raised vertically that distance. That is equal to 300 lbs. lifted 110 feet per minute, or 3,000 lbs. 11 feet, or 33,000 lbs. 1 foot high, in 1 minute. The 33,000 lbs. lifted 1 foot high every minute is taken as a standard horse power. It is much more than any ordinary horse can do, and, therefore, the engine builders were always sure that their engines would take the place of fully as many horses as the horse power would indicate that they should. Of course, 33,000 lbs. lifted 1 foot per minute is much more

convenient for calculation than 150 lbs. 220 feet, and therefore the former form has been adopted. The amount of work, or number of foot pounds, however, is just the same in either case. A foot pound represents the amount of power required to lift 1 lb. 1 foot high. It is comparatively easy to estimate the horse power of an engine with a reasonable degree of accuracy, provided we know certain things in regard to it. We must know the pressure in the boiler, the diameter of the cylinder, the length of stroke, the number of revolutions per minute which the engine is making, and lastly, the point at which steam is cut off.

When there is no cut off, steam is admitted into the cylinder during the whole stroke, and a cylinderful of steam at boiler pressure is used at each stroke, as the cut off, when there is one, takes place before the piston has reached the end of the cylinder. If steam is prevented from entering the cylinder after the piston has passed mid-stroke, the point of cut off is at half stroke. If the steam enters the cylinder during three fourths of the stroke and is then arrested, the point of cutting off is at three fourths of the stroke. It is necessary to know the point of cutting off, in order to find out what the average pressure is in the cylinder. In the commoner sorts of engines, not provided with independent cut-off valves, the point of cutting off may usually be taken at from one half to three fourths of the stroke, though sometimes more than this. It may, perhaps, be safe to take the average pressure in the cylinder at about eight tenths of that in the boiler; though where the steam pipe is long and the throttle valve is used to control the speed, the average pressure in the cylinder may be no more than three fourths of that in the boiler. The power will be the distance which the piston under this pressure travels during one minute. Therefore, we have the rule: Multiply the area of the piston by the average pressure per square inch upon the piston, multiply this result by the distance which the piston travels per minute in feet, and the result is the number of foot pounds per minute which that engine can raise. Divide by 33,000 and the result is the number of

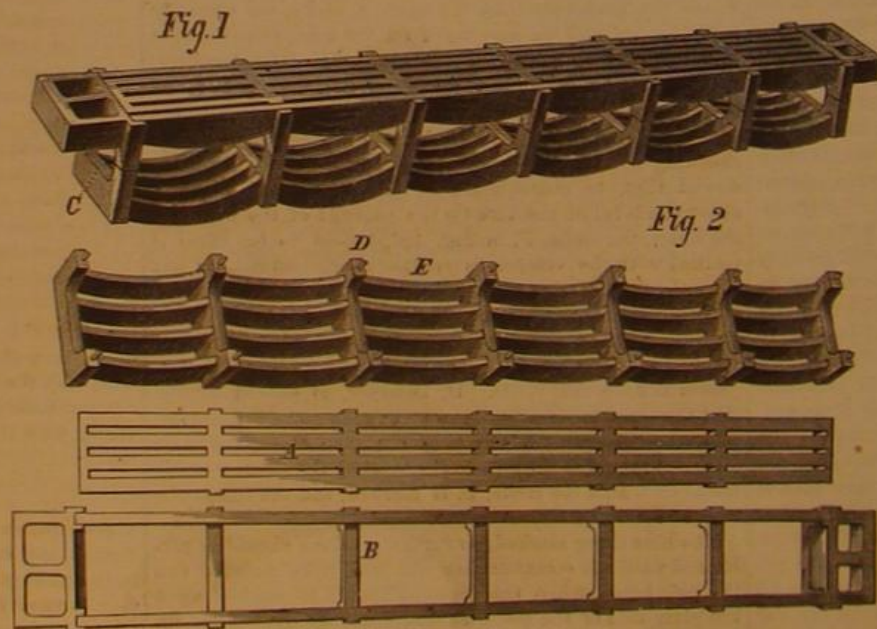
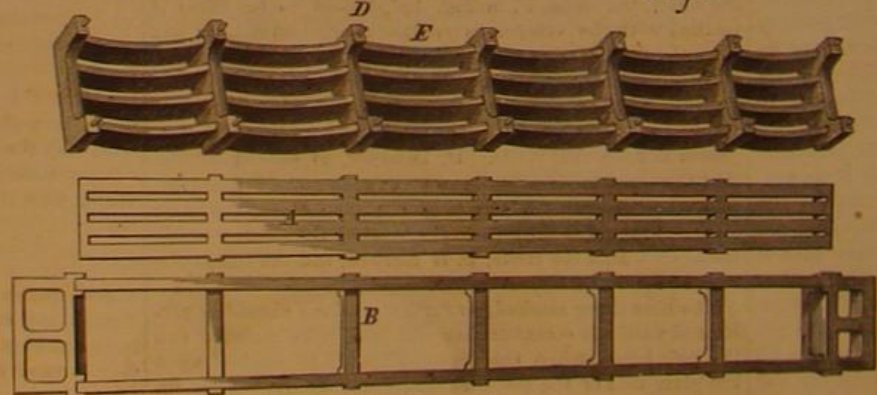


Fig. 2



ERDMAN'S FURNACE GRATE BAR.

rupting process, robbing the soil and impoverishing the producers. If continued for two generations, the people will be forced to migrate to virgin lands, there to repeat their destructive husbandry and again leave behind them sterile plains like those of Asia.

"The abandoned cotton and tobacco plantations of the Eastern coast States are evidence of our infancy in economics. A varied industry and the export only of products having the last processes of labor largely incorporated into their substance are conditions of an enduring commonwealth."

The Zodiacal Light.

Those who are interested in the observation of this phenomenon will do well to be on the alert during dark evenings in the winter months. The most conspicuous exhibitions of the light in England during the last few years have occurred in the month of January, the long standing recommendation to expect the most notable displays in the evenings about the vernal equinox having thus been by no means justified in the result. The light was perceptible for a short time on

horse power. The number of feet per minute traveled by the piston is twice the number of strokes per minute multiplied by the length of stroke. This gives the number of horse power sufficiently nearly for all practical purposes.—*Savard's Coal Trade Journal*.

Pneumatic Street Cars.

A trial of a new tramway motor came off lately on the lines of the Vale of Clyde Tramways Company at Govan, Scotland. The car, having been charged with the necessary quantity of compressed air, was made to take its trip among the ordinary cars running from Govan to Paisley Road Toll. Experiments were made to test the power of the machine for slowing, stopping to take up passengers, etc., and it appeared to be under the most perfect control. The noise was scarcely perceptible, while horses alongside did not seem to recognize the car as anything unsightly, or to be feared. Mr. Moncrieff was accompanied by the chairman and directors of the Vale of Clyde Tramways Company. The result of the trial was to impress all present with the complete success of the invention, and its adaptability to tramway purposes.

THE ALOCASIAS.

This tribe of plants (belonging to the species known as arads) is now receiving much attention from the admirers of handsome foliage. The variety, *a. intermedia*, shown in our engraving, is a singularly bold specimen, of which some of the more noticeable peculiarities are the size and configuration of the leaf and the mottled cuticle to the stalks. The curled edge of the leaf is an additional distinction, and the venous system shows a high degree of organization. Like its congeners, this plant is propagated by dividing its fleshy rhizomes; and being of vigorous habit, it soon makes a good specimen if potted carefully in a fresh open compost, consisting of fibrous peat, turfy loam, and leaf mold, with sufficient coarse sandstone grit to keep the whole open and porous.

It is worth notice that few arads like a close soil; on the contrary, a rich, free, vegetable mold is what they enjoy. If the thick roots of an alocasia or anthurium be examined, the tips will be found covered with short hair-like processes, which are vigorous and healthy wherever the soil is open, but which soon decay in a wet, stagnant compost. They seem to be of use in absorbing moisture from the air spaces between the nodules of peat and turf rather than from the compost itself; and if a covering of fresh living sphagnum be placed over the tops of the pots, near the root stocks, fresh roots soon make their appearance there, a circumstance which adds considerably to the health of the plants. It is a singular fact that the roots of nearly all the endogenous plants like to grow in living sphagnum moss, a material which may with advantage be added to the compost used for nearly all arads.

The Demagnetization of Watches.

Watches worn by students and others in technical laboratories are often rendered useless by being magnetized by the magnets used in such places. Magnets kept in the house often create equal mischief by being laid near watches, and much time and expense are sometimes needed to demagnetize them before they can be made to work. A serious case of this kind of injury recently led Professor A. M. Mayer, of the Stevens Institute of Technology, Hoboken, to experiments which resulted in a very simple method of demagnetization. The magnetized watch was laid upon a table in the neighborhood of a common compass needle. Each hour on the face was then placed in turn before it to discover the location and intensity of the magnetism in the watch. The movement of the compass showed the north and south pole to be located, say, at the figures V and XI, while the neutral points were at VIII and II. The watch was then held in a horizontal position before a large bar magnet, the two south poles being together. A gentle tilting motion was given to it for a moment; and on trying the watch again before the compass, a sensible decrease of magnetism was observed. The process was repeated till the sensitiveness of the watch at that pole was nearly extinguished, when the same thing was tried with the north pole of the watch. After a few trials and comparisons, the magnetic influence was found to be removed, and the watch readily resumed its work.—*Scribner's Monthly*.

THE GUELDER ROSE.

The guelder rose (*eburnum*), or, as we call it, snowball, is one of the most ornamental flowering shrubs which adorn our gardens. The pure whiteness of the blossom, the globular form which each mass of flowers assumes, and the profuseness with which the tree adorns itself in the spring make it a universal favorite where shrubs of variously colored blooms are massed together, to make an effective picture as a whole, as well as by exhibiting variety and contrast of colors. The guelder rose was originally a native of China, and has been varied by cultivation till many species are known, the familiar kind bearing the botanical name of *eburnum macrocephalum*. It yields seeds freely, and can be propagated with some difficulty by cuttings, which should be of young wood and placed in a moist soil under glass. Grafting, however, is the best method, and is the one adopted in China, which, as we have stated, is the native land of the tree.

M. Keteleer, a French floriculturist, has recently introduced a new variety, to which has been given the name of *v. Keteleeri*, but which (says the *English Garden*, from which we select the engraving) should be more properly called the *v. Keteleeri macrocephalum*. In France it grew well in the open air, a cutting being planted by M. Keteleer; and when one year old, it produced a dozen clusters of flowers. It can therefore be more readily propagated in this way than the common guelder rose; and it is sufficiently hardy to flourish out of doors,

although it needs some protection in severe weather. Its favorite soil is one that is dry and warm, and of a calcareous nature. M. Keteleer recently contributed a description of

than partially successful in their efforts. Among the reasons for this want of success may be given, first, a want of knowledge of the conditions of plant growth; second, a want of time to care for them properly; third, lack of the proper temperature and a pure moist atmosphere. First, very few persons realize that plants may be injured by too much or too little water, and fail to understand when the soil is too wet or too dry. Plants, as well as animals, must have pure air for a healthy growth. Those persons who are successful in growing plants have an intense love for their pets, and soon learn to detect anything wrong in their condition, and apply the remedy. Second, plants require constant care. Their condition must be watched closely and the soil not be allowed to get too dry, nor be watered too much. Their condition must be known at all times; and if a green fly appears it must be destroyed at once by crushing, or by dipping in tobacco water about the color of strong tea, or in strong soapsuds, rinsing the plant carefully fifteen or twenty minutes after dipping. If the red spiders are found, destroy them by sponging the under side of the leaves with cold soapsuds. Their presence is an indication that the atmosphere is too dry. If mealy bugs appear, they should be destroyed by touching with alcohol, or by brushing off with a dry, soft brush. If mildew attacks the roses or verbenas, it must be destroyed by washing or dipping in a solution of lime and sulphur, made by boiling one pound of caustic lime with one pound of sulphur in two gallons of water. This should be allowed to settle, and then kept in bottles ready for use. In using it, take one teaspoonful to one quart of water. One treatment in any of these cases may not be sufficient, and must be repeated as often as necessary. Eternal vigilance is the only price of success. Third, according to the temperature required for the healthy growth of different plants, they may be divided into two classes, namely: Those that grow well at an average temperature of 50° Fah., that is, ranging from 40° to 60°, and those that require a higher temperature, an average of 60°, ranging from 50° to 70°.

The first class will include geraniums, carnations, centau-reas, camellias, azaleas, abutilons, ageratums, callas, sweet alussum, English ivies, smilax, mignonette, hyacinths, primulas, stevias, petunias, verbenas, lobellias, and roses. In the second class are begonias, bouvardias, epiphyllums, and all cacti, fuchsias, gloxinias, German ivies, heliotrope, zorrénias, pileas, and roses. Roses are included in both lists, as they will succeed under both conditions.

Plants grow much better where the temperature runs lower at night than during the day. It never should go below 40° Fah. in the first case, or below 50° in the second case. If plants stand near a window, a screen should be made by pasting papers to a frame, similar to that used for mosquito screens, placing it between the plants and the window every night. A screen made in this way can be inserted in a moment, and may consist of several thicknesses of paper.

A moist atmosphere is indispensable to the healthy growth of plants, and is obtained by keeping the pan in the furnace filled with water, or an urn or some other vessel upon the stove. The atmosphere must be free from sulphurous gases, and to accomplish this end the back damper in the stove must be kept open enough to allow its escape, and the windows raised a little every day for a short time when the temperature outside will allow.

If small plants, taken from the greenhouse, be carefully potted in suitable soil, placed in a room with a somewhat moist atmosphere, free from poisonous gases, carefully watered, exposed to the sunlight a part of the day, no insects allowed upon them, and the temperature kept as directed, they will grow and well repay the labor of caring for them, and homes be made brighter and happier by the presence of an abundance of flowers.

The Use of Fallen Leaves.

In the *Gardener's Monthly*, Mr. Meehan says: These have to be gathered up. They are excellent to mix with hot-bed material, and, where practicable, should be saved for this purpose. They do not heat so rapidly as stable manure, and in this have an advantage; as tempering the violence makes manure last longer and maintain a more regular heat. They are excellent material to put round cold frames to protect half-hardy plants. A board is put up to the height of the frame boards, and about a foot or more from them, and the leaves filled in between. If the plants are somewhat tender, the bottom of the frames may be filled in a few feet with the leaves. These leaves, after having been two or three years decaying, make admirable stuff for potting plants and for flowers in general.



ALOCASIA INTERMEDIA.

the new variety to *La Revue Horticole*, the most popular magazine of botany and floriculture published in France.

Window Plants.

Professor Maynard says, in the *Scientific Farmer*: Comparatively few persons who cultivate window plants are more



THE GUELDER ROSE.

BRIDLES, BITS, HUBS, AND HORSESHOES.

Our extracts, for this week, from Knight's "Mechanical Dictionary," include an interesting series of engravings relative to harness, carriage building, and blacksmithing; and in Fig. 1 we illustrate a number of

BRIDLES, having checking and safety devices. In *a* the driving reins

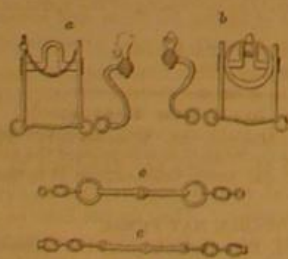
Fig. 1.



Bridles.

are attached at *E* by an elastic strap and snap hook, *C*, to the rings of the snaffle bit. Face pieces, *G G'*, are also secured to these rings, passing upward through the loops, *H I*, and uniting to form the throat latch, *K*, to which the hitching strap is fastened. The combined throat latch and face piece prevents the bridle slipping, as the draft upon the hitch strap draws the ring into the angles of the mouth. In driving, a pull on the line stretches the elastic and draws upon the face strap and throat latch, to carry back the bit. The device represented at *b* includes two pairs of branch reins attached to the ends of the driving lines, one, *I I*, leading directly to the bit rings, and the other, *c c'*, passing over the horse. The lower branches, *A*, connect with the same rings by a special spring within cases, *F*. In *c* the overdraw strap, *A*, and the check rein, *B*, are secured to the bit ring, *C*, and the driving rein, *D*, to a swivel on the bit. The driving rein passes through a ring on the end of the overdraw strap, and is also connected to the check rein. A strong pull on the driving rein throws up the horse's head and prevents him from kicking. The bit ring, *F*, in Fig. *d*, is suspended on each side from a ring, *D*, on the check strap, by a running strap, which, connected primarily to the bit ring, passes up and down through the check ring; the running strap is then carried down through the bit ring and connected by

Fig. 2.



Bridle Bits.

a ring to a safety rein, *I*. The latter is also connected to the gag rein, *K*, so that pulling upon the safety rein shortens the gag rein, and at the same time draws up the bit toward the rein on the cheek strap. As shown in *e*, the driving reins run over pulleys attached to the bit rings and throat latch, and thence pass to the check hook. Stops on the check portion of the rein limit the length of the gag part. The bridle, *f*, has a safety attachment formed by sup-

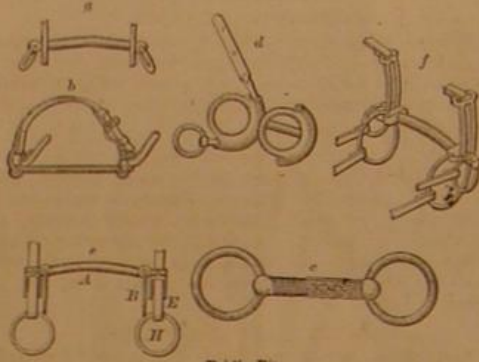
plemental reins, *A*, within the ordinary reins, and which, connecting directly to the cheek straps, pass through the rings of the bit and serve to pull the bit forcibly into the corners of the mouth. In Fig. *g*, the driving rein connects with the cheek strap, which is pulled through the bit ring, and draws the bit up into the angle of the mouth. In *h* a lever jaw, *A*, on each side, is suspended from the throat latch of the bridle. The jaws are kept apart by a spring, but by pulling on the rein, *C*, they may be brought together, so as to compress the horse's windpipe and choke him into submission. In Figs. 2 and 3 various forms of

BITS

are illustrated. Fig. 2 shows the bits used in the United States army. *a* is an ordinary curb bit, and *b* is the Mexican bit, in which the curb chain and its strap are replaced by a curb ring. By means of the branches, a leverage is obtained upon the horse's jaw, the chain behind forming the fulcrum. The snaffle, *c*, has two bars, jointed together in the middle of the mouth, and has also rings at the ends for the rein.

In Fig. 3, the stiff bit, *a*, has rein rings at the ends, and is

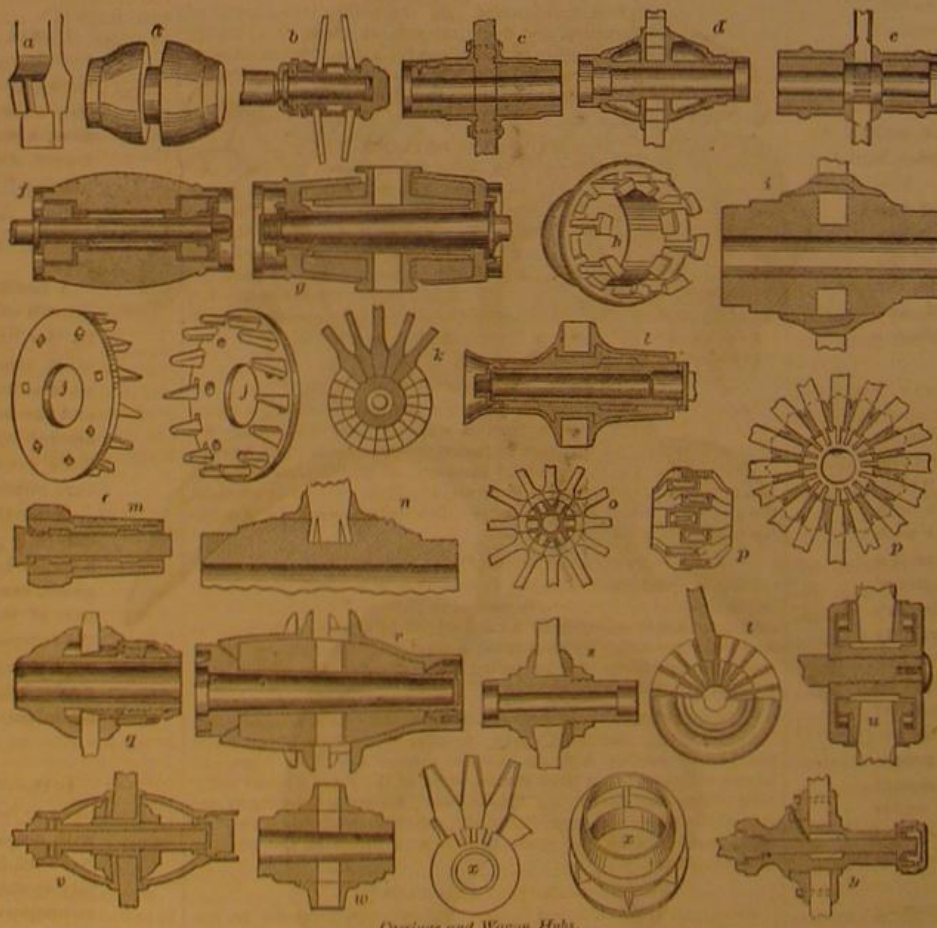
Fig. 3.



Bridle Bits.

usually without branches. It lacks the middle joint of the snaffle. *b* is a new form of upper jaw bit. It is fastened by a nose strap to the upper jaw, and buckled to the gag-bearing rein. A safety rein passes to the usual bit rings, and is also connected to the bearing rein so as to pull the usual bit back against the jaws, and the upper jaw bit up into the angle of the mouth. The elastic bit, *c*, consists of a chain covered by closely coiled wire, between the bit rings. Another form is made of twisted wire with a soft rubber covering. The bit shown at *d* has tubular rings through which pass the straps connecting the driving reins to the head stall. When the lines are pulled upon the stiff bit is drawn up into the angle of the mouth. Bit, *e*, has a pulley frame swiveled to its ends. The driving reins are buckled to the rings, *H*; and when they are pulled, the straps, *E*, run through the pulleys and draw the bit up into the mouth. The bit shown at *f* is so made that one rein is connected to the bit ring and the other to the slotted check pieces. When

Fig. 4.



Carriage and Wagon Hubs.

the latter rein is pulled, the rigid bit slides up the slots and acts on the mouth.

In Fig. 4 we give engravings of a large number of carriage and wagon wheels

HUBS.

a is a hub having a circumferential groove, in which the shoulders form a continuous band, while the tenons of the spokes are set in mortises in the bottom. *b* is a metallic hub, one portion of which forms the axle box, around which are

nuts on the inner ends of the double set of iron spokes. *c* has two metallic bands, between which the spokes are clamped. *d* has a hollow axle box around which are clamped two hollow disks, which have projecting lugs to form the spoke mortises. *e* has a metallic shell with a depressed center, in which the spoke mortises are formed, and has tubular cases driven in from the ends. *f* has rubber disks around the axle box at each end of the hub. *g* has a central disk forming the spoke sockets, and this is clamped by two outer disks with two intervening hollow cones. *h* has two hollow shells with T-shaped lugs, which interlock to form spoke sockets. *i* has two overlapping morticed hub bands. *j* has two metallic disks with projecting lugs to form spoke mortises; the disks are drawn together with bolts. *k* has a grooved hub with alternate projecting lugs to form dodging mortises. *l* has plaster material run in between the axle box

Fig. 5.



Horseshoes.

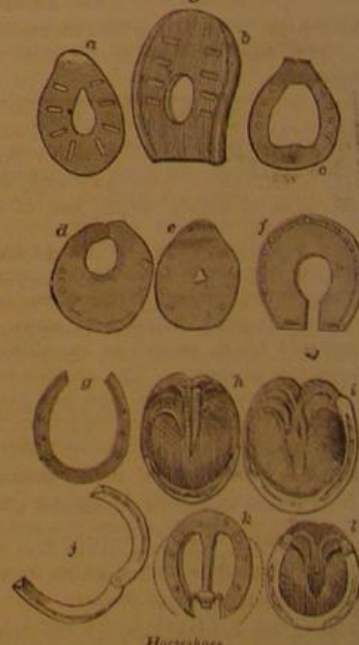
and shell. *m* is of similar construction. In *n* the hub has a dovetail mortice, wedges to prevent the withdrawal of the spokes, and beveled metallic bands as seats for the same. *o* has a morticed hub and metallic bands to clamp the spokes. In *p* the hub band has staggering metallic sockets, and the hub has mortises for the spoke tenons. The inner hub band in *q*, which screws on the sleeve of the outer portion, drives wedges against the spokes. *r* has a metallic shell with staggering mortises and projecting lips to support the spokes. *s* is a metallic hub formed in three parts, the axle box and inner hub band, the outer hub band, and the clamping nut. The circular spoke groove has a dovetail form. *t* has a metallic band with beveled mortice. In *u* the end flanges are screwed in a morticed flange ring, between which and the hub flanges are anti-friction rollers. *v* has a metallic hub shell, within which is a spoke socket formed by sleeve, nut, and projecting lips. *w* has a morticed metallic band on a wooden hub. *x* has a metallic band whose mortises receive the spokes in clusters. *y* has a metallic hub which forms the axle box, and has a lubricating chamber and spoke clamps.

Fig. 6 represents an interesting series of

HORSESHOES.

showing ancient and curious forms. *a*

Fig. 6.



Horseshoes.

is an early Arabian shoe, and *b* an Arabian shoe of more modern date. *c* is the Moorish pattern, *d* the Persian, *e* the Portuguese, and *f* the old English. *g* is a racing shoe, *h* a tip shoe, *i* a three quarter shoe, *j* a pointed shoe, *k* a screw shoe, and *l* a calked shoe. Fig. 5 shows a variety of new inventions in this line. At 1 the bifurcated springs, *a a*, clip the hoof, and are attached to the shoe by bolt and nut; 2, countersunk headed screws, parallel to the wall of the hoof, act as fastenings; 3, ridges and indentations are formed on

the sole of the shoe; 4 is a shoe for contracted hoofs. By means of the screw, *a*, and nuts between the heel clips, the branches of the screw may be spread. In 5, a supplemental roughing shoe is attached to the upper shoe by clips, *a a*, and a sliding screw block, *b*. Pins at the rear prevent lateral displacement. In 6, the shoe is hinged at the toe, and is designed to be permanent; it is beveled on its upper inner edge to receive the flange of a removable false shoe, that is expanded outwardly by a screw. In 7 is a double shoe; the upper one is hinged at the toe and has a jointed crossbar at the heel; curved clips, *a a b b*, fit the walls of the hoof and secure the hoof in place; to this the lower plate, *c*, is secured by screws. In 8, the shoe is attached to the hoof by pieces of leather and straps. In 9, the shoe has a toe cap, is jointed at the sides, and has clips and pivoted catch or connecting bar at the rear, dispensing with nails. 10 has rear clips, *a*, the cap, *b*, and strap, *c*, held by a button on the toe cap, to secure the shoe. In 11, the removable toe and heel calks, *a b*, are dovetailed into plates, *c d*, which are fastened to the shoe by screws. In 12, the toe and heel calks are adjustably attached by screws.

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Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From November 19 to December 2, 1875, inclusive.

BOILER FURNACE, ETC.—H. M. Smith et al., Chicago, Ill.
CARBURETTER.—J. H. Allen, Chicago, Ill.
CLEANING BOILER FLUES.—A. Crosby, New York city, et al.
DISTILLING APPARATUS.—J. W. Reford, New York city.
ELECTRO-MAGNETIC MOTOR.—H. M. Paine, Newark, N. J.
GAS MANUFACTURE.—J. W. Beatty, Brooklyn, N. Y.
ICE MACHINE, ETC.—D. Coughlin, Mass.
MAKING CIGARETTES.—A. A. Pope, Boston, Mass.
MAKING PLUMBERS' TRAPS.—F. N. Du Bois, New York city.
PADDLE WHEEL.—R. Forward, Cincinnati, Ohio.
POTATO DIGGER.—L. A. Aspinwall, Albany, N. Y.
PRINTING ON GLASS.—J. W. Wells, Philadelphia, Pa.
SACK-SEWING MACHINE.—W. Webster, San Francisco, Cal.
SAND BLAST.—H. A. Tighman, Philadelphia, Pa.
SCREW NUT MACHINE, ETC.—A. Marland, Pittsburgh, Pa.
SETTING CAR SPRINGS.—T. B. De Forest, Birmingham, Conn.
SHUTTLE AND SPINDLE.—E. M. Stevens, Boston, Mass.
SIGNAL BODY.—J. M. Courtenay, Cornwall, N. Y.
TREATING OIL SEEDS.—A. B. Lawther, Chicago, Ill.

Recent American and Foreign Patents.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WORK TABLE.

Joan Cannon, Lines Hollow, Pa.—A revolving disk under the top of a round table has pockets depending from the outer edge for holding work or implements. The person using the table can turn the pockets around readily to the place where it is convenient to use them.

IMPROVED WAGON BRAKE.

Thomas H. Gourley and William R. Lovelace, Talbott, Tenn.—This is a new arrangement of brake mechanism of simple and ingenious construction, but which it would be impossible clearly to understand without a diagram. Generally, the operation of holding back on the neck yoke by the team applies the shoes to the wheels; and when the draft is applied to the double tree, the brake is removed.

IMPROVED DRAFT EQUALIZER.

Hiran Cartwright, Owatonna, Minn.—This is a novel assemblage of jointed levers and bars in connection with the tongue, the whole serving as an evener to equalize the draft among the horses.

IMPROVED CARRIAGE CURTAIN.

Henry C. Moody, Oswego, N. Y.—This invention is a shade or curtain attachment to the front bow of a child's carriage, for excluding the sun and rain. The curtain is divided at the center, and connected at each outer edge and the top to the bow by a cord. The general arrangement is such that the curtain is free to slip up and down on the bow.

IMPROVED DUMPING CART.

George B. Wiestling, Mont Alto, Pa.—This invention is an improvement in the class of dumping wagons which, while adapted to dump in the ordinary way, may be also adjusted for shooting the load through a chute, or over the curb stone, into the coal hole, without discharging on to the pavement or into the gutter. The cart has, in addition to the ordinary shaft frame, and an extra frame combined with the cart body and the axle, with the rear end of the body hinged to its rear end; and a ratchet mechanism, shaft, chain, and toggle bar are combined with the cart body.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED METHOD OF CASTING CAR WHEELS.

William Wilmington, Toledo, Ohio.—This invention relates to a new method of casting car wheels designed to obviate chill cracks; and it consists in first introducing into the mold molten metal of the proper temperature, and then introducing metal of a higher temperature, which is allowed to escape from the mold in streams across the flange and tread portion, while the intermediate sections are being cooled, whereby the flaring metal is made to take up the shrinkage.

IMPROVED CAR COUPLING.

Derastus Harper, Hearne, Tex.—The link is placed on the lower projection of one drawhead, and a pin dropped, which balances the link in horizontal position ready for coupling with the approaching drawhead. The pin of the other drawhead is supported on the top part of a swinging gate, which is prevented from swinging to the outside by a top projection, but which is readily carried back by the entering link, so as to release the pin, and drop the same for coupling with the link. On raising the pin for uncoupling the link, the gate drops into vertical position, and supports the pin on a recessed part between arms.

IMPROVED PUDDLING FURNACE DOOR.

Joseph Boyland, Troy, N. Y.—In this invention there are the swing stops on the door frame or furnace wall, and curved ribs on the door with which the stops act to fasten the door shut. The ribs are a little eccentric to the pivots of the stops, so that in case any matters get under the door so as to prevent it from closing down tight the stops will fasten it all the same. The device seems to be capable of easy operation.

IMPROVED MIDDLING PURIFIER.

John F. Gandolfo, Dubuque, Iowa.—This is a series of inclined sieves graduating from fine to coarse, in passing through which the middlings are acted upon by a blast which increases as the coarser sieves are reached. By employing a shoe with an endwise movement, the middlings are propelled forward over the sieves in a straight line with rapidity.

IMPROVED SUBMERGED TIDE AND CURRENT WHEEL.

John J. Hill, Hayden's Ferry, Arizona Ter.—This water wheel has curved vertical buckets tapered toward the outer edge, and having a thicker inner edge coming short of the shaft, a space being thus left around the shaft. This allows of water entering at one side of the wheel and escaping at the other, thus affording two impulses, and rotating the wheel in whatever direction the current may be flowing.

IMPROVED STOP COCK.

Nehemiah Upham, Athol, Mass.—This inventor proposes an improved valve for water and steam pipes, that may be opened easily with little friction, and manufactured in a convenient manner. It consists of a valve case with sliding valve segment, operated by a pronged and raised spindle and intermediate friction roller, which is retained in place by a spring or its equivalent, when the valve is partially open.

IMPROVED MECHANICAL MOVEMENT.

Edison Leslie, Brown's Cross Roads, Ky., assignor to himself and George W. Hunt, of same place.—These inventors have devised a simple mechanical arrangement of cranks, pitmen, and lever, by which they claim that loss of motion through the slipping of the belt used is prevented, and power transmitted more effectively.

IMPROVED WINDMILL.

David L. Osborn, Ashland, Neb.—The invention consists in vanes hinged by straps to arms that are outwardly inclined from the hub and in the mode of combining arms, rods, and hub extension. The vanes approximate the form of a screw to a greater extent than when arranged exactly radial and in the transverse plane of the wheel; and an adjustable weight expends its power in keeping them turned sideways to the wind. Other devices increase the resistance of the weight as it rises by increased power of the wind, so that the regulator is graduated to a considerable extent to the force of the wind.

IMPROVED DRAWBRIDGE.

Mitchell Vincent, St. Paul, Minn.—This is an improved pontoon drawbridge for railway and other traffic. It consists of two stationary pontoons supporting the approach bridges, and two pontoon piers carrying the drawbridge, and moving with the same, one being hinged to the stationary pontoon to swing with the drawbridge. The drawbridge is closed by a capstan and chain from the opposite stationary pontoon, and opened from a pier above or below the bridge in case no current for opening in the drawbridge is available.

IMPROVED SELF-LOCKING CULTIVATOR TEETH.

John Harris, Marquette, Wis.—The cultivator teeth in this device are so combined with an ingenious arrangement of springs and levers that, should the teeth strike an obstruction, they will unlock and swing back, and again lock themselves in place as soon as they have passed the obstruction.

IMPROVED GEOGRAPHICAL GLOBE FOR SCHOOLS.

Newbern Norris Browne, Woodstock, Ala.—This inventor proposes a globe made of rubber or other flexible material, which may be inflated by suitable disposition of a tubular axis.

NEW HOUSEHOLD ARTICLES.

IMPROVED CLOTHES DRYER.

George W. Green, High Point, N. C., assignor of one third his right to Oliver S. Causey, of same place.—This is a new combination of pivoted bars, which when folded together occupies but little space, and which, when extended, offers a large amount of drying surface. The construction appears to be strong and simple.

IMPROVED FIREPLACE SCREEN.

William C. Williamson, Newbern, Tenn.—The upper section of the mantel is made hollow, and provided with a hinged lid, which is opened and closed by a suitable locking device. A screen winds upon a roller in the hollow space, and passes through a bottom slot to the fireplace below. The lower end of the screen is attached to an ornamental rod, which is locked to the sides of the mantel when the screen is wound up entirely, so that the bottom rod closes the guide slot. The screen is drawn down to cover the fireplace when not used.

IMPROVED CLOTHES DRYER.

Frank M. Clark, South Tamworth, N. H.—This is a series of pivoted joints connected to a morticed block, which may be secured to a wall. There is a simple device for extending and folding the arms. The whole may be compactly folded.

IMPROVED WINDOW SCREEN.

Henry B. Walbridge, Brooklyn, N. Y.—The ends of the gauze are wound around two small rollers, so that it may be adjusted to the width of a narrower or wider window, and said ends are confined by opening springs slipped upon the rollers. The outer ends of the springs are extended in a tangent to said rollers, so that they may be slipped beneath keepers attached to the sides of the casing, in such positions that the portion of the gauze between the rollers may bear so snugly against the bottom rail of the sash as to prevent the passage of flies, mosquitoes, etc.

IMPROVED CLOTHES DRYER.

Willis Adams, Neelyville, Ill.—This is a new arrangement of pivoted arms and connecting pieces, so constructed that it may be easily folded into a very small compass for storage and transportation, and which can be conveniently folded and unfolded. When unfolded, the device affords a large amount of drying surface.

IMPROVED WASHING MACHINE.

John I. Shotwell, Welland, Can.—The new feature in this consist, in alternately working plungers, that are carried by a revolving crank shaft against an adjustable spring rack with rubbing rollers. The spring rack presses the clothes with considerable force against the plungers, so that the thorough cleaning of a greater or smaller number of clothes is produced.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CIDER MILL AND PRESS.

Henry Krumsick, Nashville, Ill.—This is such a combination of cider mill and press that the apples, grapes, or other fruit passing through the mill may be directly conveyed to the press box, and the press be worked in connection with or without the mill. The mill is supported on a frame, that is placed laterally across the press box, and attached to the standards or main posts of the press, the mill-operating shaft being journaled in bearings of the lateral frame, and made detachable with the same and the mill.

IMPROVED PEARL BARLEY MILL.

Henry S. Northrup, Quasqueton, Iowa.—The wheat or barley to be pearled passes to the inside of a stationary casing, near the eye or shaft of the revolving grindstone, being conducted by side channels with supply regulating slides, from the hopper at the top. The channels feed a continuous supply of barley to the casing, and keep the same packed full all the time, so that the stone may always act on a uniform quantity of barley, avoiding thereby the getting loose of the same in the case, and the increasing of the speed of the stone.

IMPROVED HONEY PACKAGE.

Lawrence Drake, New York city.—This improved package for honey is a glass jar contrived in form and shape for receiving and inclosing a comb and the frame in which the honey is made. The cover is of glass, sheet metal, paper, or any other approved material. The object is to provide a package that will protect the honey from flies, air, and dirt, and at the same time expose it to the inspection of the purchaser.

IMPROVED PORTABLE HAY PRESS.

Michael McCarty, Pueblo, Col. Ter.—In this press the follower is operated vertically by means of rods worked by chains and a windlass. The improvement consists, first, in jointing the rods to enable the follower to be tilted to one side of the top of the press case, to allow the hay or other material to be inserted; and second, in novel means for fastening the door of the case out of which the bales are discharged.

IMPROVED HARRROW.

Henry Mehl, Yellow Stone, Wis.—This harrow has adjustable double lock bars, which serve also as guard pieces to carry the harrow sections over obstructions, exposing thereby the teeth in a less degree to violent shocks and injury. The harrow may be folded for being readily placed on a wagon for transportation to and from the fields.

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1,2, & 3 H.P. Engines. Geo. F. Shedd, Waltham, Ms.

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Diamond Tools—J. Dickinson, 64 Nassau St., N.Y.

Temples and Oricans. Draper, Hopdale, Mass.

Notes & Queries

J. O. will find directions for removing moles from the skin on p. 347, vol. 32.—J. F. H. can increase the draft in his boiler furnace and economize fuel by inserting a jet of steam in his shaft. See answer No. 45, p. 396, vol. 33.—Mrs. J. can prevent rust on the bright parts of her sewing machine by following the directions on p. 169, vol. 33.

—W. H. H. will find on p. 74, vol. 28, full directions for laying out the sides of a hopper.—O. E. D. will find a description of a speed indicator for railway trains on p. 271, vol. 33.—R. M. can make Pharoah's serpents by following the directions on p. 315, vol. 32.—F. M. can find out the quantity of water which can be delivered by a pipe of any particular size by using the formula on p. 48, vol. 29. Area of a circle=diameter²×0.7854. This also answers P. Q. Sixty feet head of water=13½ atmospheres=26½ lbs. on the square inch, nearly.—E. T. is informed that vulcanite, as used for jewelry, ornaments, etc., is a patent material. He can clean his printing press blankets by washing them with potash lye.—P. H. G. can glaze his shirt bosoms by following the process described on p. 203, vol. 31.—T. M. D. is informed that full directions for molding in various materials are published on p. 58, vol. 24.—M. M. L. will find full descriptions of the principal forms of the perpetual motion nonsense in vols. 23 and 24.—H. W. H. will find answers as to his questions on the friction and passage of water in pipes on p. 48, vol. 29.—W. K. N. will find directions for tempering rock drills on p. 202, vol. 31.—R. H. H. will find directions for testing the purity of water on pp. 187, 281, vol. 33. This also answers C. L. M.—A. S. will find that greasy cotton waste is very liable to spontaneous combustion. See p. 28, vol. 33.—J. M. P. will find formulae for calculating the strength of boilers on pp. 116, 165, vol. 28.—W. T. P. will find a description of a calcium light on p. 219, vol. 30.—H. C. will find directions for making friction matches on p. 75, vol. 29.—T. W. can attach glass letters to windows by using the cement described on p. 47, vol. 33.—L. J. T. will find a recipe for black ink on p. 92, vol. 33, for purple ink on p. 315, vol. 33, and for blacking on this or the following page.—E. D. D. M. should read the SCIENTIFIC AMERICAN, and he will then be aware of the impossibility of perpetual motion machines.—S. W. M. will find directions for hardening millpicks on p. 170, vol. 25.—J. G. A. is informed that the plaster composed of gypsum (plaster of Paris) and marshmallow root does not possess the virtues claimed for it.—G. P. A. can nickel plate his iron castings by following the directions on p. 235, vol. 33.—S. L. J. can clean marble by following the directions on p. 330, vol. 32.—G. A. M. can fasten rubber to wood with good glue.—A. W. should put a tablespoonful of brown sugar into a quart of flour paste, and use it to fasten paper labels on tin cans.—C. S. R. will find a good recipe for sealing wax on p. 251, vol. 28.—T. H. H. will find a description of the manufacture of vinegar on p. 106, vol. 32.—E. J. S. will find full directions for making plaster molds on p. 58, vol. 24.—A. M. D. S. will find directions for silver plating without a battery on p. 408, vol. 32.

(1) L. E. McK. & J. W. K. ask: Is it healthy to keep plants in a sleeping room? A. Plants in a sleeping apartment are not considered as conducing to health, and some of the medical authorities claim that they are very injurious.

(2) M. E. D. W. asks: By what means can I detect petroleum or cotton seed oil in so-called linseed oil? A. Petroleum may be detected by its property of imparting a fluorescence to animal or vegetable oils, and by its aromatic odor on burning. An oleometer may be used to distinguish cotton seed oil from linseed oil.

(3) J. H. T., of Flekkefjord, Norway, asks: Am I running any risk in using tubs made of old petroleum barrels for washing underclothes in, or can I in any way make them fit for such use? A. In a short space of time, by the use of soap, the barrels will become deodorized and will suit your purpose perfectly.

1. What is the cause of a person's finger nails becoming concave, warping, cracking, and splitting? A. It shows an impoverished condition of the blood. Dr. Bean claims that certain diseases can be foretold by the condition of the nails. 2. Is there any remedy? A. Consult Wilson "On Skin Diseases."

(4) B. says: It is claimed that if a small quantity of common salt be put into a kerosene oil lamp, the danger of an explosion is lessened, and the illuminating power of the oil is increased. Is this so? A. The statement is entirely without foundation.

(5) N. M. A. asks: What is damp, newly precipitated alumina? In the manufacture of certain commodities, I am recommended to use oxalate of alumina, prepared by dissolving damp, newly precipitated alumina in a concentrated solution of oxalic acid. A. In one vessel prepare a strong solution of alum in water, and at the same time, in another vessel, dissolve a quantity of chloride of ammonium (sal ammoniac) in equal parts of water and strong aqua ammonia. Add the latter solution to the former and stir well for a few moments. Then allow to settle for a short time. Decant the liquid, wash the precipitate in clean water, and digest with hot solution of oxalic acid until solution of the precipitate is effected.

(6) W. V. J. asks: By what process can I transfer decalcomanie pictures to paraffin wax? A. We do not think it probable that you will succeed in employing paraffin in the way you propose. Try softening the paraffin on the surface by the aid of heat, and when ready, press the picture tightly against the surface until the paraffin has hardened again.

(7) J. W. R. says: In your issue for October 9 are directions for making a weather glass. I have followed them with great care and nicety (being well used to chemical manipulations) and succeeded only in obtaining a colorless and limpid liquid, which remains entirely unaffected by the most sudden and severe atmospheric changes. Can you give any probable solution for my failure? A. You have employed either too much of the solvents or else your alcohol was not of the desired strength. We have constructed several of these instruments according to the recipe given, and have had no difficulty.

(8) A. A. H. says: I bought a bottle of clock oil: and having a small perfumery bottle with a ground glass stopper, I poured the oil into it. I suppose the bottle was not washed clean, for it turned the oil to the color of soapuds. What can I do to the oil to purify it? A. This was probably due to the ammonia usually present in these perfumes. Treat with a little oil of vitriol, decant off the oil, and then wash with clean water.

(9) F. F. asks: 1. What is the best method of raising the poppy, and how is the opium extracted from it? A. Opium is the dried juice obtained from the unripe capsules of the white poppy (*papaver somniferum*). For properties, etc., see Pereira's "Materia Medica," also an extensive article by Dr. Eatwell in *Pharmaceutical Journal*, 1852, London, England. 2. Will it flourish in Central Illinois? A. We consider it very doubtful.

(10) B. C. S. asks: How can an oval cylinder be turned in a common iron lathe? A. By putting on a cam to move the slide rest in and out at every revolution of the lathe.

(11) J. says: I am building a sheet iron circular tank about 8 feet in diameter and 5 feet deep, and I wish to know how great is the tensile strain that tends to tear apart any portion of the lowest 12 inches of the sides. If there is no question of resolution of forces, I make out that this strip 12 inches wide has to bear a tensile strain of 3 to 4 tons, which seems high. A. The pressure will be 36 times the weight of a cubic foot of the liquid in the tank.

(12) E. F. says: I am very much troubled with my hands becoming very rough from constant use of copperas water. Can you suggest a remedy? A. You may avoid this by wearing a pair of India rubber gloves, so as to avoid contact with the iron solution. Use a little good glycerin or glycerin soap as a remedy.

(13) A. F. O. asks: 1. What book must I consult in order to obtain the most exhaustive information concerning the practical details for compensating the pendulum? A. You will find the principal forms of compensating pendulums described in any good text book of physics. We do not know of any special treatise on the subject. 2. In a recent publication a pendulum is described in the following words: "A wooden rod, dried and varnished, carrying at its lower end (by way of bob) a hollow leaden cylinder. If the rod be about 46 inches long, and the cylinder 14 inches, it will vibrate nearly in seconds." Do you call that a good pendulum? A. It would answer for ordinary purposes. 3. What should be the diameter and weight of the leaden cylinder? A. The cylinder should weigh from 8 to 10 lbs.

(14) C. M. B. asks: At what speed should an ordinary wood-turning lathe run? A. At about 700 feet a minute.

(15) J. P. says: We wish to run a shaft at 60 revolutions per minute. On the shaft is a cam that strikes a plunger, which can be driven forward only by great force. We have on same shaft also a balance wheel weighing 2,100 lbs., with a diameter of 52 inches and face of 6½ inches. We belt from a 24 inch pulley on a counter to this balance wheel, the balance wheel being the driver. Can we gain more power or momentum by putting a 30 inch pulley on the shaft at the side of the balance wheel, and belting on to the 30 inch pulley instead of the balance wheel? In either case, the speed of the balance wheel would be 60 revolutions per minute. A. We do not imagine that much advantage would result from the change.

(16) C. B. H. says: A friend and myself are discussing how to give a locomotive her full speed. I claim that, to do so, it would be necessary to throw her lever back to the farthest notch and open her throttle in the same proportion; but he says we ought to place her lever on the first notch off the center, and leave the throttle open. Which is right? A. You are.

(17) C. R. says: In your issue of October 20, you say: "Experiment has shown that the velocity of the shell when it leaves the mouth of the cannon is about 1,500 feet per second. The height from which the projectile would have to fall to acquire this velocity is 26,800 feet. Consequently the work actually done by the powder is equal to 219,000 foot pounds. Will you give the formula by which this result is attained? A. It is the product of the weight of the ball multiplied by the height due to the velocity.

What pressure per square inch is necessary to press separate pieces of ice into one homogeneous mass, which shall display no joints? A. At ordinary temperatures, a very considerable pressure, more than can be applied without special apparatus, is necessary.

What is a calory? A. It is the amount of heat required to raise the temperature of 2.2 lbs. of distilled water from 39° 2' to 41° Fah.

(18) J. E. asks: Is there a process for uniting wrought iron with cast iron? A. We know of none.

(19) J. E. S. says: 1. We are building a steamer, 22 feet long, 5 feet wide, and 3 feet deep. Will an engine with a cylinder 4x3 inches have power enough to run it? A. The engine will answer very well. 2. What size of upright boiler will it take? A. Make a vertical boiler 30 inches in diameter and 4 feet high. 3. Will a three foot wheel, placed in the middle of the boat and having a six inch dip, be large enough? A. Yes. 4. At what speed could we run her? A. Probably 4 or 5 miles per hour. 5. What pressure would the boiler stand? A. About 120 lbs.

(20) H. P. M. asks: What is the best method of hardening malleable iron? A. See "Wrinkles and Recipes," published by H. N. Munn, at this office.

(21) C. R. C. says: A pane of window glass may be cut into pieces by being rubbed by a small portion of the white ash obtained from the igni-

tion of certain woods in contact with air. The ash is to be placed on the glass and briskly rubbed over it with a flat piece of wood. Are the cutting particles crystallized carbon, and can they be utilized? A. When plants, etc., are burned, a portion of the silicic acid (sand) and soda, lime, or potash become fluxed together by the heat to form minute particles of hard glass.

(22) S. G. P. asks: Does a feed tank to a steam boiler need stay bolts in the heads, to carry with safety 100 lbs. to the square inch? It is made of ¼ inch iron, and is 24 inches in diameter and 40 inches long, singly riveted. A. It would be better to stay the heads.

(23) T. H. asks: Should a pulley with curved arms be so put on the shaft that the working strain tends to straighten the arms, or the reverse? A. The former. 2. When the arms have two curves, should the pulley be put on so that the working strain tends to straighten the part of the arm next the hub or that next the rim? A. The former is best.

I want to make a model that will require a considerable number of very small, thin castings. Can you tell me of a composition that will flow quite freely at a not very high temperature, will be about as strong as ordinary brass, and will file drill, tap, etc., comfortably? A. You describe the properties of good brass.

Can you tell me of any easily got and easily applied solvent for borax, to clean it off work where it has been used as a flux for brazing? A. It is best to scrape or file the joint.

(24) J. S. asks: What thickness of cast iron should a hollow globe of 18 inches diameter be, to sustain a steam pressure of 120 lbs. to the square inch? A. About ¼ inch.

(25) S. & H. G. P. say: We are using a 40 horse power tubular boiler, for the purpose of pumping oil wells. Four wells are worked by the boiler. One steam line (1½ inch pipe) extends up a hill to a well 1,150 feet from the boiler. Another line (2 inch pipe) extends in another direction, on almost level ground, to a well 1,078 feet from the boiler. Another well is 300 feet from the boiler on the 2 inch pipe, both engines taking steam from the same line. The fourth well is near the boiler house, and the engine (in the boiler house) supplies the boiler with water. We use about 2,700 gallons of water every 24 hours. We carry 100 lbs. steam pressure, and run our engines 55 revolutions per minute. Our steam pipes are laid in 8 inch square boxes, packed with sawdust, and are tight. The connections with the engines and the safety valve are also tight, so that there is no escape of steam except through the several engines, which are in ordinary good working order. We use for fuel principally natural gas from the wells; but at times the flow of gas is not sufficient, and we have to use some bituminous coal. Now W. W. S. claims that, if we reduce the pressure in the boiler to 40 lbs., it would not take so much water nor so much fuel to do the same amount of work. I claim that it would take more water (because we would not work our steam so dry as at present) and consequently more fuel, as we should have an increased amount of water to heat. Which is right? A. Your consumption of steam and of water will, in proportion to the work done, be more economical at the higher pressure.

(26) C. R. says: There is a pipe, 2 inches in diameter inside and about 800 feet long, with 4 or 5 feet fall. The water will run for 4 or 5 days and then stop. There is no leak in the pipe. What is the cause? Is it not the friction on the inside of the pipe? A. Probably air collects at a high point.

(27) J. C. P. H. says, in reply to a correspondent who asked if there was again in power in having the area of the sails of a windmill equal to the whole area of the circle, over the old style of 4 sails: You answered: No. In a technical point of view you are correct; but I hardly think you mean to state that the full leverage area of any given diameter does not contain more power than the same diameter or area, only half or quarter filled with leverage area or wind surface. Do you so mean, and upon what principle is the statement based? A. If a windmill could utilize all the power in a cylinder of wind with a diameter equal to that of the sails, of course it would be well to give the sails the greatest area possible. As this is not practicable, however, it is easy to see that there will be an area which is best for any given case. This area might possibly be determined by analysis; but it is generally fixed by experiment.

(28) M. A. asks: 1. When was power first obtained from electricity? A. Page's magneto-electric engine, described in *Silliman's Journal*, vol. XX, 1831, was probably one of the first constructed in this country. 2. Which is the best direction in which to cover magnets with wire? A. Dr. Joule's very powerful electro-magnets were wound in the direction of their length.

(29) W. L. P. asks: Is there any difference between one inch square and one square inch? A. No.

(30) M. A. G. says: We desire to put a lightning rod upon a church spire, 120 feet high. About 12 feet of the top is a galvanized iron finial, which terminates in a point covered with gold leaf. Would you advise us to carry the rod above the finial, or would it be better attached to it, so that the finial will constitute a part of the rod? If the latter is the best plan, how would you attach the rod to the galvanized iron? Would it be well to simply put the rod around one of the waists of the finial? A. The rod should be attached to the base of the finial by a firmly soldered and riveted joint, so as practically to make an unbroken connection. All joints in the rod should be firmly soldered and secured against separation. If the soil is dry, you will need a large amount of conducting material placed underground in connection with the rod. See p. 400, vol. 33.

(31) J. W. P. asks: Is there anything that may be added to collodion for ferrotype plates, that will make it hard enough to stand a brush after the picture is taken? A. There is no foreign matter that can be added before the picture is made; but a collodion made of long fiber cotton, with an excess of ether, will usually answer best. If this will not do, flow the plate while wet (after the picture is taken) with dilute albumen or gum arabic.

(32) I. O. A. says: I am straining my eyes by working in white wood and reading by lamp-light. I want to use spectacles, but I am told that if I once use them I must always use them. Is this so? A. Spectacles of the proper kind may be used to assist the eyes to see indistinct objects; but if there is not light enough to see well without them, their use would certainly be injurious.

(33) A. E. asks: How can I make a good washing fluid? A. Make a strong solution of washing soda, and render it caustic by the addition of quicklime.

(34) W. C. asks: How can I cement emery together? A. Use the best glue.

(35) L. J. T. asks: How can I make a good baking powder? A. Take tartaric acid 5 parts, sesquicarbonate of soda 8 parts, and potato flour 16 parts. Dry them perfectly, mix, pass through a sieve, and keep free from moisture.

(36) J. E. J. asks: Has it ever been explained how the common turkey buzzard is able to mount up without flapping his wings? A. We think not. See p. 292, vol. 32.

1. When will Saturn and Mars be in conjunction again? A. About 4 o'clock A. M., July 28, 1877. 2. Would an achromatic spyglass of 50 powers be of any use for astronomical observation? Would it enable a novice to discern Jupiter's moons and Saturn's rings? Would it show the globular form of any of the planets? A. If you have a spyglass which will give you good definition with a power of 50, you can see all you speak of and a good deal more.

1. What is the proper name of the gas generated by burning bituminous coal? A. The larger part is carburetted hydrogen; carbonic oxide and carbonic acid gas are also present. 2. Is it poisonous? A. Yes, slightly.

(37) J. H. asks: 1. How do engravers lay the design on the plate before they commence the operation of engraving? A. They coat the plate with a thin layer of whitening in water, and then use a red transfer paper, tracing the design with a steel point. 2. In drawing the engraving tool over the face of a copper plate, will it not leave a rough or feather edge? A. Not if the copper is of the right quality, and the tool is sharp and in the hand of a qualified operator.

(38) J. R. C. asks: Can you give me the meaning and derivation of the word *terra cotta*? A. *Terra cotta* (Italian) means "baked earth," and is the name for ware made of a paste of white clay, fine sand, and pulverized broken crockery, slowly dried, and baked to hardness.

(39) T. T. Y. asks: 1. What are quaternions? A. "A quaternion is the quotient of two divided right lines in space, considered as depending on a system of four geometrical elements, and as expressible by an algebraical symbol of quadri-nomial form."—Sir William R. Hamilton. 2. Where can I find analysis of them? A. See three admirable letters of the above-named author. You may find them in Nichol's "Cyclopedia of the Physical Sciences." We do not know the publication you mention.

(40) J. G. S. asks: Can you give a good cure for cracks in the skin of hands? The points of my fingers and thumbs are badly cracked, and although kept as clean as possible, glycerin being applied, they will not heal. A. Try spermaceti ointment.

(41) W. B. H. asks: Please give me a recipe for making oil paste shoe blacking for shoes. A. Take ivory black 16 parts, treacle 8 parts, oil of vitriol 4 parts, diluted with water 2 parts, oil 2 parts, gum arabic 1 part, soft water (for final dilution) 64 parts. Mix well.

(42) Z. Q. Z. asks: What substance is best to use on the back of postage stamps, edges of envelopes, etc., to make them adhesive? A. Try a solution of gum dextrin (see p. 251, vol. 29) with a little refined sugar in it to prevent the paper from curling up when dry.

(43) K. says: When throwing the spectrum of vaporized metals on the screen, is it usual or best to use the condenser, as in the magic lantern, besides the focussing or condensing lens on the stand just before the prisms? A. Yes. Place the condensing lens between the lantern and prisms.

1. Will there be any disadvantage in making up a battery of 12 one gallon Bunsen cups and 40 one quart Grove cups? Is there any loss of tension or quantity by uniting Bunsen's and Grove's in the same circuit? A. No, unless the resistance of the circuit outside of the battery is very small. In the latter case the 12 one gallon cups alone will give the stronger current. If the external resistance of the circuit is of any considerable magnitude, the best effect will be obtained by uniting all the cells in series. The latter combination always gives the highest tension or potential. 2. Please give full instructions for setting up the Chuteaux battery; mentioned in your paper of May 22, 1875. A. There are several modifications of the Chuteaux battery, one form is made as follows: A glass or stoneware jar is perforated at the bottom, and an inverted saucer placed over the hole. Single plates of zinc and carbon are then arranged on opposite sides of the jar, and a sheet of tin or other thin metal placed in the middle (between the zinc and carbon). The side containing the zinc plate is filled with sand, the oppo-

site side, containing the carbon, with pounded coke, after which the metal partition is withdrawn and a thin layer of sand spread over all. The exciting fluid is contained in an inverted jar over the battery; another jar beneath catches the liquid after it has passed through the sand and coke. Take 15 parts, by weight, of water, 1 of bichromate of potash, $\frac{1}{2}$ of sulphide of mercury, and 2 of sulphuric acid, to form the solution.

(44) K. asks: 1. What is the best sized cell to use for a battery to produce the electric light? A. With an equal number of cells, the larger of two sizes gives the most heat and light. 2. In amalgamating zincs with mercury, will it do to immerse the zincs in mercury, or would this give them too much mercury? A. It is usual, after the zincs have been properly cleaned, to place them in a shallow dish and pour the mercury over them with a spoon. They should be carefully brushed afterwards to remove the excess of mercury. 3. How long should the nitric acid last in the Grove battery? Why does the current become so weak when the nitric acid becomes weak? A. That depends upon the intensity of chemical action. With a given quantity of acid, zinc, etc., a certain definite quantity of electricity will be evolved. This we may obtain in a longer or shorter time by making the resistance of the circuit large or small; if it is very small the battery becomes perceptibly weakened in a very short time. 4. Does not the current depend entirely upon the decomposition of the zinc? A. The current is the resultant of all the chemical actions which take place in the battery. 5. As platinum is a very poor conductor, is not the current weakened when passing through the platinum strips from the nitric acid to the zinc? Sometimes the strips become so hot as to almost boil the acid in the battery. A. Anything that adds resistance to the circuit necessarily reduces the current proportionately.

(45) P. D. S. asks: Is there anything that will destroy the attraction of a magnet when placed between it and steel? A. No; but the attraction may be partially neutralized by interposing a heavy piece of iron.

(46) N. S. asks: 1. Should all spirals, for lifting electromagnets, induction machines, magneto-electric machines, relays, and sounders, be insulated and wound on bobbins? A. All wires for electro-magnets, etc., should be insulated; especial care must be taken in this particular for secondary coils of induction machines. When the electro-magnet is small, it is often covered with paper, and the wire then wound on the core itself. 2. If I should wind flat spirals by commencing at one end of the bobbin, and wind a single flat spiral of the requisite diameter, then drop down to the shaft of the bobbin, the wire remaining unbroken, and then wind another flat spiral, and so on till the bobbin is filled, will I have a good secondary for an induction coil, if I insulate properly between the coils? Or if I take a piece of insulated wire, commence at its middle, and wind both ways with opposite ends, and so wind the flat spirals, and continue each way from center of bobbin toward the ends till filled, will this be equally good? Which is the best of these two? A. For medium sized coils, it is better to divide the bobbin in two parts. Then place it in a lathe, put one end of the wire through the dividing disk, and wind back and forth continuously until one end of the bobbin is full. Turn the bobbin end for end, connect with the finished coil by the wire passing through the dividing disk, and wind as before for the second coil.

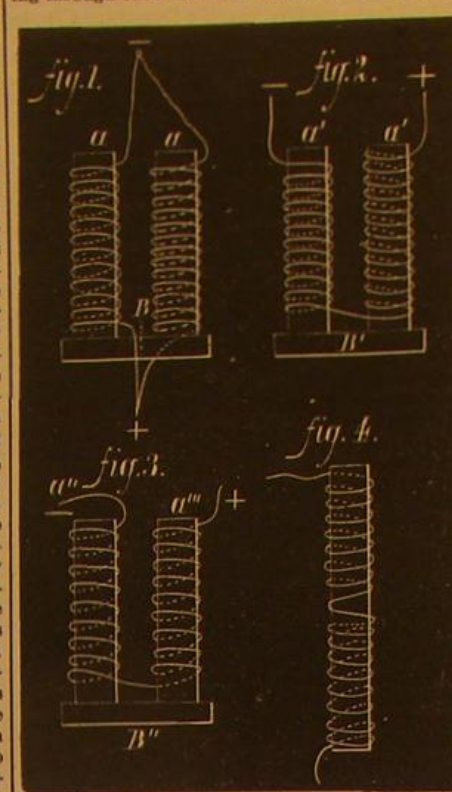
(47) A. S. F. asks: 1. Does it make any difference in the power or the wear of a horizontal engine whether it runs over or under? A. No. 2. Is a speed of 125 revolutions per minute too fast for an engine of 14 inches diameter of cylinder, and 24 inches stroke of piston, said engine being well and carefully constructed with a view to such speed? Band wheel is 8 feet in diameter and of 18 inches face, and weighs about 3,600 lbs. A. No. 3. Is it entirely safe to run a line shaft, of 2½ or 2¾ inches diameter and 140 feet long, receiving the power of a 70 horse power engine at one end, and carrying pulleys as large as 42 inches diameter and of 16 inches face, at a speed of 300 revolutions per minute, such shaft being first class in all respects and carefully put up? A. Yes. 4. Would it be safe to use 20 horse power from such shaft, at the farther end from the engine? A. Yes, if its bearings are not too far apart.

(48) J. C. says: There is a pump in a well 85 feet deep; the pump is situated 65 feet below the surface (20 feet from the bottom of the well). The pipe above the cylinder is 65 feet long and 1¼ inches in diameter. The cylinder of the pump is 2¼ inches in diameter, and the length of the stroke of the plunger is 6 inches. The pump will pump water, but it is very hard to work it. The plunger makes 40 strokes a minute and is worked by a crank. Is the pipe containing the pump rod large enough to take the quantity of water as fast as it is pumped? A friend says the pipe is large enough, but that the plunger should make a larger number of strokes; and if it does this, he thinks it will work more easily. A. Your pipes, especially the suction pipe, would enable the pump to work more easily if they were a little larger in diameter.

(49) T. J. S. says: How can I quarter the driving wheels of a locomotive? A. What sort of quartering do you mean?

(50) J. B. F. says: In a recent issue, you state to a correspondent that you know no way of producing simultaneously in an electromagnet two north or two south poles. I send you herewith a sketch, showing several ways in which this may be done, as it may interest those of your readers who are experimenting in electro-magnetism. Fig. 1 represents the cores of an ordinary electro-magnet, coiled in the usual manner, but with the ter-

minals of each coil connected as shown. Now, if we connect one pole of the battery at —, and the other at +, the current will divide, one half passing through each coil in the same direction, pro-



ducing at a two north poles. If we change the connections of the battery, reversing the current, both cores at a will become south poles, and in both cases B will be a consequent point. Fig. 2 represents similar cores, but so coiled in one continuous line that the current shall flow around both cores in the same direction. When connected with the poles of the battery as shown, both poles will be of similar name, say north; and if the connections are changed, both poles will be alike but opposite to those last named, and in both cases B' will be a consequent point. Fig. 3 represents similar cores, but so coiled that the current shall flow around each core in opposite directions. This will produce one north and one south pole, and a neutral point at B'. Fig. 4 represents a straight bar magnet with each end coiled in opposite directions; when connected with the poles of the battery, both ends of the cores will show similar polarity, while the center will be a consequent point. In order to understand how these effects are produced, I think it is only necessary to refer to the electric force circulating around a wire through which a current is passing, and to state that the direction of this force or influence is due to the direction of the current in the wire. To show this in the most simple form, place a galvanometer needle over a wire through which an electric current is passing, and the needle will be deflected in one definite direction; now place the needle under the wire, and it will be deflected in the opposite direction. Now confine the needle in the direction opposite to that in which the current deflects it, and its polarity will soon be reversed by the action of the current.

(51) A. S. C. says: W. F. C. deserves credit for coming forward to support the theory which allows an ice boat to travel faster than the wind which drives it, but his diagram carries a confutation upon its face. He says that, with the sail set to an angle of 45°, the bolt, which represents the direction of the wind but not its force, if pushed through an interval of 1 inch, will cause the vessel to move forward a like amount. True; but then again he says: Make the angle of the sail 22½° instead of 45°, and the space passed through by the boat will be double that passed through by the bolt or wind. This result would be equally true with the first, had he not neglected to state that four times the speed or force of the wind was necessary for its accomplishment in the same time. Does he suppose that the wind, at a known pressure, after doing its full duty in driving the vessel at a certain rate, can be made to double that duty by increasing its resistance twofold, which he does by lessening the angle of the sail one half? If that were true, what is to prevent his attaining, by diminishing the angle sufficiently, a speed infinitely greater than the wind? This theory of a boat's traveling faster than the wind should, like its twin sister "negative slip," be relegated to the shades.

(52) E. D. C. says, in answer to a query as to why the railway gauge of 4 feet 8½ inches was adopted: My book of reference says that the gauge was originally 5 feet, and the flange of the wheel was on the outside. That not working satisfactorily, the flange was changed to the inside, which makes the measurement 4 feet 8½ inches.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. W. P.—They are scales of mica.—C. W. D.—Both contain pyrites. By exposure to the air, some of the pyrites has been converted into sulphate of iron.—W. J. S.—The glistering powder is sulphur of iron; the black is hornblende. Neither is valuable.—J. K. S.—It is fibrous steatite or soapstone.—G. P.—No. 1 is quartzite. No. 6 is ferruginous quartz. We do not find the other specimens spoken of in your letter.—T. H. A.—The amount of substance was too small for chemical examination. Try aniline red, or madder red, or red lead.

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 Etheric Force. By W. E. S.
On the Yellows in Peaches. By P. H. F.
On a Hydro-Pneumatic Puzzle. By C. K.
On Diphtheria. By J. P.
On a Boiler Explosion. By T. E. K.
On the SCIENTIFIC AMERICAN. By S. S. B.
On the Laws of Proportion. By I. H. H. & S.
On Carbonic Acid as a Preservative. By C. W. S.
On Heating Cars. By G. W. P.
On Laying Out a Square. By J. M. D.
On Gravity and Matter. By W. I. L.

Also inquiries and answers from the following:

P. G. G. N.—A. M. J.—S. D. S.—F. E. B.—W. C.—J. A.—W. E. D.—N. E.—C. T. W.—J. B. E.—R. P.—G. B. R.—J. G. S.—W. C.

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 inquiries analogous to the following are sent: "Who sells Portland cement? Whose is the best shingle-splitting machine? Who sells collections of minerals? Who sells machinery for making school slates? Who makes *papier maché*? Why do not the makers of the sand blast apparatus advertise in the SCIENTIFIC AMERICAN? Whose is the best tile-making machine? Who sells the best photographic lenses?" 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

December 7, 1875.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Alarm, burglar, H. A. Sherman.....	170,905
Animals in giving birth, aiding, W. Dulin.....	170,827
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Bedstead, sofa, G. N. Seidler.....	170,777
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Bird cage, G. Gunther.....	170,847
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DESIGNS PATENTED.

8,320.—MONEY BOX.—J. G. Baker, Philadelphia, Pa.	
8,321.—CASSIMERE.—C. Clarke, Rockville, Conn.	
8,322.—STOCKING.—M. Landenberg, Jr., Phila. Pa.	
8,323.—TRIMMING.—C. Lindenthal, New York city.	
8,324.—GLASSWARE.—F. S. Shiley, New Bedford, Mass.	
8,325, 8,326.—EMBROIDERY.—W. Steinhaus, New York city.	
8,327.—GLASS DISHES.—J. S. Atterbury, Pittsburgh, Pa.	
8,328, 8,329.—EMBROIDERY.—E. Crisand, New Haven, Ct.	
8,330.—INKSTANDS.—G. F. Finney, Philadelphia, Pa.	
8,331.—INKSTANDS.—G. E. Hatch, East Cambridge, Mass.	
8,332.—TOY CHARIOT.—E. R. Ives, Bridgeport, Conn.	
8,333.—INKSTANDS.—H. S. Kerr, Philadelphia, Pa.	
8,334.—FRAME CORNER.—C. P. Poldner, Boston, Mass.	
8,335.—SHIRT FRONTS.—V. H. Rothschild, New York city.	

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, December 1 to December 4, 1875.

5,444.—J. M. Cooley, Hamilton, Ont. Side plaiter. Dec. 1, 1875.	
5,445.—T. Webb, Elyria, Ohio, U. S. Feed cutter. Dec. 1, 1875.	
5,446.—C. C. Robertson, Hamilton, Ont. Combined corset, shoulder brace, etc. Dec. 1, 1875.	
5,447.—L. N. Fontaine, Ottawa, Ont. Liniment for rheumatism. Dec. 1, 1875.	
5,448.—A. Chambers, Marylebone Road, London, Eng. Pneumatic signal. Dec. 1, 1875.	
5,449.—W. L. Scott, Montreal, P. Q. Stamping with rubber type, etc. Dec. 1, 1875.	
5,450.—I. H. Culp et al., Chifford, Ont. Carriage. Dec. 1, 1875.	
5,451.—W. P. Plant et al., London, Ont. Gang plow. Dec. 1, 1875.	
5,452.—J. H. Holland, Aurora, Mass., U. S. Land roller and seeding machine. Dec. 1, 1875.	
5,453.—F. L. Blakely, Clinton, Iowa, U. S. Lap robe. Dec. 1, 1875.	
5,454.—J. H. Morrell, New York city, U. S. Water supply and ventilation of buildings, etc. Dec. 1, 1875.	
5,455.—B. H. Ghent, Hamilton, Ont. Drum heater. Dec. 1, 1875.	
5,456.—A. D. Cable et al., Montreal, P. Q. Apparatus for rendering doors and gates self-closing. Dec. 1, 1875.	

5,457.—B. Temple, Hamilton, Ont. Combined tube kettle and cooking apparatus. Dec. 1, 1875.	
5,458.—H. E. Van Benschoten, Hillsdale, N. Y., U. S. Boot sole and heel protector, etc. Dec. 1, 1875.	
5,459.—J. C. Schomaker, Geddes, N. Y., U. S. Lightning rod standard. Dec. 1, 1875.	
5,460.—H. Bailey, New York city, U. S. Tubular tubes for steam boilers. Dec. 1, 1875.	
5,461.—C. A. Scadding, Toronto, Ont. Printer's galley. Dec. 1, 1875.	
5,462.—J. B. Ryles, Hicksville, Ohio, U. S. Neck yoke leather. Dec. 1, 1875.	

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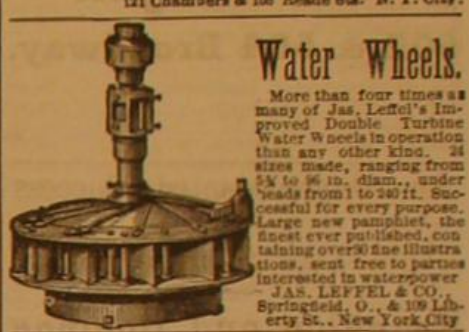
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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XXXIV.—No. 3.
[NEW SERIES.]

NEW YORK, JANUARY 15, 1876.

\$3.20 per Annum.
[POSTAGE PREPAID.]

THE MEXICAN RAILWAY.

In the construction of the Mexican Railway, the configuration of the country has been found to present many difficulties, and the skill of the engineers has been severely taxed, especially on that portion of the line known as the Infernillo; and on the spot depicted in our engraving (selected from *Engineering*), a bridge over a deep gorge, with a sharp curve on a steep gradient, has been successfully constructed by the Crumlin Iron Works Company, of Monmouthshire, England. In building this viaduct, a temporary structure, with even sharper curves and steeper inclines, was used; and the value of the Fairlie engines in mountain railroading was fully proved. The stream which rushes down the narrow gorge passes 100 feet below the viaduct, at the foot of the deep slope of broken rock, fallen from the hills above, on which the stone work for the piers and abutments had to be erected. The rocks above overhang the work, projecting in many places beyond the center line of the railway; and the workmen employed to remove these rocks were suspended by ropes and on ladders attached to the trees above.

The viaduct consists of nine spans of 51 feet each; the curve is of 325 feet radius, and the grade rises 1 foot in 25. Steel rails are laid on all the heavy inclines, and guide rails are introduced on the curves. The rails on the viaducts are carried by transverse sleepers attached to the upper member of the girder, to which they are secured by hook-headed bolts.

Make a Note of It.

Those who have never tried the experiment rarely appreciate the benefit which an enterprising, progressive mechanic derives from keeping a record of matters worth remembering. An intelligent workman, especially one who reads, is constantly acquiring interesting and useful information, which at some time he will probably have occasion to apply

practically in his business. Almost every day he learns something new, and says to himself: "I must remember this;" but unless he has occasion immediately to apply his knowledge, he is very apt to forget all about it, or to retain only a vague recollection of having some time read or heard something about it. The memory, unless highly trained and naturally retentive, is a treacherous repository for odd scraps of useful knowledge not gained by experience or personal observation, and every mechanic should have a paper memory, which will never let a useful fact slip away.

We should advise all mechanics, and especially all young men with unformed habits who are learning mechanical trades, to keep note books in which to enter anything worth remembering which may come to their knowledge. Facts learned from observation and experience, or gathered from conversation with other mechanics, useful hints gained from books, valuable suggestions, or facts of practical interest found in newspapers should always be promptly recorded and saved. When a book is full, it should be carefully indexed and laid away in some place where it will be easy of access. The mere fact of writing, especially if condensation is required, will tend to fix a fact in the memory, and give a man a more ready control of what he knows. In any case, he has the fact at command at all times, and a book such as we have described, containing the gleanings of years of study and practice, becomes of inestimable value to the possessor. We have seen mechanics' note books which would not have been given in exchange for a whole library of technical works, and we have never known a man to begin the record of facts who was not glad he acquired the habit.

We regard this as a matter of great practical importance to mechanics in the trades we especially address. No printed text books contain all the points which a smart mechanic will pick up in the course of his business, and nothing will take the place of a scrap and note book. Let our readers, young mechanics especially, try the experiment, and we

promise them that they will find immediate and life-long benefit from so doing. It will be to many the stepping stone to success in life, by inculcating careful habits of acquiring useful knowledge, and making them wisemen and better mechanics than they would otherwise have become. To all young mechanics we say: Never let a fact worth remembering slip away from you. Make a note of it in some shape, and then put it where it will be accessible when you want it most. The habit is easily acquired, it need consume no time required for the performance of other and more important duties, and the pleasure which it will give will more than compensate for the trouble involved, even were no subsequent benefit to be expected from it.—*Iron Age*.

Young Lions Nursed by a Terrier.

Carefully caged in our Central Park Museum are two young cubs. They are four or five weeks old, a pair, lion and lioness, fine healthy little creatures, and are nearly old enough to be shown to the public. They are the progeny of the pair of beasts, known as Lincoln and Jenny, in the Museum. But the mother being from some cause unable to nurse them, they were at once given to a large terrier whose puppies were taken away, and who plays the part of a foster mother. She seems, indeed, as fond of the cubs as if they were her own offspring, and covers them with caresses, though they are nearly as big as she is. It is a curious fact that lions reared in captivity are not as gentle as those captured and tamed. The parents of these cubs, which were caught when wild, and tamed, are very tractable, while some of the other lions which were born and brought up in the Museum are sullen and ferocious.

TO MAKE brazing solder, ordinary brass is mixed with or melted with one sixth its weight of zinc. Pour out of the crucible, cool, and granulate by crushing with a hammer



THE METLAC VIADUCT ON THE MEXICAN RAILWAY

Scientific American.

MUNN & CO., Editors and Proprietors.

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A Disastrous Balloon Ascent.

M. Tissandier, the French aeronaut, accompanied by a party of distinguished scientific gentlemen, recently undertook an ascent over Paris in the balloon *L'Union*, in order to make topographical drawings of the fortifications. While at a height of 750 feet the balloon exploded; the great bag at once emptied itself, and the car with its occupants fell with terrible velocity, the former burying itself in the ground. Strange to say, although every individual was more or less wounded, no one was killed.

WHAT WORKING MEN SHOULD EXHIBIT AT THE CENTENNIAL.

A paragraph is going the rounds of the daily press about an elaborate model yacht which somebody is building for exhibition at the Centennial. The hull is to be made of countless pieces of different woods, the rigging of fine silk, the fittings of silver. Every detail of a real vessel is to be repeated in miniature; and to crown all, this remarkable production is to be the work of an individual who never has been aboard the style of craft he proposes to imitate. We mention this instance merely as one of scores, similar thereto, which have lately come to our notice, and which show that hundreds of persons all over the country just at present are at work with the idea of exhibiting like results of their skill at the Exposition. In our estimation, all these people are making an unfortunate mistake, for they are simply wasting valuable time and labor to no good purpose whatever.

If the maker of the yacht above referred to can produce a model, cut roughly from a log if need be, which will possess merit for fine lines or superior design, or which will afford a new idea regarding safety, speed, buoyancy, stability, or any of the qualities sought by marine architects, then he will perform useful work; but we cannot imagine anything more useless than a miniature affair which, because built by a totally unskilled person, cannot be supposed to be a model, and which, too costly even for a child's toy, reduces itself to an evidence of the patience with which the producer has thrown away his otherwise unoccupied time. If any reader of this journal is making minute steam engines to run on a five cent piece, or building miniature furniture or ornaments of immense numbers of fragments, or trying his hand at building working models of large machines on a ridiculously small scale, or indulging in any other like effort, we earnestly counsel him to stop. We grant that model building by learners in trades often serves as excellent practice; but the attempts of tyros are not, it is presumed, ever intended for exhibition, or made with that incentive. To all working men we say: Exhibit. If you have a really nice piece of work which you can command, send it to Philadelphia; but let it be something in your own trade, that is the result of your own individually acquired skill, and not some useless though very pretty affair, tinkering at which has killed a few heavy hours. There will be committees of workmen sent over here from Europe to examine minutely everything, and to report thereon, so that no fear need be entertained but that every article in the great edifice will be critically scrutinized by experts, and judged on its merits.

It is well to remember another fact about these elaborate miniature or piecemeal productions, and that is that the yellow faced, almond-eyed Chinaman, who is now making his way in almost every town in the country, can do that kind of work a thousand times better than you, with all your skill in mechanics, can ever hope to. He can bring over with him from his own country carvings in ivory, or in that hardest of substances, jade, and you can form no idea even of the tools used in cutting the almost invisible lines, much less how the work was accomplished. Your finest productions are incomparably coarse and crude beside these. He can build miniature yachts and steam engines which will excel yours beyond all question, provided you give him something to copy, and then he will reproduce every scratch or accidental stain on the original. Clearly, then, when you attempt the work which is peculiar to the country of the cheapest of cheap labor, you only depreciate your own toil by inviting an unfortunate comparison.

What we want to see in the Centennial are first, new ideas, secondly, evidences of trained and skillful workmanship. Of the former there will be no lack; whether the same will be true of the latter rests with the workmen themselves. We want a display that will tell the world that, besides possessing the ablest inventors, the United States contains the men who can put ideas into shapes that cannot be excelled. Therefore if you have spare time, do not waste it in producing something which does not, but something that does, tell this fact. Do not make fancy inlaid work or build boats, unless such is your trade; if it be, strive to make the best inlaying or the neatest model you ever produced. But if it be without your trade, let it alone; you can no more hope to compete with those whose trade it is to make such things than they with you in your particular branch of industry. If the article you are to exhibit is within your own calling, and is to be the labor of yourself alone, there lavish your work. If the object is of metal, make pattern after pattern until you get a form on which you can imagine no improvement. If you can hit upon a new design—and new designs are sadly needed for a great deal of useful machinery—so much the better. Then try until you obtain perfect castings; and this done, fit the parts to perfection. Do not finish with nickel or silver plate, but go at it with the file. If you know anything about the delicate and beautiful mechanical operation of polishing with that tool, let the world see that you do. It is evidence of superior mechanical skill, and proof that no defects are hidden, as might be the case under a film of plating. If you are laboring on only a part of a machine, and fellow workmen are doing the rest, exhaust all your efforts on your part. It will have the salutary effect of making your comrades do likewise, almost despite themselves, for the finish on the machine must of course be uniform; and besides, your employer will hardly refuse to give you the public credit which would be but a just recompense for your skill and industry.

In a word, stick to your own business, and let that of other people alone. If you are tempted to work on something out of your line, bear in mind that others will take care that the Exposition shall not be wanting in that particular respect, and that your amateur help in supplying a deficiency would

be the last required. Show the world the very best you can do in your particular calling, and this without regard to whether your labors tend to the production of a magnificently finished engine or a neatly forged bolt.

STANLEY, CAMERON, AND NORDENSKJÖLD.

The year 1875 will ever be a memorable date in the history of geographical discovery. Within the twelvemonth two of the most important questions of African geography have been settled; and in the far north the demonstration of an open water way between Europe and the countries drained by the great Siberian rivers is perhaps the most important addition to geographical science that could be made in polar regions. Certainly there remains for no future year so many first-rate problems to solve.

The source of the Nile! For twenty centuries it has been the goal of the explorer's ambition. The boldest spirits have essayed its discovery, only to be turned back by insuperable obstacles. Its conquest waited for the plucky energy and resistless push of Stanley.

Starting from Zanzibar in November, 1874, with 300 soldiers and carriers, an important part of whose luggage was the open boat *Lady Alice*, in sections, Stanley had before him 700 miles of unknown country—part forest and part desert—much of it swarming with hostile savages. By dint of resolute marching and fighting, he accomplished in a hundred days what in the usual course of African travel would have taken as many weeks, though at the cost of half his command; and on February 27, he caught his first glimpse of the great lake with which his name must hereafter be inseparably associated.

Speke and Baker had traced the Nile to the Victoria Nyanza. What was the compass of that great freshwater sea, and whence came its supplies? Thanks to the *Lady Alice*, which was soon set up and afloat, these questions had not long to wait for resolution. Within the next sixty days, its shores and numerous islands had been mapped, and its tributaries noted. Of the ten considerable streams which feed the Nyanza, the largest and most important proved to be the Shimceyn, in all probability the ultimate source of the Nile. The details of the discoveries thus auspiciously begun we shall not consider here, nor the importance of the region now for the first time opened up to geography. It is enough to note that, through Stanley's daring energy and genius for command, the question which, more than any other, has vexed geographers and challenged explorers for two thousand years has been substantially settled.

In the meantime Cameron has taken up the unfinished work of Livingstone, and—spurred on no doubt by a determination not to be forestalled by his Yankee rival, as he was in the search for Livingstone—he has overcome the obstacles that baffled the veteran explorer, and accomplished perhaps the longest journey ever made by any adventurer in that benighted continent. And its results are as brilliant as the passage was heroic. No other explorer ever crossed the continent so near the equator; and none save Stanley ever achieved so much in so little time. His path lay through the most difficult and dangerous part of Africa, from Tanganyika to the mouth of the Congo; and when the story of the passage is made known, it will, nay, it must, present some of the most stirring chapters of dashing adventure in the history of African exploration.

One thing is certain: The theory of Livingstone has been disproved; and not the Nile, but the Congo, receives the drainage of the great interior basin of the continent. And Africa hides no other secrets to compare with the two which Stanley and Cameron have, within the same few months, manfully wrested from her jealous keeping.

Less significant geographically, but of far greater promise commercially, is Professor Nordenskjöld's discovery of an open passage by sea between Europe and Northern Asia. The tract of country thus brought into economical communication with the rest of the world is a vast and largely fertile region, much of it splendidly timbered, traversed by navigable rivers, and only waiting for a suitable outlet for its productions, to become densely peopled. According to Professor Baers the valleys of the Obi Irtch and the Yenisei exceed in extent the combined areas watered by the Don, Dnieper, Dniester, Nile, Po, Rhone, Ebro, and all the other rivers flowing into the Black Sea, the Mediterranean, and the Sea of Marmora. The entire region made directly accessible to commerce is estimated by Dr. Petermann to embrace an area one fourth greater than all non-Russian Europe.

The attainment of the pole would give greater renown to the explorer who should succeed in reaching it; but the consequences to humanity would be insignificant compared with those quite certain to flow from this much needed waterway to the heart of Asia.

PHOTOGRAPHING THE INVISIBLE.

Dr. Schnauss, in *Photographisches Archiv*, essays to enlighten his countrymen with regard to the so-called spirit photographs and that sort of thing, and endeavors to shoulder the blame of such deceptions or delusions upon "that land of humbug, America."

Humbugs do flourish here, we are sorry to admit: humbugs of every grade, from the mysteries of Mumbo Jumbo, devoutly believed in by too many citizens of African descent, to the finer mysteries of Baron Reichenbach's odic force, not less devoutly believed in by many citizens not of African descent. With such a composite population, constantly reinforced by emigrants from every quarter of the globe, it is not surprising that every variety of superstition should from time to time be thrown into, and rise as scum from, the cosmopolitan crucible out of which the average American citizen proceeds. It is not surprising either that keen-witted

and unscrupulous people—too many of them to the manor born—should take advantage of the credulity of the undeveloped citizen, to their own gain and their victim's detriment. Such is the natural consequence of the mixture of diverse grades of civilization. All we claim is that, with time and widening experience, the over-credulous have their wits sharpened and their eyes opened; and if it were not for the constant accession of raw material to be imposed upon, humbugs would die a natural death, even in this favored land of humbugs.

Dr. Schnauss's illustration of American iniquity (so-called) is a case in point. He charges us with the invention of "spirit photography;" then serenely proceeds to demonstrate that his own countryman, Baron Reichenbach—aided and abetted by "a large number of scientific men"—produced the first spirit photographs, in the capital of German intellect, Berlin. What is even more amusing, our learned Doctor goes on to state, as a demonstrated fact, that "several bodies appear luminous to people after their eyes have been accustomed to darkness, as for instance large steel magnets and big crystals; water shaken up in a bottle will emit phosphorescence, and luminous waves may at times be seen coming from the fingers, sometimes greenish, sometimes reddish, according to the side of the body."

We have been laboring under the impression that these pretended appearances were in reality all in the observer's eye—illusions, in fact, the "sensitive" witness seeing simply what he looked for: a position supported by not a few experiments, wherein the doubly deceived observer was led to see what from his own theory could not exist—"magnetic" flashes, for instance, proceeding from a wooden magnet (?) deceptively painted. But to Dr. Schnauss they are actual verities, as he has "seen similar luminous phenomena in the persons of somnambulists." He has gone further, and repeated, "with great care and attention," the photographic experiments of the father of spirit photography, on the strength of which he renders the verdict that the luminous emanating from one's fingers' ends, etc., as seen by very sensitive persons, is not, as Reichenbach supposed, identical with solar rays!

If the Doctor is a fair specimen of his country's intellectual productions, we may at once abandon all hope of eliminating humbug, so long as emigration continues. Supply always follows demand. But we will give our censor credit for one thing: he has learned, though tardily, what was shown long ago in the SCIENTIFIC AMERICAN, that a genuine "spirit photograph" may easily be obtained, provided the precaution be taken to sketch the required ghost upon the back ground with some colorless fluorescent material, as, for example, a solution of sulphate of quinine. Though invisible to the eye, such a sketch will appear in the picture, as perfect a ghost as the most credulous could wish to see.

ONE OF MR. EDISON'S CURIOUS EXPERIMENTS.

If the dark box (illustrated in SCIENTIFIC AMERICAN of December 25, 1875) provided with two carbon points be brought within a short distance of any of the working telegraph sounders, used at the Western Union Telegraph Office, Dey street and Broadway, the sparks, heretofore described by Mr. Edison, he states, at once make their appearance between the points. The flashes thus produced correspond with the opening and closing of the circuit of the magnet, and thus the signal or message that is passing through the instrument is reproduced in the form of light, within the Edison box. No connection of the carbon points by wires with the telegraph instrument is necessary. Simply bringing the box near to the instrument is sufficient.

WHO INVENTED THE BARREL?

Few inventions have had a wider or more varied usefulness than the barrel; few give such promise of perpetuity. Unique in principle, simple yet singularly perfect in plan and structure, the barrel is little less than a stroke of genius. Who set up the first one? Who first conceived the happy thought of making a vessel tight and strong out of strips of wood bound together with hoops? And when did he live?

No history of inventions, none of the encyclopedias in our great libraries, no historian of human progress, so far as we know, gives any information on the subject, unless we except the Roman author Pliny, who mistakenly attributes the invention to the Gauls who inhabited the banks of the Po. We say mistakenly, since there is the best of good reason for believing that the barrel was in use long before the Gauls took possession of their Italian home, perhaps long before the Gauls existed as a people.

The monuments of Egypt furnish proof of the early use of hooped vessels, though no date is given of their invention. In one of the inscriptions copied by Wilkinson may be seen two slaves emptying grain from a wooden vessel made with hoops, while a scribe keeps tally, and a sweeper stands by with a broom to sweep up the scattered kernels. Close by an unfortunate is undergoing punishment by bastinado, for short measure perhaps, or, as Mr. Wilkinson suggests, for petty theft. The measure is barrel-shaped, and precisely like the *kayl* of modern Egypt. It would hold, apparently, about a peck. Unfortunately the age of this inscription is not indicated. Measures of the sort would seem to have been in common use very early in Egypt, though not for the storing of liquids, for which purpose skins and earthen vessels were employed.

At first thought, Egypt would be the last place to look for the invention of hooped vessels, its arid climate making it specially unsuited for their employment. Possibly, however, that may have been the compelling cause of their invention.

Throughout the East, the bamboo is largely used for making

hollow vessels, a section of the stem through a node securing a solid bottom, and one between the nodes an open mouth for a natural tub or bucket. In well wooded regions, nothing would be more natural than the employment of hollow tree trunks for the same purpose, or sections of tree stems, hollowed out by fire or otherwise. In drying, such vessels would split and spoil, and it would require no great genius to repair them by means of withes or wooden bands, the primitive form of the hoop.

If the users of such natural barrels should migrate to a region where timber was scarce, economy of lumber would be likely to suggest the building of barrels from pieces artificially split, in short, the use of staves, by means of which the primitive cooper would be able to make several barrels out of a block that would suffice but for a single dug-out.

But this is speculation merely. It is enough to know for a certainty that the cooper's art, like the potter's, is one of extreme antiquity. We had no suspicion of its venerableness when we began to trace its history in response to the inquiry—who made the first barrel?

LOWER CALIFORNIA.

Peninsular California has had the name of being about as worthless a strip of land as the Continent affords—rocky, sunburnt, and barren. Its inhospitable mountains, however, appear to be well stocked with precious minerals, and its shores are not without the elements of fertility for other lands, even if themselves are infertile. The United States steamer Narragansett has been making a survey of the coast, the reports of which show that the mineral wealth of the country is wonderful, embracing rich deposits of silver, gold, iron, copper, antimony, alabaster, and salt. At Triunfo a silver-mining company is producing bullion to the amount of \$50,000 a month. The mines are very rich. At Purgatoria and Providencia copper mines are being actively worked, and are yielding large quantities of rich ore, which is brought to the seashore on pack mules to be shipped to San Francisco and Europe. At the island of San Marcos, there is a rich mine of alabaster, capable of yielding an immense profit if properly worked. At Carmen Island is a salt deposit a mile and a half long and a half a mile wide, depth unknown. The salt is pure and beautifully crystallized. It lies in a natural evaporating pan some 400 yards from the sea, with which it is connected by underground passages. Another source of wealth is the guano islands, especially Isla Raza, from which 10,000 tons of the fertilizer have been taken. It is computed that as much as 60,000 tons more lie upon a strip of shore three quarters of a mile long and half a mile wide. The Gulf of California abounds in whales, sharks, swordfish, saw fish, skates, porpoises, seals, turtles, and small fish in great variety. The presence of fossil shells of existing species, at an elevation of 1,000 feet or more above the present sea level, indicates that at a geologically recent period the peninsula was an archipelago, the high mountainous land at the southern extremity forming a single large island.

A California paper reports the recent arrival in San Francisco of the first successful shipment of canned turtles from Guaymas. The turtles of the Gulf are very abundant, and are equal in flavor to the best West India turtles; but they suffer on the voyage so that they cannot be brought alive to the California market. By canning them, it is found possible to place their much appreciated meat, in excellent condition, within the reach of all at moderate prices. Guaymas alone can furnish 200 tons of the meat annually. The turtles weigh from 25 to 250 lbs., but they will not average more than 15 lbs. of meat, so great is the proportion of refuse. It is expected that canned lobsters, cuttlefish, rock cod, and other delicacies from the Gulf will soon be added to the food resources of the Pacific coast.

RAPID BRIDGE BUILDING.

On the 20th day of November last, the Market street bridge, over the Schuylkill river at Philadelphia, was, with the exception of its piers and abutments, destroyed by fire. The loss was a very serious one, as the bridge formed the principal connection between West Philadelphia and the city proper, while over it passed the tracks and large traffic of the Pennsylvania railroad. It was, besides, the most direct route to the Centennial grounds. So urgent was deemed the necessity of replacing the structure that, before the flames were fairly quelled, the mayor's proclamation was issued, and consultations of city authorities and engineers speedily began. Before these deliberations, however, had resulted in any definite project, President Thomas A. Scott presented himself at the mayor's office, with an offer to build a strong bridge with double the capacity of the one destroyed, to cost \$65,000, or \$10,000 less than the insurance on the latter. Furthermore, he would sell the structure to the city for exact cost, and have it ready for traffic by January 1, 1876.

Mr. Scott had anticipated the acceptance of his offer, and had already sent out orders to cut the timber, at various points along his road, and load it on cars. When the formal acceptance came, further commands flashed over the telegraph wires, and down came the loaded cars, attached to the lightning express trains. One hundred and fifty men stood ready on the banks of the river, tools in hand, and at the word given, on the evening of December 5, the attack on the charred remains of the old bridge began. From that moment work was unceasing; one gang of men relieved another, and torches and calcium lights gave illumination all night. Sundays and stormy days were unnoticed, and thus the labor continued, until, at one o'clock on the afternoon of December 24—three hours less than twenty-one days from the time the mayor signed the ordinance, and seven days ahead of time—the bridge was finished and formally opened to travel.

The structure—though of course but a temporary one, since it is designed at some future time to replace it by one of iron or stone—is solid and massive, and good for five or six years of constant wear. In fact, it would last indefinitely with proper repairing and replacement of timber from time to time. It has a Howe truss, and is constructed of white pine, with an oak flooring. It is 540 feet in length, the two end spans measuring 162 feet each, and the center span 216 feet. The truss is 26 feet high in the clear, and 28 feet from out to out. The width of the bridge is 48 feet including the sidewalk, which is 10 feet wide. The new structure is said to be superior to the old one. The proceeding is an example of what energy and discipline can accomplish.

WATER IN THE PIPES.

At this season of the year, and especially during cold snaps, the gas has a habit of misbehaving itself in an annoying and, to most people, incomprehensible manner. At night, and just as *paterfamilias* is about to retire, he is startled by an ominous drip, drip, apparently in the floor, sounding exactly like the escape of water from a burst pipe. With visions of soaked carpets and ruined ceilings running across his mind, he makes his way to the story beneath, with the expectation of sadly looking upon a gradually growing dark stain in the middle of the plastering. None is there, however, and he tries another room with the same result; then he goes to the kitchen and shuts off the water from the upper stories, but still the dripping sound continues. Finally, in the course of a critical inspection of the wash basins, he lights the gas in an unoccupied room, and at once the flame proceeds to execute a series of astonishing leaps and jumps. Of course, he establishes a connection in his mind between the sound in the floor and the performance of the gas flame, and thereupon, with a sigh of relief that it is only the gas, bears the less evil resignedly, out of thankfulness for the absence of a possible greater one.

Next time the trouble happens, it may occur in the parlor and ruin a projected entertainment; or in the midst of a dinner company the gas may suddenly proceed to dance and then obstinately go out, either of which proceedings will result in the discomforted host employing a plumber early the next morning. That worthy will arrive at his leisure, of course, with a helper and a couple of small boys and some candles, and with the aid of an air pump proceed to force some water out of the pipes, and thereupon send in a huge bill. In about a month, or after a few more very cold days, the gas will repeat the performance, and the plumber will find another golden opportunity, and this will be continued at intervals through the winter.

If the luckless householder venture to ask the plumber what the trouble is, "water in the pipes" will be all the information vouchsafed, and the questioner will be none the wiser as to how it got there or how it is to be kept out, other than by employing the man of lead and solder and his several attendants, which is exactly that individual's object. But we will tell you, reader, what the cause is, and how to avoid it. The true sources of the difficulty are gas traps, which are low points or depressions in the pipes, due to the latter being carelessly put in. During moderate weather, when there is no condensation of the gas, and hence no formation of water, these give no trouble; but when water does form, it of course settles in these depressions, and either shuts off the gas altogether at points beyond, or else allows the gas to pass fitfully, producing the jumping of the flame. It is obvious that forcing the water out is only a temporary remedy; and that the only proper mode of getting rid of the difficulty is either to take out the pipe and put it in straight, or else tap it at the depression and add a drip large enough to hold a pint of water. A foot of two inch gas pipe makes a drip which will rarely or never fill up, and which answers excellently for the purpose. It is often found that chandeliers fill up with water during cold weather, owing to the parlor drop being led directly from the main pipe, thus drawing into the chandelier the water which otherwise would run down the rising main to the meter. The proper plan is to cross over from the main pipe, no matter how short the distance, and then add the drop.

If occupants of city houses will bear the above in mind, and see that the plumbers strike at the root of the evil as we have pointed it out, they will save themselves sundry annoying bills, and no small amount of inconvenience.

The Localities of Malaria in the City.

The Health Board is endeavoring to ascertain the different localities on the built-up portion of this city subject to strictly malaria troubles. Not only is this inquiry to be confined to intermittent and remittent fevers, but to all the obscurer diseases in which the element of periodicity is sufficiently well marked to cause suspicion. A map of the city is sent to each physician, with the request that he will indicate the precise situation of each case of the sort which he may be called upon to treat, and transmit in due time the results of his labors. This is matter of the greatest possible importance in connection with the true sanitary interests of the city; and it is to be hoped that every medical man will do his utmost to second the endeavors of the Board and offer to it any suggestions which may tend to promote the end in view. It is by the accumulation of such reports that a scientific basis can be made for an accurate estimate of the means which may be necessary to remedy the evil.—*New York Medical Record*.

THE band saw of Messrs. Emerson, Ford, & Co., of Beaver Falls, Pa., took the \$100 gold prize at Cincinnati this fall. It was used on a J. A. Fay & Co. re-sawing machine, and distanced two French hand saws in the competition.

IMPROVEMENTS IN THE MANUFACTURE OF COKE.

The production of iron of a quality and at a price that will meet the wants of the consumer, and at the same time yield a profit to the manufacturer during periods of depression in the market, truthfully says *Sauvage's Coal Trade Journal*, requires that every step be well taken with a view that no labor be needlessly employed; that all material entering into its composition be carefully selected, and cleansed of all foreign matter before it is put into the tunnel head. It is a fact too often overlooked that, to make a good iron, pure fuel is an absolute necessity.

Bituminous coal is frequently found so mixed with sulphur, slate, and other impurities that, despite immense deposits in the immediate vicinity of points where fuel is required, its use is abandoned owing to its being unfit for the blast furnace.

In the annexed engraving are represented some new coke ovens which are said to have produced coke from coal when all previous similar attempts had proved failures. They were recently built by McAnahan, Stone, & Bayley, of Hollidaysburgh, Pa., for the Cambria Iron Co.

These ovens are 36 inches wide, 7 feet high, and 23 feet long, and present the appearance of a succession of arcades closed at each end with iron doors. They are surrounded on the two sides and bottom with combustion chambers in which the volatile matter is burnt as it passes away from the coal that is being coked. The burning of this gas maintains a high and certain heat, sufficient to coke the coal.

Charging the ovens is done by means of hopper-filling cars that run on tracks on top of the ovens; each oven has two filling holes through which the coal contained in the cars is emptied. The discharge is effected by a powerful steam ram, shown in the illustration, which moves back and forth in front of the ovens on a three-rail track. On the end of a long rack is a head which fits the oven, which is pushed through the latter by powerful gearing, and expels the coke from the door at the opposite end. The coke being left on the cooling ground on the other side of the oven, the ram is withdrawn, the door closed, covers taken from the filling holes, and coal dropped in before the oven has had time to cool. The charge for an oven is 17,500 lbs. of coal, and in 72 hours this charge is coked, producing 13,125 lbs. of coke, which is a yield from the coal of 75 per cent; the cost of labor in coking a gross ton of coke in these ovens is 35 cents. Careful experiments made with coal from the same mine coked in pits, during the most favorable weather, showed that 59 per cent from the coal, at a cost of labor of 76 cents per ton of coke, was the best that could be done. The best result in the beehive oven was 61 per cent from the coal. Taking a whole year's work, both in beehive ovens and in pits upon the ground, the yield was about 50 per cent of coke in weight from the coal.

The coal in Jackson and Vinton counties, Ohio, although existing in such great quantities, has been considered unfit for iron smelting until very recently, and it is through the application of modern improvements in the way of crushing and washing the coal, then coking it, that the great and beneficial result has accrued.

Experiments recently had at the Vinton Furnace proved eminently satisfactory. The coal is crushed and bolted almost the same as flour would be, then washed thoroughly by streams of water playing upon it constantly while it is undergoing the crushing process, until all the impurities of sulphur and slate are extracted. It is now ready to be coked.

The ovens are improved Belgian, patented by McAnahan, and may consist of any number. At Vinton there were twenty-four, each three feet wide, seven feet high, and twenty-two feet in length, built of fire brick, with iron doors at each end; the charge is 180 bushels of crushed coal; it remains in 48 hours, and is then ready to draw.

The bottom and sides of each oven, as well as the tops, are solidly lined with fire bricks. All along, near the top of each oven, are small apertures through which the gas from the heated coal passes, and is carried down one side, and under the oven and up the other side, and is burnt in its passage, thus creating the heat which keeps the fire brick of the oven a bright red in all its parts. The ovens are filled from the top by means of hopper cars, which run on a track and dump coal into an aperture on each end of the oven; it is then raked level by hand through the doors, which are

afterward closed and sealed up with soft clay. There is a mica-covered opening in the doors, so that the combustion may be observed, and the proper time noted for drawing. These improvements must prove of value to the locality.

The cleaning and crushing process is described as follows: The car load of coal is emptied on a sloping iron screen with bars three inches apart; the coal that does not pass through this falls on to a level screen of iron bars, where it is pounded by hand power until it all passes through. Then it passes between iron cylinders driven by steam power, and is crushed until it will all pass through a $\frac{1}{8}$ inch screen. This crushed coal is elevated precisely like flour in a flouring mill, with small buckets or scoops on an endless belt. At the top, where the belt passes over a roller, the fine coal is poured from the little buckets into a great bolt, which

one, C, merely opening into the interior, the other, D, extending nearly to the bottom. To these tubes are connected sections of pipe, that on C having a suitable mouthpiece.

In operation the vessel, A, is placed in the tank until filled with water through the valve. The lips are then applied to the mouthpiece on the tube, C, and air blown in. The effect of this, pressing on the surface of the water in A, is to close the valve in the bottom, when the water rises through D, and is forced out through the pipe thereto attached. The invention is small, is easily sent by mail, and is especially adapted to the parlor fountains which we illustrated a year or so ago. It is manufactured by the American Fountain Company, 6 Cortlandt street, New York city, whither inquiries for further particulars may be addressed.

How to Treat Frosted Plants.

A writer in *Inter-Ocean* says: "The disastrous effects which tender plants, which have become frozen, are subject to is generally known to cultivators; but how or why freezing produces the effect it does upon plant life is not so easily ascertained; and all attempts, heretofore made by scientific men to solve the question, have been, at most, only partially successful. In practical experience it is found that the length of time, and the degree of cold to which plants are exposed, affect them in proportion to the duration and intensity of these conditions, and these point, therefore, to the speedy restoration of a suitable temperature as the best means of restoring plants that have unfortunately been exposed to frosts. But the thawing out should, in all cases, be moderately gradu-

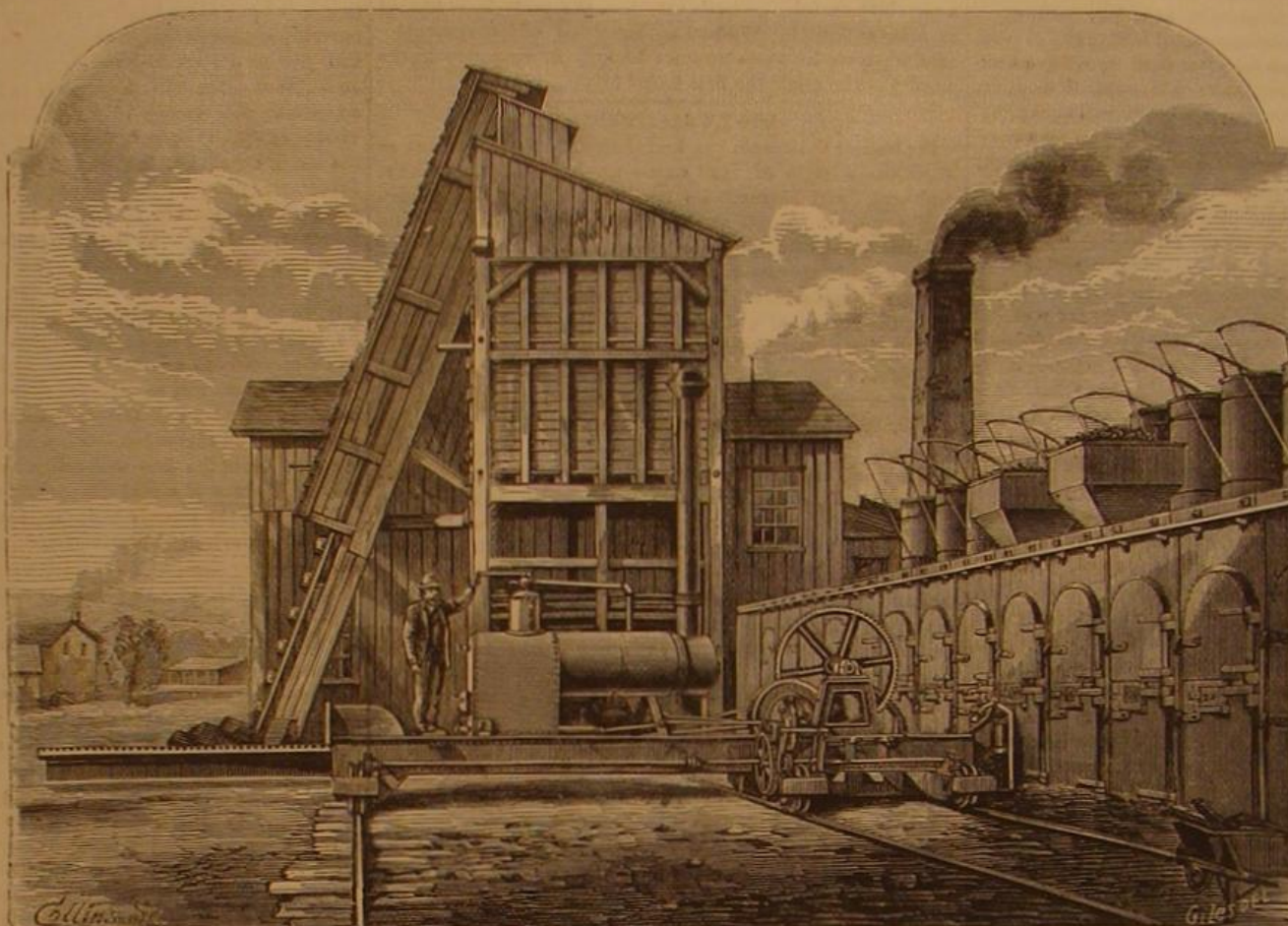
al; and one of the best things to do, when plants have become frozen, either in the dwelling, conservatory, or open air, is to sprinkle the foliage with cold cistern or well water, as the temperature turns to rise. In the dwelling or conservatory, however, it will be necessary to start the fire in the stove, furnace, or flue, the first thing of all, to give the temperature an ascendancy; but it should, for several hours, not be allowed to rise above an ordinary suitable degree. Some advocate shading the plants from the sun and light for some length of time, but the policy of so doing has never been apparent to me, while I have frequently had proofs to the contrary; and the sun's rays, striking upon the plants with gradually increasing heat, in a great measure aid in their recovery. There is a great difference in plants as regards their ability to resist cold; and while some by the slightest frost will be injured beyond cure, others will bear various degrees, and even alternate freezing and thawing again and again, with impunity. Avoid handling plants in a frozen condition as much as possible, as the injury to them will be heightened should the leaves become bent or be roughly brushed over. To restore flowers that have become frozen, place them in cold water until the leaves are thawed out."

A Good Suggestion.

An excellent proposition has been made, which, if it be carried into action, will greatly add to the permanent value of the Centennial. In each county, provision should be made for the delivery of an address on the Fourth of July, tracing the history of that particular community during the past century or from the time when it was settled, and including a sketch of its growth, industry, resources, prospects, etc. These addresses, bound in some uniform style, as, for instance, that of Congressional reports, might thereafter be bound together by the States, and thus become of invaluable historical importance. The proposition is an admirable one, and should be carried out.

Automatic Locomotive Whistle.

Mr. L. S. Ware, C. E., of Philadelphia, Pa., sends us diagrams and description of an automatic railway signal, designed to remedy the defective system now in use, which depends on the clearness of the atmosphere for its efficiency. It is the invention of M. Lartigue, electrician of the Chemin de Fer du Nord, of France, and of Mr. Forest, professor at the Ecole Centrale. It consists of a whistle on the locomotive, which is opened by an electro-magnet, the current being sent from a stationary battery, placed at some distance from the depot or junction which the signal is designed to protect. The device is conveniently and well arranged, but is not, we think, likely to supersede a simple lever on the engine operated by a lug near the rail, which device, we learn, has been tried successfully in England.



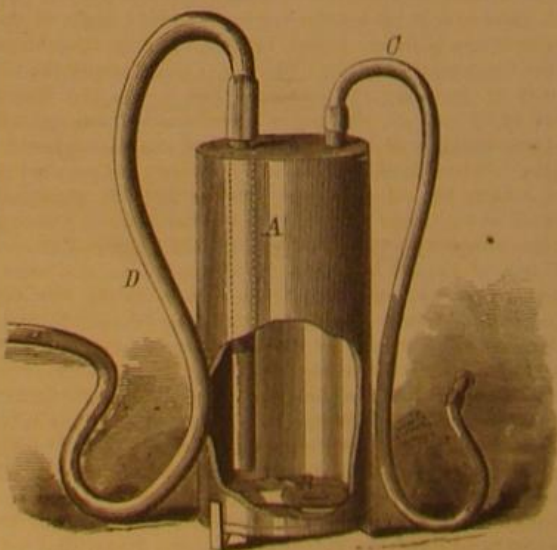
THE CAMBRIA IRON COMPANY'S COKE OVENS.

revolves precisely like a bolt in a flouring mill. Extending the whole length of this bolt, and directly over it, is a small water pipe, perforated with numerous small holes, through which streams of water fall upon the bolt.

The Cambria Iron Company has over 100 of these ovens in use at Hollidaysburgh and Johnstown, Pa., and the Rock Hill Iron Company employs 47 more. Patents for some improvements are now pending through the Scientific American Patent Agency, to Mr. McAnahan.

IMPROVED APPARATUS FOR EMPTYING AQUARIA.

It is not everybody that knows how to arrange a siphon for draining water out of aquaria or parlor fountains after the fish or vegetation therein have rendered the fluid foul, and to attempt to start the water running by sucking on the pipe after the siphon is placed in proper position, is often to receive an unpleasant mouthful. Emptying the water from the tank or globe, as out of a bucket, is impossible in an aquarium where there is loose rockwork, and in any event



it is a proceeding by no means calculated to improve the condition of the fish or the plants. A simple little device, however, has lately been invented which will perform the operation of removing the water very easily and surely. It is represented in the annexed engraving, and consists of a small vessel, A, in the bottom of which is a hinged valve, B, which opens inwards. Entering the top of the vessel are two tubes,

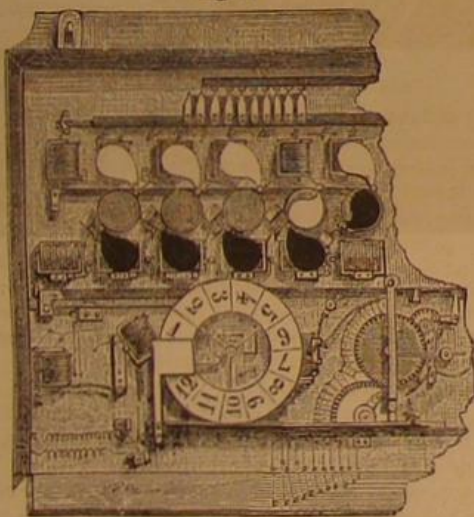
VOTING BY MACHINERY.

M. Martin, a noted French electrical engineer, whose numerous labors with regard to the electric light have resulted in his almost total blindness, has recently invented a curious apparatus for voting by machinery, the details and engravings of which we extract from *La Nature*.

The invention is intended to be used in legislative and similar assemblies, and it is so arranged that, on the question being put, each member has only to press a black or a white button in a box before him, according as he wishes to vote "no" or "yes." When one circle on a large indicator board appears of the corresponding color. The indicator is represented in our large engraving above each circle, on which places are prepared to receive the names of the voters. In case the member does not wish to vote, he presses both of his buttons, and the fact is noted by his circle appearing half black and half white.

The interior mechanism of the indicator board is represented in Fig. 2. The electro-magnets above the circles operate so as to throw down the white screens, while similar magnets below the circle raise the black screens. Another ingenious feature is that the machine may be caused to instantly record the number of votes cast on each side. For this purpose two wheels are provided, each numbered on its sides with figures, up to the total of members of the assembly. Each wheel turns before a window in the indicator, which is just large enough to show the necessary figure. A lever moved by a weight describes a semicircle when the presiding officer touches a button placed before him, the effect of the last operation being to break a current. The lever carries a copper contact which travels over a distributor, and establishes a current whenever it passes before a circuit corresponding to a vote given. This current is transmitted to an electro-magnet, on the right for the positive and on the left for a negative vote, and the effect of the

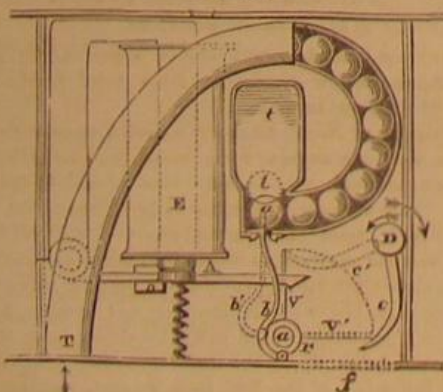
Fig. 2



magnet is to move the corresponding wheel as many figures ahead as the contact establishes circuits through the distributor. The result is shown at the windows marked 22 in the large illustration.

There is also an arrangement whereby a record of the votes is made on paper. The electro-magnets which move the screens at the same time cause points to project, and

Fig. 3.



these, through some mechanism of which our cotemporary fails to convey an intelligible idea, mark upon a sheet of paper when the latter is pressed behind them. The sheet is previously prepared with the names of the voters at proper places, so that from the nature of the mark it is instantly seen how the individual voted.

By another system, invented by MM. Clérac and Guichet, the whole assembly is enabled to see how the voting progresses, and each member can see, without leaving his seat, whether his vote has been received and registered. On

each side of the tribune is placed a large slab, divided into as many compartments as there are members. One of these slabs is for the affirmative votes, and the other for the negative. On each member's desk are two knobs, one in electrical connection with the compartment on each slab which belongs to that member's seat.

Fig. 3 represents the interior of one of these divisions or compartments. It is composed (1) of an electro-magnet, E, whose armature, A, holds back a small shutter, V, of a gau-

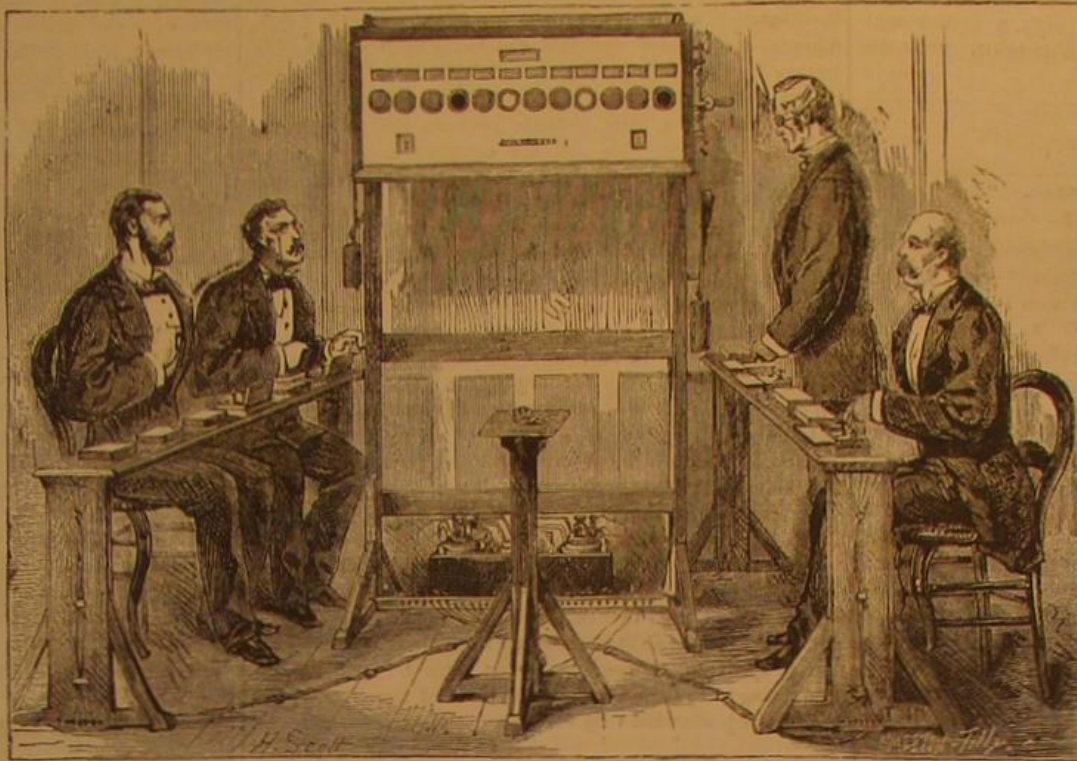
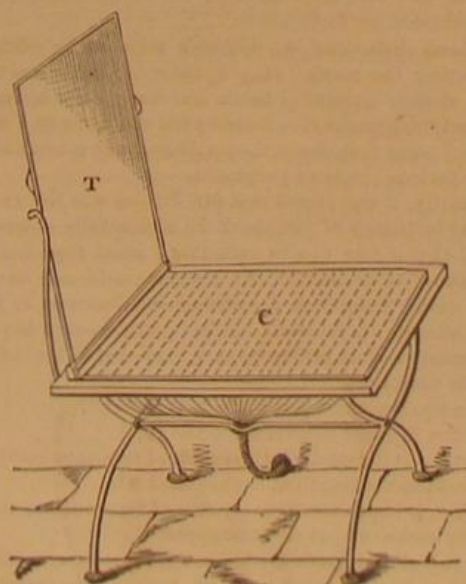


Fig. 1.—ELECTRIC APPARATUS FOR RECORDING VOTES.

dy color, and an arm, b, both fixed to and movable around the axis, a; (2) of an inclined tube, T, containing ivory balls, and whose lower end, t, pierced laterally, only allows one of these balls per vote to pass out; (3) of a cam, c, fitted into a shaft traversing all the compartments of the same vertical row; (4) a small window, f, looks toward the assembly.

When the member presses the knob—either "yea" or "nay"—before him at his desk, the electro-magnet attracts the armature, A, which releases the shutter, V, and which at once—by means of a spring, r—shuts down in front of the window, f, so as to become visible to the member voting. At the same time the arm, b, obeying the impulse of the spring, r, pushes out a ball from the tube, T, into a vertical receiver, t, whence it arrives into a receptacle for all the balls from its corresponding frame. These various duties are accomplished, comparatively speaking, simultaneously in the different parts of the two frames, so that the whole of the voting is declared to the assembly by the appearance of the closed shutters, at the same time that its total value is

Fig. 4



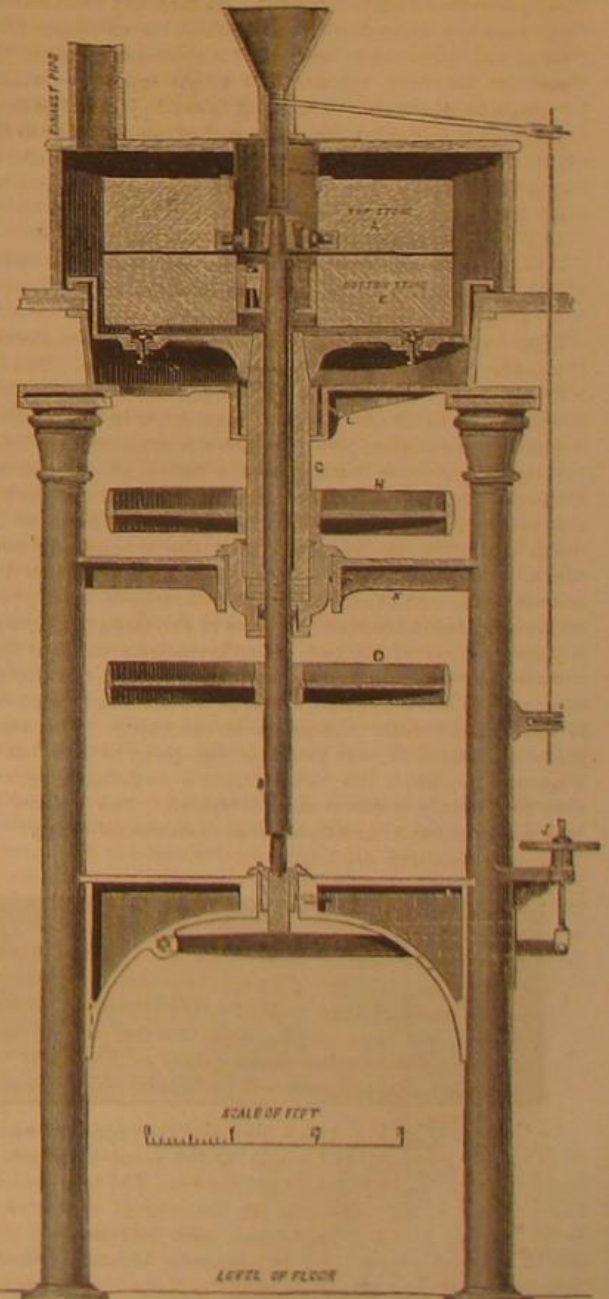
automatically declared by the final collecting tube graduated for the purpose. After the voting, the shutters and arms of all the compartments are restored by a single movement to their original position, by means of the vertical shafts, D, and the cams, c. The machine is then ready for a fresh vote. There are twenty ivory balls in the tube, T, which suffices for a sitting, and they are all exactly the same in size, and each bears either the name of a member or a number. When the numbering of the votes is accomplished, it merely suffices, after each ballot, to take away these balls and make up from them the list of voters. But the inventors have even done away with the necessity for this labor. The same electric current which has thus far worked the machine prints the name of the member and indicates the nature of his vote. Upon a metallic board, T, Fig. 4—prior to the voting—is a sheet of paper, sensitized by a salt easily decomposed by electricity (such as ferrocyanide of potassium); then this board is lowered upon a plate of hard caoutchouc, into which are embedded metallic pieces, each bearing the name

of a deputy engraved upon it. Just as on the two frames, each member has allotted to him in this plate two metal pieces, the one in iron and the other in copper, communicating respectively with his "for" and "against" voting knobs. At the same moment, therefore, that the electric current drops a ball in either frame, it decomposes the salt on the prepared paper, and prints the member's name in red or blue, according as he votes "yea" or "nay."

IMPROVED MILL.

We illustrate herewith a novel system of grinding wheat, which deserves a good deal of attention. Very little description is necessary. It will be seen that the bed stone, instead of being fixed as usual, is set in a kind of frame or saucer, supported on a tubular shaft, and that this bed stone revolves in one direction while the runner revolves in the opposite way. At the first glance it would appear that there is very little in this. The remarkable feature is that, from evidence placed before us, we are left no room to doubt that a single pair of stones thus fitted will grind as nearly as may be three times as much wheat in a given time as a pair of millstones worked in the ordinary way. The stones are driven by two belts, one open and the other crossed. The top stone, A, is carried by the spindle, B, and driven by the pulley, C, while the bottom stone, E, is driven by the pulley, H. The hand wheel, I, regulates the feed, while J is used for adjusting the stone or tempering the grist. K is the footstep for the hollow spindle, fitted with friction plates.

The stones are driven at about the usual velocity, say, 108 to 112 revolutions. Now, at first sight it would appear that precisely the same results would ensue if the top stone of an ordinary mill were driven at twice the usual velocity; but this conclusion would be erroneous. Any attempt to overdrive an ordinary mill makes



the flour too hot, and for this reason there is a certain normal velocity which cannot be exceeded. In the mill now under consideration, although the relative velocity of the two stone faces is just twice as great as the normal velocity, there is no overheating whatever. The mill runs quite cool, and as we have said, brings down about three times the ordinary quantity of flour. The result seems to be brought

for the purpose of sounding the storekeeper as to the feasibility of walking through the tunnel, and as to hard customers in particular. He did not "know about hard customers, but you cannot get through the tunnel today, for a large mass of rock fell last night, and the train cannot get through this morning." "But perhaps we can walk through?" "Well, you can try it, but I would not insure your safety." We tried it. Procuring a miner's lamp, which resembled a diminutive coffee pot, with a wick in its snout and a large fish hook for its handle, we were soon within the yawning portal,

"Leading to gloomy arches,
Where the June sun ne'er is seen."

and traversing the weird solitude of the Hoosac Tunnel.

A massive arch of stone masonry, of comely design, forms the westerly portal; brick and cement arching extends from this far beyond the reach of frost and daylight. A leisurely walk of about one hour (escaping several brief showers by dodging from the railway sleepers to the curbing of the central drain, and *vice versa*) brought us to the sound of workmen ahead. Up to this point, darkness and silence, save our own voices and feeble lamplight, had prevailed, the stillness being broken by the faint music of water trickling from above and flowing copiously along the central drain towards the westerly portal. Here we were saluted by two blasts some rods ahead, sharp and terrific, like claps of thunder, which made old Hoosac tremble. Lamps began to multiply, and the aspect ahead was soon changed from utter darkness to that of a section of an illuminated street on a dark night. The numerous lamps moving hither and thither, the glow of several forges in full blast, together with the ceaseless din of the hammers, anvils, drills, and trowels of one hundred and sixty workmen, rendered the scene and sensation at once novel, strange, and exciting. We soon came upon the mass of rock and debris which fell in the previous night, and which prevented the passing of the cars that morning. It was a huge pile, and would probably require the entire day for its removal, to allow the train to pass. In getting over this obstruction, my friend managed to blunder into the central drain; but as the water was but little above his knees, his agility saved him from much wetting and discomfort. The work now in hand here consists of dislodging a large amount of rock, pronounced unsafe by the judges, and filling up the recesses thus formed with brick and cement arch work. This job is chiefly west of the central shaft, and is swallowing up a vast amount of brick and cement. As we advanced, we soon passed the central shaft, which appeared to be nearly closed up with timber. The air soon became stationary: up to this point we had noticed a decided current from the west, but it gradually diminished, and what seemed to be a compound of smoke and fog now increased in density. The darkness and silence soon became profound.

One hour and twenty minutes more of this most strange experience found us nearing the easterly portal: here the smoke and fog were so dense that daylight could scarcely be discerned five rods before we emerged into the outer world. The easterly half of the tunnel is comparatively dry. Its arching is of Nature's own masonry, and the easterly portal is fringed with Nature's own handiwork, which apparently will stand till old Hoosac shall be riven.

Let the reader cast his eye upon some object five miles away, and then imagine an underground passage twenty-six feet in diameter from beneath his feet to that object, and he may have some conception of the extent of this vast excavation. Or let him take a piece of No. 16 wire (the size of a small knitting needle) five feet long, make it perfectly straight and level, then elevate its center about one eighth of an inch for the grade of the tunnel; then erect a piece of similar wire, three inches long, upon the center of the long one for the central shaft, and he will have a good model and a comprehensive idea of the proportions of this notable work.

Worcester, Mass.

F. G. WOODWARD.

Carbonic Acid as a Preventive of Decay.

To the Editor of the Scientific American:

In September, 1868, I had occasion to be at the Avondale mines shortly after the shafting and brake were destroyed by fire, causing over one hundred persons to be smothered to death, all means of escape being cut off. On the fourth day after the disaster, the bodies were reached and brought to the surface. On inspection, I noticed that they did not present the appearance of being dead. The looks on the faces were natural, and the skin soft and pliable and of a pinkish or flesh-tinted hue; the limbs were limber and movable. No blackness or discoloration was visible.

In trying to account for this condition, I was led to reflect as to what might be the cause which checked these bodies from decay; and I could only attribute the effect to the configuration, which made large quantities of carbonic acid gas: which, being heavier than air, filled the mine entirely, excluding the atmosphere and preventing its oxygen reaching the bodies: thus protecting the animal substances from change.

I afterwards tried by actual experiment if my idea was right, and I found, to my entire satisfaction, that if any animal or vegetable body was placed in an airtight vessel, and the atmospheric air excluded, its place being supplied by pure carbonic acid gas, it will keep without any sign of decay or change so long as it is kept hermetically closed. I have not the least doubt that, by the proper construction of large metallic vessels or tanks, made perfectly airtight, animal and vegetable bodies placed in such receptacles (all air being drawn out and pure carbonic acid gas forced into its place under pressure) could be transported to great distances

and kept for a long period without any loss by decay. By the use of said gas, I think, dead bodies could be kept in a properly constructed case, thus obviating the use of ice. Medical colleges could use it to keep subjects from putrefaction, and do away with the use of alcohol, thus lessening expense and giving better specimens for dissection.

Wilkesbarre, Pa.

C. W. S.

A Worm in a Horse's Corn.

To the Editor of the Scientific American:

I desire to give you a piece of my experience in horse-shoeing. Not long since, a horse was brought to me to be cured of a corn in the foot. In paring the corn, I found a worm about $\frac{1}{2}$ inch long, $\frac{1}{4}$ inch thick, and sharp at each end as a needle point. One end was black and the other white. The black end was next the sole of the foot and the white end in the flesh. After removing the worm, and burning with nitric acid, the corn was entirely removed, and the horse permanently cured of lameness, with which he had been troubled for some time.

D. O. W.

Carrollton, Ky.

The Cheapest Microscope.

To the Editor of the Scientific American:

Inclosed please find a simple little instrument of my invention, which, although of very insignificant appearance, is nevertheless, by the addition of a small drop of pure glycerin, converted into a wonderful little microscope of great power.

By means of the point of a fine needle, insert a small quantity of pure glycerin in each of the holes in the little strips



of brass; on withdrawing the needle, there will remain two perfect double convex lenses, one in each hole. Use one of the lenses as a receptacle for any minute object which you wish to examine; hold the instrument, with the other lens very near to the eye, between the thumb and finger, and adjust the focus by a gentle pressure.

Loda, Ill.

HORACE C. DEAN.

Boil it Down.

[It is not often that we print poetry, but the following verses contain such good advice, to writers for the press and others, that we transfer them to our columns for the benefit of our readers and ourselves.]

No editor likes to print very long articles; no reader likes to read them; and correspondents will do well to take the advice of our poet, and be brief. Condense and re-condense your copy; write with ink; state your inquiries briefly; communicate what you have to say without a prolix preface stating the great length of time you have been a subscriber, how greatly you prize the paper, etc., but come right to the point and state your wishes tersely. We are glad to receive suggestions, answer inquiries, and give written opinions on the patentability of any invention, and to publish correspondence on any subjects of interest which are appropriate to our paper.]

Whatever you may have to say, my friend,
Whether witty, or grave, or gay,
Condense it as much as ever you can;
Say it in the readiest way;
And whether you write of household affairs
Or particular things in town,
Just take a word of friendly advice:
Boil it down!

For if you go spluttering over a page,
When a couple of lines would do,
Your butter is spread so much, you see,
That the bread looks plainly through.
So when you have a story to tell,
And would like a little renown,
To make quite sure of your wish, my friend,
Boil it down.

When writing an article for the press,
Whether prose or verse, just try
To utter your thoughts in the fewest words,
And let them be crisp and dry:
And when it is finished, and you suppose
It is done exactly brown,
Just look it over once more, and then
Boil it down.

Liability of Palace Car Companies.

A case involving the liability of palace, drawing room, and sleeping car companies, was recently tested before a court in the State of New York. A passenger took a berth in a Pullman car from Detroit to Buffalo. Upon retiring, he placed his overcoat in a vacant berth over that in which he slept. In the morning the coat was missing, and diligent search failed to recover it. Evidently it had been stolen, and the passenger brought suit against the Pullman Palace Car Company to recover its value. The court held that the company was not liable. The judge who delivered the opinion said, among other things: "It is sought to charge the company with the responsibility of the innkeeper, upon the assumption that the law implied a contract or imposed a liability of the same nature; that responsibility was declared by the civil law to be as strict and severe as that of common carriers, and modern jurisprudence has adopted and applied the principle. But it went no farther, as is sought to be done in this case. He cannot lawfully refuse to receive guests to the extent of his reasonable accommodations, nor can he impose unreasonable terms upon them. The necessities of the traveler require these just rules to be adopted.

As a compensation for the responsibility thus incurred, he has a lien upon all the property of the guest at the inn for all his expenses there. There are no facts in this case justifying the application of such rules of law. The company could not be compelled to receive and entertain passengers, however amenable it might be upon its contract with the carrier, and had no lien for the price of accommodations. The traveler voluntarily, and not of necessity, availed himself of what was placed before him for his comfort, and he cannot cast the burden of care and diligence upon the defendant; neither is it right or just that the law should do so."

Decomposition of Products of Sewage.

Popoff has investigated the phenomena attending the spontaneous decomposition of a slimy mass taken from the mouth of a street sewer where it discharged into the river. It contained every possible sort of kitchen refuse, as well as other organic matter in an advanced stage of decay. It was of the consistency of pap, had a dirty gray appearance, and a reaction neutral or scarcely perceptibly alkaline, and emitted a peculiar odor. Flasks were filled with this matter, somewhat diluted, and the gas given off was examined at intervals of two to four days. One sample gave off the following amount of gases within 34 weeks:

	Carbonic acid.	Marsh gas.	Oxygen.	Nitrogen.
A	11.75	2.48	4.71	81.06
B	34.99	29.03	0	35.98
C	55.81	42.54	0	1.65
D	56.00	42.70	0	1.30
E	45.90	54.10	0	0.00
F	43.30	56.60	0	0.10

At first the enclosed air lost its oxygen, and there remained merely a mixture of carbonic acid and marsh gas (CH_4); at first the carbonic acid preponderated, afterwards the marsh gas.

The slime consisted of (in addition to some amorphous inorganic matter and numerous crystals of carbonates) cellulose and a large number of pigment bacteria, among which the red and yellow predominated; then the green and other forms of zoöglia. These organisms were already present in the decomposing mass in large quantities, and increased so prodigiously, by long continued putrefaction, that it was easy for the unaided eye to recognize them from the red and green colors. This very considerable increase of the bacteria, which kept pace with the production of carbonic acid and marsh gas, permits us to recognize the reciprocal relation. Careful observation of the temperature within a flask, as compared with the air outside, showed that the heat in the flask was always greater. At the beginning the difference was slight, from 0.36° to 0.72° Fah.; at the close of the second month, the difference had increased to 0.8° and 1.0° . This production of heat in the putrefying substance, which could be detected in spite of the heat continually rendered latent by the developed gases, makes this operation analogous to alcoholic fermentation.

As in fermentation, so too in the production of marsh gas, the temperature has an important effect. The evolution of marsh gas was observed at different temperatures, which remained constant during the experiment, from 42.8° to 164° Fah., and it was found that the production of marsh gas increased very strikingly with a rise of temperature. The greatest evolution of gas was observed at 128° Fah.; from 113° upward it decreased, and ceased entirely at 122° to 131° Fah. Masses of this slime, which had been heated for one or two hours up to 275° , 230° , 212° , 167° , 127.4° Fah., so as to kill the bacteria, evolved no gas at all. On the other hand, a mass which had been frozen was just as capable of fermentation after it was thawed out, as that which had not been frozen. The composition of the gases evolved at various temperatures only differed in this, that at higher temperatures the marsh gas very soon began to predominate over the carbonic acid, while at lower temperatures this required a longer time.

Another analogy between the evolution of marsh gas and other forms of fermentation is found in the circumstance that such substances as the cyanide of potassium, quinine, chloroform, carbolic acid, etc., which check fermentation, also check the production of marsh gas.

Further experiments prove that, in the decay of cellulose, marsh gas is the chief product formed. Hence it is clear why marsh gas appears in Nature in places where large quantities of vegetable remains, which consist chiefly of cellulose, are heaped up, as in swamps and bogs, on river banks, in coal mines, etc., where the decomposition of cellulose takes place on a large scale. In this way, too, may be explained the fact that marsh gas is often evolved in the alimentary canal of man and the higher orders of animals.

Pumping Water Directly into Mains.

We recently published a communication calling attention to the water works at Ross in England, which anticipate an essential part of the well known Holly system in use in many parts of this country. Mr. T. C. Lewis, of Portsmouth, Vt., now writes to say that a similar plan has been in use in Bellefonte, Pa., ever since the year 1815. The water, from the spring that turns the wheel to supply power for pumping, is forced into the mains and is there kept constantly under pressure.

Mr. J. A. Richardson, of New York city, says that Mr. Holly's patent disclaims the idea that there is any novelty in furnishing water in limited quantities for ordinary use by means of forcing pumps, or in the use of stationary pumps for extinguishing fires; but that the Holly invention consists in effecting these two objects by a single apparatus.

IMPROVED STILL COLUMN.

We illustrate herewith an improved column for refining stills, which is designed to take the place of the so-called French column, now in common use. The practical working of the invention is the same as that of the French column, but its mechanical construction, as will be seen from the following description, is entirely different, and it is claimed to possess many advantages. The apparatus may be located in one story of ten feet in height, instead of requiring three stories twenty five feet high, thus effecting a large saving in room and copper plates. Easy access may be had to the interior, for making repairs; leakage is prevented, and a finer spirit is produced with less steam pressure. The essential feature in the device is the arrangement of the chambers, which, instead of being placed vertically one above the other, are situated side by side, as shown in the engraving.

A is the common refining copper still, above which is located the column in which the chambers, B, are formed by semicircular horizontal plates, C, extending alternately from opposite sides, and by vertical partition plates, D, near the center. Between the partitions, D, small spaces are left in order to establish communication between the chambers. Overflow pipes, E, at both sides of the column connect the chambers of each series, and gradually convey the exhausted liquor back into the still, A. Near the bottom of each chamber is a drain pipe, F, provided with a suitable stopcock, which communicates with the overflow pipes so as to allow of the easy emptying of the chambers for cleansing, etc. The overflow pipe from the lowest chamber passes directly into the still.

The operation is as follows: After being filled with liquor the still is heated. The alcoholic vapors are quickly eliminated and pass over the first vertical partition, D, into the lowest chamber, striking against the adjoining partition plate of the next chamber above. The vapors are then forced through the liquor in the lowest chamber, and thence pass up from chamber to chamber, gathering additional strength from the contents of each, until they reach the goose condenser, G, where partial condensation occurs, and the vapors are returned to the uppermost chamber of the column. The strongest vapor passes over to the worm, and, being condensed to liquid form, is drawn off at the tail of the latter. The liquor falls from the highest chamber to the next below, and so on, until the bottom of the still is reached through the overflow pipe of the lower chamber being completely exhausted of alcohol.

It will be seen that the intercommunicating arrangement of the chambers virtually produce two columns in one. All the overflow pipes are at the outside, and thus are very easily repaired. The cost of the apparatus, the inventor states, is reduced to one half that of the French column, while the operation of the device, as he has proved by practical experience, is such as to produce quicker and better results.

Patented through the Scientific American Patent Agency, November 16, 1875. For further particulars address Mr. Edward Melchers, 103 Monroe street, Toledo, Ohio.

IMPROVED BARREL FAUCET BUSHING.

We illustrate herewith a new faucet bushing for beer or other barrels, which, while firmly holding a cork or stopper, allows of the same being pushed inward on the faucet being inserted, without any leakage. The exterior of the device shows a perfectly flat surface adapted for the reception of the tax stamp, which the introduction of the faucet necessarily tears and cancels.

The thimble, A, has a flange provided with suitable apertures, through which the securing screws may be inserted, and also an external screw thread which attaches it to the barrel. B is a plug fitted to close the inner end and to prevent the escape of the liquid during transportation. C is a tubular nut or second thimble, having both an internal and external screw thread, the latter permitting it to be attached to the internally threaded outer portion of the thimble, A, thus acting to prevent the cork from being forced outward. The internal screw thread gives a means of attachment of the faucet as shown. The nut, C, has a flange on its outer end, which is let into a countersink in the thimble, A, so that, when the parts are in place, a flat exterior surface is afforded.

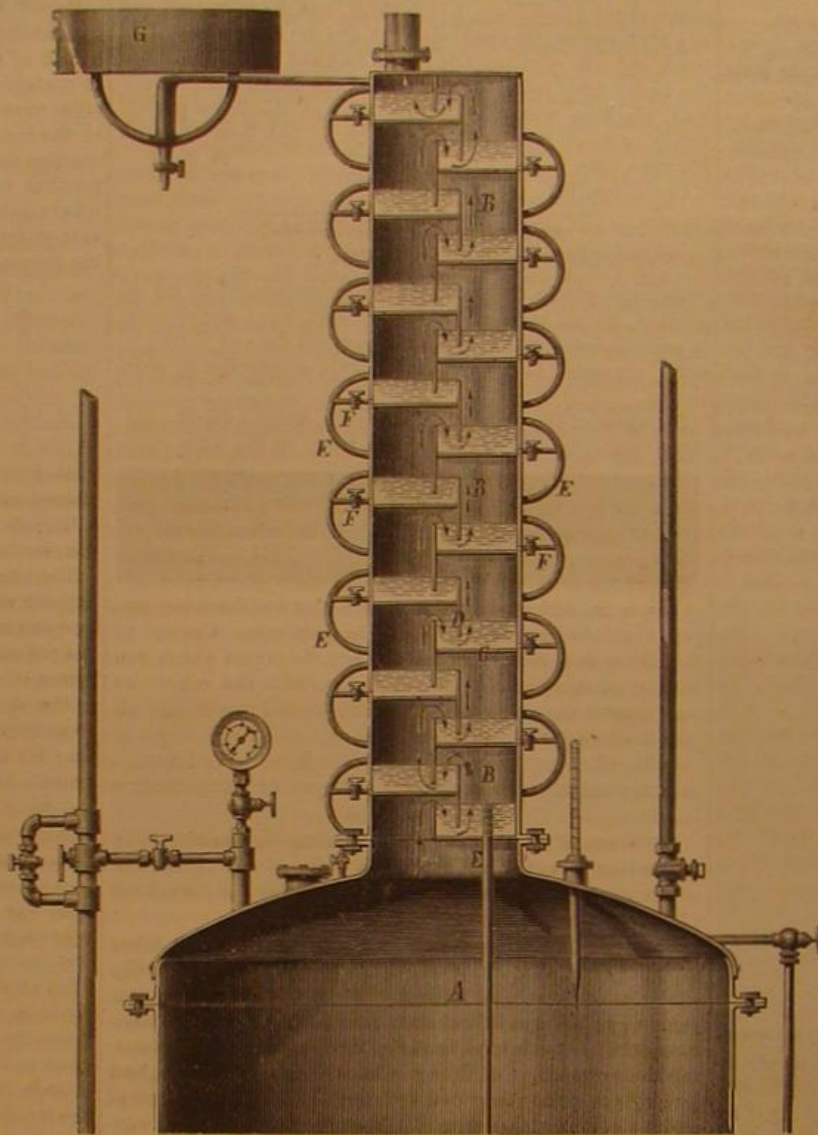
The entering faucet shank forces the plug, B, out of the bushing, and the liquid then escapes through the openings, at D, at the end of said shank. The lateral apertures also permit of the passage of the fluid, should the plug remain over the inner end of the bushing. The invention is claimed to fit more tightly and to be less expensive than the similar devices commonly employed. It will prove of much convenience to grocers, liquor dealers, apothecaries, and others.

Patented December 8, 1874. For further information ad-

dress the inventor, J. F. Mantey, Industry, Austin county, Texas.

A Hint to Young Mechanics.

Two things are uppermost in almost every industrious young man's mind, the desire to make and save money, and to be established in business for himself. Now as an encouragement to persevere in that industry, also in faithfulness, close attention to business, and also in improvement of the mind, we suggest that a few dollars placed at interest will grow in amount wonderfully fast, if the interest is also invested and a few dollars regularly added to it. The evenings usually spent in idle ways, if devoted to scientific,



DEYMANN AND MELCHERS STILL COLUMN.

practical books and papers, will, in a few years, make a young man educated and prepare him for directing an establishment of his own. Remember it is the most skillful, artistic, and finished workman that rises above his fellows. When you have mastered your trade and find your mind stored with useful hints and thoroughly scientific knowledge, then turn to a partnership or part interest in business with your employers. Your standing and the little capital saved will help you wonderfully. If such a part interest is not practicable, select another industrious co-laborer and commence in a one story, one roomed office, with a particular specialty of which you are thorough masters. Push to completion in perfect workmanship such small orders as you

while in this position.

The Woburn tanners tacked the sides on frames, and still continue that practice, as far as we are advised, but many other tanners merely suspend the sides over sticks, and agitate the liquor, either by rocking the sides on frames or plunging them into the liquor, by hand or other power. By either method the same result is reached. The side is plumped in shoulder and offal, and a smooth, round grain is formed, which takes a lasting impression. These qualities add so materially to the economic value of the stock in cutting, whether for shoe or bag purposes, that ordinary upper leather tannage is driven out of competition, and is now seldom used except when, as at present, oak rough tannages are held in excess, and are selling at a loss of three or four cents per pound.

There can be no doubt that boot grain, made from a depleted tannage, will crimp and possibly wear better than leather raised and tanned as above described; but when enough of the fiber is retained with the grain, as is the case where an eight or even a six ounce substance is retained, then it is very doubtful whether the old-fashioned tannage presents any advantages over the new. The case is, however, far different where these raised tannages are split down to a light grain or buff substance. In some of these goods, little more than the grain itself is retained, while the great bulk of the fiber is split off and goes into trunk and carriage leather. We need not dwell on this practice, nor insist on its damaging effect on the trade.

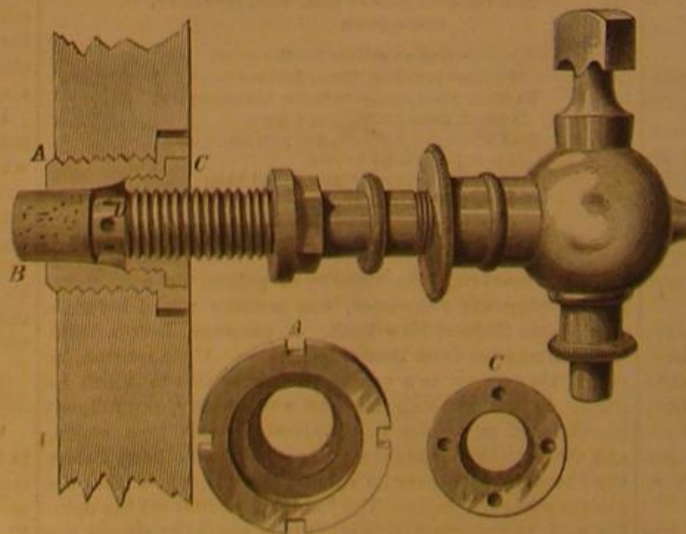
The custom of coloring and partially tanning on frames suspended in the liquor has improved of late the union crop tannages almost beyond conception. This improvement consists in plumping and making fine the bellies, shoulders, and pates. We assume similar advantages would result to the hemlock and oak rough leather tannages if thus carried on. There is no more difficult task than to find oak rough leather suitable for fine harness and bridle purposes, and much of this difficulty arises from this deficiency of plumpness and fineness in the shoulders and offal. If oak rough leather tanners will adopt our suggestion, and color and partially tan their stock in a suspended state, they will at once overcome this difficulty, and improve the durability as well as the appearance of their oak rough leather.—*Shoe and Leather Reporter*.

The Manufacture of Rough Leather.

There is no good reason why female hides should be purged of their gelatin, while those of the male are plumped by all the methods known to the tanner's art. The practical tanner may urge that the female hide is intended for upper, while that of the male is used for sole and belt leather, and (when used for these purposes) he may insist that it should be treated in the manner indicated. But this assumes a necessity which it is our purpose to dispute.

In all the countries of Southern Europe, the full grown cow hides are manufactured into sole leather; indeed, with the exception of the ox and steer hides brought from South America, the whole supply of sole leather in those countries comes from their cowhides, for they do not raise oxen, but use cows, both as beasts of burden and also to supply the food of the people. This fact shows that cowhides, when properly manufactured, may serve a very useful purpose for sole leather. Besides, it is conceded that cow hides do make a finer-textured leather than ox hides, and they are largely used in the manufacture of "union crop" leather, thus making a large proportion of the finest sole leather for women's and children's shoes. Until within a few years, a greater part of the finer grades of women's shoe leather was thus made from cow hides. When, therefore, female hides, either in France, Germany, or the United States, are used for sole leather purposes, the tanner finds no difficulty in suitably plumping them, and in making weights which approximate those made from steer or ox hides.

The practical and important economic problem, therefore, arises, whether our tanners are justified in purging and depleting these valuable pelts down to an upper leather substance, even conceding that such a process does make good tough stock. We say: No. We insist that such a tannage is wasteful, and should be abandoned. The boot and pebble grain leather manufacturers have adopted a system of expanding the fiber and plumping the substance, which overcomes, to a great extent, the waste here referred to. These manufacturers long since learned that they could not get a round, plump, firm, and fixed grain on a leather depleted in the bath, and tanned with weak, sour liquor. The grain and fiber were too soft and yielding to furnish a grain leather that would hold the impression made by the board or the die. This defect induced the Woburn tanners, long ago, to prepare leather specially for their grain and buff purposes. This special method was confined to that section of Massachusetts for several years, but has now extended to all manufacturers of this description of leather in the country. It consists in suspending the sides in liquor, and tanning them



MANTEY'S BARREL FAUCET BUSHING.

can persuade the public to extend to you. Remember that personal application, integrity, and industry will in a few years bring their reward. They always have and they always will.—*Mechanical Journal*.

A GOOD bronze for ball valves, and for pieces to be brazed is made of copper 87 parts, tin 12, antimony 1.

THE JAGUARS.

The jaguar (*Felis onca*) is the largest of the carnivora found on either of the American continents; and its size, strength, and ferocity are such that it is often called the South American tiger. It is found both in North and South America, generally between the tropics, and as far north as the Red River, La.; and the larger specimens are but little smaller than the average tiger of Asia. The height at the shoulder is frequently nearly three feet. The skin is beautifully marked with black circles enclosing grayish spots, on a ground color varying from light brown to ashy yellow; but the configuration of the marks varies widely on different specimens, and sometimes even on the same animal. Humboldt states that 2,000 jaguar skins are annually exported from Buenos Ayres, and they are much valued for their beauty.

The habitat of the jaguar is generally a thick forest, especially in the neighborhood of a river, as the animal swims well, and will catch fish for its meals when flesh is scarce. When driven by hunger, it does not hesitate to visit the abodes of man, and its strength enables it to kill and carry off a horse or a cow with ease. Its favorite mode of attack is to leap on the victim's back, and, by placing one paw on the head and the other on the muzzle, to suddenly break its neck. It, however, rarely attacks man, and then its hunger and ferocity are such as to make it terrible. It is very fond of turtles, and extracts the flesh from the shell with great skill.

A recent writer asserts that the variation of the marks on the skin of the jaguar is due to climatic influences, the species being found over territory ranging from 32° south latitude to 25° north, from the Argentine Republic to Texas. Like its Asiatic cousin the tiger, the jaguar cannot be tamed, long confinement, ample food, and kind treatment doing nothing to check its ferocity. It is therefore a constant source of alarm to the neighborhood where it lives, which alarm is not diminished by the fact that its predatory excursions are always made at night. It is exceedingly subtle, approaching its prey noiselessly, and walking behind bushes or other screens till near enough for action; it then makes some slight noise with its tail, which alarms the victim and seldom fails to induce him to move to find the cause of the disturbance. The jaguar then springs on the neck of the prey, tears the throat to pieces (or breaks the neck, as above described), and carries off some portion of the carcass; next day it will probably return for another meal, and this gives an opportunity of tracking the beast to his lair. But although the jaguars are numerous in the region which we have mentioned as their home, their sagacity enables them to keep well concealed and out of the range of the rifle.

The family group depicted in our illustration is now in

the Zoological Gardens, Cologne, Germany, and the specimens are of great beauty. Jaguars are also to be seen in the Zoological Gardens in London and in Amsterdam, and others were, and probably now are, in the Jardin des Plantes in Paris.

The Manufacture of Lubricating Oils.

The records of the Patent Office contain almost the only description of the improvements that have been made in the manufacture of lubricating oils. These records are inaccessible to the great majority of people, but they are of great value to any who are interested in the manufacture of oils, frequently containing suggestions that lead to other discoveries and to valuable improvements. We give below descriptions of two improvements in lubricants, which the *American Manufacturer*, of Pittsburgh, Pa., has compiled from the Patent Office records.

The first invention consists in a compound of residuum formed from the distillation of petroleum oil, Carolina tar, and petroleum, or any liquid fatty substance for producing a cheap and durable lubricating oil that will not gum in using. The function of this residuum is to give body and consistency to the compound. The Carolina tar contains an acid, and separates all granulous substances which are injurious to the lubricating qualities of the oil. The introduction of petroleum oil is to reduce the compound to a proper gravity.

To prepare the oil, take the following relative proportion of the above ingredients, the quantity of each being proportionately increased or diminished, according to the aggregate quantity of the compound desired: To about 1,600 gallons of the residuum, add about 150 gallons of Carolina tar, and boil them together in a tank with steam heat for about 6 hours; then turn off the heat and let it settle for 6 hours; then draw it off into another tank and add a sufficient quantity of petroleum or other liquid oils to reduce the mixture to a proper gravity for lubricating purposes. The proportion of Carolina tar to the above quantity of residuum may vary 20 gallons either way; but the relative quantities stated are found to best answer the purposes of manufacture.

The second invention consists in a lubricating compound made of mineral oil, plumbago, flowers of sulphur, and soapstone, to which may be added tallow, rock salt, and palm oil, in such a manner that the plumbago and soapstone act as vehicles to distribute the lubricating material, while the flowers of sulphur and the rock salt act particularly as coolers.

In carrying out this invention, mix the ingredients in the following proportions: Mineral oil, 4 lbs., 7 ozs.; plumbago, 10 ozs.; flowers of sulphur, 8 ozs.; soapstone, 4 lbs., 7 ozs. It will in some instances be found desirable to increase the body of such compound, and in such to have present a cool-

ing agent, and to provide for such, to employ, in connection with the aforesaid ingredients, tallow, palm oil, and rock salt, and under such conditions that good results are produced when the proportions are made: Mineral oil, 3 lbs., tallow, 2 lbs.; plumbago, 4 ozs.; rock salt, 4 ozs.; palm oil, 4 ozs.; flowers of sulphur, 2 ozs.; soapstone, 4 lbs., 2 ozs.

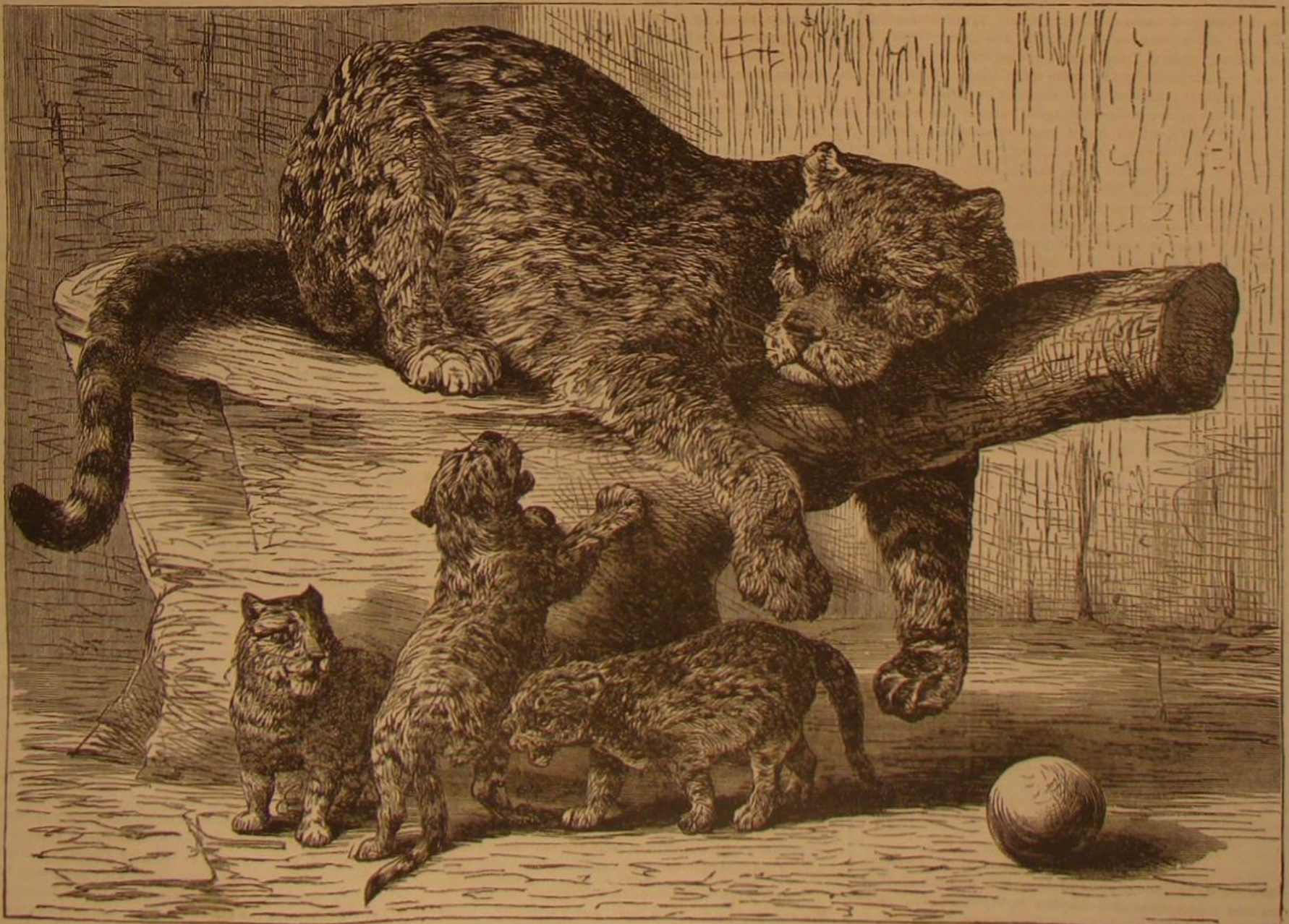
In mixing these ingredients together, heat the mineral oil slightly, and stir in the soapstone in a finely pulverized state; then add the plumbago, also pulverized, and finally the flowers of sulphur, stirring the mass until a homogeneous mixture is produced. If tallow, rock salt, and palm oil are used, melt the tallow; then add the mineral oil and palm oil, and, while this mixture is yet hot, stir in the remaining ingredients until a homogeneous mass is produced.

The object of the flowers of sulphur and of the rock salt is to keep the journals cool; and the soapstone and plumbago also have somewhat the same effect, while they are used particularly as vehicles to distribute the lubricating material uniformly over the journal, and to prevent the journal from coming in contact with the box.

Brave Boys.

At Rochester, N. Y. lately, says the *Democrat*, one Friday night a man threw a small dog into the river from the railroad bridge. Instead of passing over the falls, as was expected, the dog reached a large piece of ice close to the brink. He was seen there Saturday, Sunday, and Monday, but no one ventured to rescue him. An attempt was made to induce him to jump into the river by throwing stones at him, but it failed. The moaning of the dog, during the night, was painful to listen to. About noon on Tuesday, two small boys passed over the bridge, and, seeing the dog, determined to rescue him. Neither one of them would go alone, but each challenged the other to go with him. They started, walked through the cold water to where a single misstep would have sent them to their death below the falls, picked up the poor dog, and regained the bridge in safety, to receive the hearty compliments of those who had witnessed their daring adventure. The dog when rescued had been on the ice just above the brink of the falls for four days, and was so weak that he could not stand up. It would afford a great deal of satisfaction to many that witnessed the dog's misery to see the man who threw him into the river properly punished.

To SOLDER German silver, pour out some spirit of salt in an earthenware dish, and add a piece of zinc. Then scrape clean the edges to be soldered, and paint over with the spirit of salt. Apply a piece of pewter solder to the point and melt with the blowpipe.



FEMALE JAGUAR WITH HER YOUNG.

British Trade Mark Registration.

A new act of Parliament takes effect January 1, 1876. Its provisions, so far as they go, are good enough, but it is our duty, says *Iron*, to call the attention of our readers to the important fact that no very great space of time is afforded them for registering their trade marks. An office for registration is to be opened not later than January 1, and it is also enacted that no person shall be entitled to institute any proceedings for any infringement of a trade mark after the first of July next, unless such trade mark be registered. Six months, then, comprise the margin allowed for the registration of existing trade marks in the United Kingdom—no very long period when we consider the tardiness of our country in adopting a system long since recognised and enforced in others. There will be a great deal of work to be got through in the first six months of the ensuing year, but, with the experience of the Patent Office to guide them, the Commissioners of Patents have ample means for forming a system.

Readers of *Iron* will, of all people, the least need reminding of the importance of securing the legitimate trader in the enjoyment of the peculiar device by which he distinguishes his goods. To the public it is an indisputable advantage that cutlery or other goods should bear not only the name, but the mark of the maker, while the strict inviolability of his cognisance is to the latter of vital necessity. As the ancient craftsman hung out a sign over his shop to tell his business to the large majority of clients who could not read his name, so have modern manufacturers, whose goods are carried all over the world, among men of every color and language, adopted marks which speak a language equally comprehensible to the Tartar and the Guano. No stronger proof of the value of a symbol which has been impressed upon goods of special quality can be brought forward than the evil persistence with which the most celebrated trade marks of Sheffield were pirated in the days when commercial treaties as yet were not. The mere name of the maker, which might appear sufficient for every purpose to those who have not given much thought to the subject, practically affords the slenderest kind of protection. It would be impossible to restrain another maker of similar name from putting it upon goods made in imitation of those which have acquired world-wide renown, and a trick not unknown in local elections in the West of England—the finding of a man of straw bearing the same name as a popular favorite—would be easy of perpetration. In the case of the Messrs. Coats, a firm of the same name in the United States having imitated their wrappers, and thus seriously interfered with their trade, the courts stopped the imitation, but of course could not prevent the use of the name. This restriction, however, proved sufficient, as purchasers at once saw the difference in the wrappers, and the mere similarity of name did little harm. Glenfield starch, again, has often been inquired for as the starch “with a long chimney upon it,” and Asiatic customers exist who buy certain English goods by the trade mark alone. It is needless to multiply instances of the superior importance of the symbol to the name: suffice it to recall the fact that one special kind of knife, which had a great reputation in certain parts of South America, went completely out of fashion in consequence of the market being flooded with inferior German imitations bearing the same mark. The advantage of a distinctive sign has received ample recognition at the hands of those best qualified to appreciate its importance. A single firm has spent in a couple of years as much as \$15,000 in protecting their marks from infringement—a very practical test of the value they set upon them.

[We suppose we need not remind readers of the SCIENTIFIC AMERICAN that, under the American patent law, all trade marks, no matter how long they have been in use, may be patented, or, in other words, registered. Full information can be had at this office. No manufacturer should neglect to avail himself of this important protection.]

Preparation of Ebonite.

The use of ebonite, one of the newer preparations of india rubber, is constantly increasing, on account of its better applicability to many purposes in the arts than its near ally, vulcanite. The two substances are quite similar, being composed of india rubber and sulphur, with some preparation of gutta percha, shellac, asphalt, graphite, etc., although these latter are not essential. In vulcanite the amount of sulphur does not exceed 20 to 30 per cent, whereas in ebonite the percentage of sulphur may reach as high as 60. An increased temperature is also required for this preparation. The approved formula consists in mixing together 100 parts of rubber, 45 of sulphur, and 10 of gutta percha, with sufficient heat to facilitate the combination. In manufacture, a sufficient quantity of this mixture is placed in a mold, of a desired shape, and of such material as will not be affected by the sulphur contained in the mass. It is then exposed to heat of about 315° Fah. and a pressure of about 12 lbs. to the square inch, for two hours. This is done most readily by placing the mold in a steam pan, where the requisite pressure and temperature can easily be kept up. When cold, the ebonite is removed from the mold, and finished and polished in the usual manner.

The Dioptric Light.

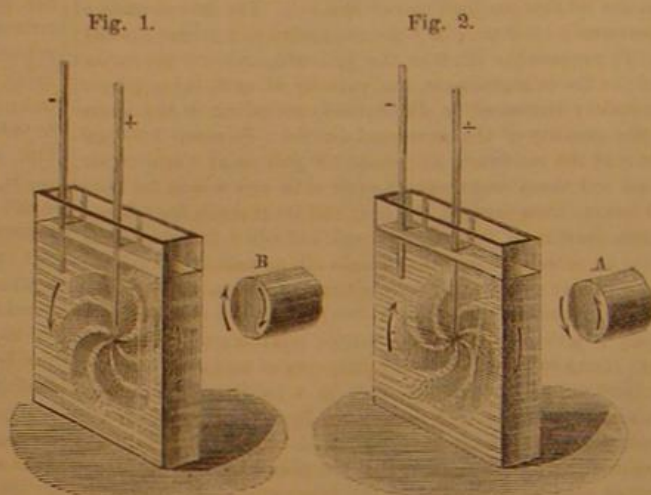
We published in our issue of December 4, 1875, an illustration and description of a dioptric light, the invention of Major-General Meigs. We have since received a number of communications relative to its being an old device. One is from Mr. W. C. Gayton, of Chicago, Ill., in which he claims that the spherical lens has been in use in England for more

than 30 years. It is much used by lace makers, he states, who require a strong light; and a single candle, if surrounded by a circle of these glass globes filled with clear water, will give light enough for four or five women at this work, which is very trying to the eyes.

C. G., of Upper St. Clair, Pa., states that another form of the device consists of a globe half filled with water and half with lard oil. This forms the lamp, and a globe of water is suspended at a little distance, so as to throw a clear light on the work.

THE NEW NEBULAR THEORY—POSSIBLE WORK FOR THE ASTRONOMERS.

In a recent issue we published a brief note calling attention to a recent experiment, made by a French scientist, in which a cloud of metallic particles, carried from an electrode by the electric current, assumes, in the midst of an enveloping liquid, a gyratory spiral movement, under the influence of a magnet. It will suffice to glance at the annexed engravings (taken from *La Nature*), which well represent this experiment, to recognize the forms of the spiral nebulae described by Lord Rosse, some of which have the curvature of their branches directed opposite to the course of the



bands of a watch, as shown in Fig. 1, as in the case of the nebula of *Coma Berenices*, etc., and others in the same direction, as is seen in the nebula of *Canes Venatici*. In view of this somewhat striking analogy, M. Gaston Planté's suggestion, that the nuclei of these nebulae may be constituted by electrical action, and that the spiral form may be determined by the presence of highly magnetic celestial bodies in the vicinity, seems not wholly improbable. The gyratory motion in opposite directions would then be explained, as the experiments show, by the nature of the pole of the magnet which happened to be turned toward each nebulous mass, as indicated by the positions of the arrows in the engravings, and the magnets, A and B.

If this view be accepted, the next step is to examine known stars in the vicinity of the nebulae, in order to determine which, by their position, are capable of exerting this magnetic influence, or to explore the heavens about the axes on which the spirals appear to revolve, in order to discover new bodies to which the same result may be attributed. Then, if a star be found satisfying the conditions, it will become necessary to search along the line passing through the centers of the nebula and the star, to find out whether there is, in relation to the other magnetic pole of the star, a second nebula, the spirals of which, turned in opposite direction to the magnetic currents of that pole, appear nevertheless to the observer as if rotating in the same direction as the first nebula. These three bodies would then constitute a symmetrical system, and the hypothesis that such might exist is not inadmissible in view of the vast profusion of cosmic matter distributed through stellar space.

Such researches as are above described would require the most powerful instruments; and if they should lead to the results indicated, decisive proof might be considered as deduced in favor of the electric origin of the heavenly bodies.

M. Planté, in answer to the objection which might be raised, that there does not appear in space any conducting medium leading an exterior electric current to the center of the nebulae, recalls other experiments made by him with powerful electrical sources. He states that he has observed small luminous rings, composed of incandescent particles, quite detached from the electrode. These rings, the interiors of which were agitated by liquid currents, moved in the space comprised between the electrode and a larger luminous ring formed about them by the impact of the electric wave against the sides of the voltmeter.

These rings, he considers, are true electrical nuclei, separated from the principal flow which generated them, and analogous to the nuclei of isolated stars or to stellar agglomerations, such as those which constitute the annular nebulae of *Lyra*, *Cygnus*, and the Milky Way. He adds the somewhat startling assumption that the large luminous ring, which forms the limit of the development of the electric wave in the voltmeter, might even reveal to us the existence of an immense annular nebula, which, though to us invisible, might envelope all others, and form the extreme wave of the general electrical movement of the Universe.

Mr. Lick's Mammoth Telescope Again.

We are pleased to learn from our California exchanges that, at a meeting held on December 7, of the Regents of the University of California, a communication was received from Mr. Lick, apprising them of his bequest of the sum of

seven hundred and fifty thousand dollars, to be expended under his direction in the construction of an astronomical observatory and the purchase and erection of the largest and best telescope that art and science can produce. The spot selected for the placing of this telescope is upon the summit of Mount Hamilton, in the county of Santa Clara. This mountain is some 1,400 feet higher than Mount Diablo, and is said to be free from fogs at all times of the year. The county of Santa Clara has charged itself with the building and maintenance of a good road to the summit; and the Regents of the University have made application for a section of the land, to be listed to the University, with a view of devoting it to the purposes for which it is designed by the generosity of Mr. Lick. It is estimated that the purchase and placing of the telescope and other scientific apparatus will cost about \$300,000, leaving a fund of \$450,000 for its maintenance and for instruction in this department of Science.

New Alloy for Iron.

BY PROFESSOR SERGIUS KERN.

Experiments proved that, by using chromeisen instead of spiegeleisen, extremely soft steel is obtained; rods made for experiments were very easily bent, even by hand. It is seen, from these attempts to replace spiegeleisen by chromeisen, that the use of the chrome iron alloys is limited, and the steel obtained is for most purposes too soft for the manufacture of such materials as rails, axles, tires, etc.

During some experiments with the chrome iron alloys, a strange phenomenon was observed. It is well known that chromium is extremely hard, and scratches even hardened steel; meanwhile an alloy was obtained which was malleable, and in a fresh state could be easily bent. It was also remarked that sometimes in opening the crucibles nothing but slag was found; but in breaking the crucibles, the alloy was found to be in the bottom of them. That may be attributed to the corrosive properties of the liquid alloy, which often penetrated even through the bottoms of plumbago crucibles.

The abovementioned alloy was analysed, and the following average composition was found:

Metallic iron, 96.40 per cent; metallic chromium, 2.30 per cent; carbon, traces; lime, silica, 1.30; total, 100.00.

By melting a mixture of cast iron, tin, and lead in the following proportions, a very liquid alloy is obtained:

Cast iron, 79.00 per cent; tin, 19.50 per cent; lead, 1.50; total, 100.00.

The alloy has a very handsome appearance, and fills perfectly well the casting molds; thus it could be used for casting small articles. The alloy is to some degree malleable.—*Chemical News*.

Something New in Boiler Flues.

The National Tube Works Company, of McKeesport, Pa., says the *Times*, are now manufacturing wrought iron lap-welded tubes in all sizes up to fifteen inches diameter, the larger of which are now being adopted on our steamboats for boiler flues, instead of the riveted flues, and the following steamers are now using them for this purpose: Steamer Vince Shinkle, two boilers, forty seven inches diameter and twenty-four feet long, ten lap-welded flues in each, of eight inches diameter; steamer Cons Miller, two boilers, forty-one inches diameter, twenty-four feet long, with six lap-welded flues in each of ten inches diameter; steamer Golden Rule, three boilers, forty-four inches diameter, twenty-six feet long, with three eight and three ten inch lap-welded flues in each. These tubes are giving perfect satisfaction, and the local inspector at Cincinnati says they have proven themselves all that could be desired. There are many advantages claimed for these tubes, as flues, among which we might mention the following: They are cylindrical in form, a point not claimed for the riveted flue, thereby lessening the chances of collapsing, if not absolutely preventing accidents of this kind. There are no rivet heads or laps to interfere with the draft, and consequently the flues are not liable to choke up with soot, are much less apt to scale, and, having a smooth unbroken surface, are of course much more easily cleaned, a fact that will be appreciated by the firemen. Another point claimed is that they are of uniform gage, having no rivets or laps, and must naturally require much less fuel, a fact that will undoubtedly receive due consideration.

Waterproof Tissues and Paper.

Les Mondes says that bichromate of potassa has the property of rendering glue and gelatin insoluble in water. Thus paper, and stuffs of cotton, linen, or silk, if once coated with this insoluble glue, become perfectly impervious. To render glue insoluble, it is sufficient to add, to the water in which it is dissolved, 1 part of bichromate to 50 parts of gelatin. The addition is only made at the moment when the liquid is to be used. The process is conducted in full daylight. The Japanese make their umbrellas with paper prepared in this manner.

The Brighton Express.

Brighton is fifty-three miles from London, and the railroad which connects these two cities is the famous one of the world for speed, for safety, and for the enormous wealth of its commuters. From fifty to sixty miles an hour is the rate of speed, and there are no stopping places. A billiard ball does not roll over the green cloth with more ease than this train moves. A correspondent of the *Evening Post* says: "I have seen the sea at Brighton, and fifty-three minutes afterwards I have seen the dome of St. Paul's through the fog of London. The tracks are kept in perfect order, and the cars are built of solid mahogany."

SCIENTIFIC AND PRACTICAL INFORMATION.

NEW INVESTIGATIONS IN MAGNETISM.

MM. Treves and Durassier have recently investigated the question of whether, and how, in a steel magnet, the known portable force varies when the weight and section are affected by the gradual dissolution of the magnet in an acid. The result is that the force is always proportional to the section and to the weight, so that a curve representing the variation of weight and section would be parallel to one indicating the diminution of intensity. As the dissolution progresses, the metal shows serrated inequalities perpendicular to the axis of the bar; and if a horseshoe magnet be treated, the curved part is found to dissolve incomparably quicker than the straight portions.

A NEW MODEL FOR SHIPS.

The circular ironclad lately constructed in Russia, and described in the SCIENTIFIC AMERICAN of August 7, 1875, may possibly lead to a radical change in the construction of sea vessels other than those for warlike purposes. A young officer of the Russian navy, attached to Admiral Popoff's staff, has constructed a saucer-shaped sailing yacht, 20 feet in diameter, which is described as extremely fast. The little craft is cutter-rigged, with an exceedingly high mast, and has great speed under canvas, in combination with an altogether unequalled power of staying and wearing. She is perfectly round, decked somewhat after the fashion of a Bermuda boat, and, having great stability, can carry, almost without inclination, all the canvas which it is possible to spread upon her. Strange to say, she is extremely handy as well as fast. Such, at least, is the account given of her in the London Times by Mr. E. J. Reed.

OXYCHLORIDE OF SULPHUR.

Paul Behrend, of Leipzig, has recently discovered a new and convenient method of preparing the oxychloride of sulphur, also known as sulphuryl chloride, SO_2Cl_2 . This was accomplished by taking sulphuryl oxychloride ($\text{SO}_2\text{HO}, \text{Cl}$), which is formed by the union of sulphuric anhydride with hydrochloric acid, and sealing it up in glass tubes which were heated for 12 or 14 hours to a temperature of 338° to 356° Fahr., in a paraffin bath. On distilling the contents of the tube, pure sulphuryl chloride was obtained.

METALLIC GALLIUM.

The new element gallium has recently been obtained in a pure metallic state by M. Lecq. Its brilliancy places it between platinum and silver. It was obtained by treating electrolytically the aqueous solution of its ammoniacal sulphate, and the very coherent deposit formed was subsequently burnished.

The Food Equivalent of Health.

General Sherman, in his chapter on the "Military Lessons of the American War," says: "To be strong, healthy, and capable of the largest measure of physical effort, the soldier needs about 3 lbs. gross of food per day, and the horse or mule about 20 lbs. An ordinary army wagon drawn by six mules may be counted on to carry 3,000 lbs. net, equal to the food of a full regiment for one day; but by driving along beef cattle, a commissary may safely count the contents of one wagon as sufficient for two days' food for a regiment of 1,000 men; and as a corps should have food on hand for twenty days ready for detachment, it should have 300 such wagons, as a provision train; and for forage, ammunition, clothing, and other necessary stores, it was found necessary to have 300 more wagons, or 600 wagons in all for a corps d'armée. Each regiment ought usually to have at least one wagon for convenience to distribute stores, and each company two pack mules, so that the regiment may always be certain of a meal on reaching camp without waiting for the larger trains." A curious calculation of a similar nature exists, made by Tempelhoff, a Prussian general, the historian of Frederick's wars: "100,000 men," he says, "consume daily 150,000 lbs. of flour, equal to 200,000 lbs. of bread. Bread and forage are seldom to be had in sufficient quantities on the spot—hence magazines are established along the line of operations. The bread wagons carry a supply for six days, the men for three more. In commissariat wagons, flour for nine additional days could be conveyed—one wagon to 100 men for nine days, thus 1,000 wagons supplied the army for that time. An operation of 18 days' duration could thus be conducted without an intervening magazine, but field ovens were required to make the flour into bread. But bread for three days requires two days to bake it; at the end of six days, therefore, a halt must be made to bake or else the ovens would fall behindhand with the supply; so that, in advancing into an enemy's country before magazines could be formed there, six days was the extent of march practicable without a halt."

A Strange Explosion in Boston.

A singular explosion occurred in South Boston on the evening of December 22. A large gas main, running under the Federal street bridge and along Federal street, exploded, tearing up the pavement, killing and wounding a number of people, and blowing others into the water. It is supposed that gas had escaped from a defective pipe until the ground had been saturated by an explosive mixture of gas and air. How it was fired is not known. The main pipe, about five inches in diameter, passes through under Federal street bridge, and along the causeway leading from it up Dorchester avenue, the continuation in South Boston of Federal street. This causeway is composed of three feet or more of dirt and gravel, with the pavement resting on a foundation of piling, and on either side, for 17 feet or more, is the river.

Eye witnesses state that a bright flash was first seen about the middle of the causeway, followed by a sharp explosion

and paving stones, gravel, and debris flying in all directions. Almost immediately the causeway on the right hand side fell over into the river, carrying over with it several persons. The number of these is not yet ascertained, but it is feared several were buried under the debris at the bottom of the river. The pavement was completely torn up for a distance of 175 feet from the wooden portion of the bridge to Crosby's warehouse, which was seriously shattered. Had the explosion occurred five minutes later the loss of life would have been far greater, as the draw of the bridge had been up for some time, and a crowd of 300 or 400 persons, on their way from the city to their homes in South Boston, had collected on this side, and in a few minutes would have swarmed upon the causeway.

Another Subterranean Explosion.

An explosion in one of the city culverts of Philadelphia, Pa., accompanied by the rupture of a gas main and the upheaval of inlet covers and the iron tops of manholes, coming soon after the fatal occurrence of a somewhat similar nature in Boston a few days ago, has led the Public Ledger of the former city to make some inquiry into the fact. It does not appear that the explosion came from any contact of inflammable gases with fire, as there is no account of any flames having been seen by anyone. A rupture of a small gas main seems to have been an incident of the violence, and not the cause of it. The damage appears to have been occasioned by confined air, compressed within the culvert by the backing up of the tide water of the river to such a degree as to break out through the inlets and manholes with great force. This is not an unusual occurrence, and not by any means so dangerous as the ignition and explosion of inflammable gas in a culvert would be.

The Value of the Scientific American.

S. S. B. says: "I believe that, since its first year (1848, I think) I have missed but one year's numbers of your journal. In the burning of my house, four years ago, I lost some 18 years of your paper, with many other valuable books; but none was so great a loss as the file of your paper. In 1854, I lent a volume of the paper to a friend of mine, who was erecting a factory. He told me that that volume of the SCIENTIFIC AMERICAN saved him about \$800 in the construction of a grist and saw mill."

D. L. R. says: "The SCIENTIFIC AMERICAN affords me more pleasure than anything else that I can find in the literary line. It is indeed a great storehouse for deep, interesting thought. Not a bit of room is wasted. As an American I am proud of it, and wish it all prosperity from ages on to ages."

F. McC. says: "I cannot refrain from saying a word for the SCIENTIFIC AMERICAN. As it is now conducted, it cannot be beaten as a scientific periodical. I make it a rule to always take my copy to the weekly meetings of our association, and never fail in finding something to read aloud to the members, with profit to them all. You are doing a world of good in sounding the Keely motor."

Rendering Wood Fire and Water Proof.

M. P. Folacci has devised a new mode of rendering wood waterproof and incombustible, which involves the use of the following composition: Sulphate of zinc 55 lbs.; American potash 22 lbs.; alum (ammonia base) 44 lbs.; oxide of manganese 22 lbs.; sulphuric acid at 60° , 22 lbs.; river water 55 lbs. The above ingredients, with the exception of the sulphuric acid, are mixed in a boiler, where the water is added at a temperature of 113° Fahr. As soon as solution is effected, the acid is gradually poured in. To prepare the wood, the timbers are placed in a suitable chamber, on gratings, and separated by spaces of about a quarter of an inch. The composition is then pumped in to fill completely the receptacle, and is maintained therein in a state of ebullition for three hours. The wood is then withdrawn, and dried in the air. According to the inventor, it becomes practically petrified, and the most intense flame only carbonizes the surface very slowly.

A Magnetic Island.

The volcanic rocks composing the foundation of the Isle St. Paul are ferruginous. Those on the north side of the crater, which result from the slips whereby all the east side of the mountain is laid bare, attract the two poles of a magnet, and contain 6 per cent of iron. Those met with around the cones of scoria situated at the foot of the exterior slopes of the crater, on the sea shore, are true magnets with two poles, containing 14 per cent of iron. The observations made for declination and inclination indicate the local action of a south pole toward the center of the crater, a fact which should warn navigators to guard against the magnetic influence of this island.—A. Cazin, in Comptes Rendus.

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

Round steel wire rope will bear more than double the weight required to break iron wire rope of similar diameter. The following is the London rule for gas pipe sizes: For 200 lights, 2 inch iron tube; 120 lights, $1\frac{1}{2}$ inch; 70 lights, $1\frac{1}{4}$ inch; 50 lights, 1 inch; 25 lights, $\frac{3}{4}$ inch; 13 lights, $\frac{1}{2}$ inch; 6 lights, $\frac{3}{8}$ inch; and 2 lights, $\frac{1}{4}$ inch.

Apply soapuds to a suspected leaky joint in the gas pipe. The formation of bubbles will show any escape. This is safer than trying the joint with a lighted match. If the leak occur in the branch of a bracket or chandelier, it is repaired by soldering with plumber's fine solder; if it be a very small one, heat the place first with a spirit lamp, and fill the aperture with cement.

The drive wells which are extensively used in the South and West are made as follows: A piece of $1\frac{1}{2}$ inches gas pipe is perforated with several hundred holes near the end, which is covered with a fine brass wire screen, and this in turn is protected by a covering of sheet zinc or iron also perforated. The extremity of the pipe is sharpened, or a steel point may be fixed. It is then driven into the ground, adding pieces on the top as it sinks in. As soon as the proper depth is reached, a pump is attached, and the result is an inexhaustible well, often giving an abundant supply of water in half an hour after the end of the pipe first entered the soil.

NEW BOOKS AND PUBLICATIONS.

THE ALDINE, a Fortnightly Journal devoted to the Fine Arts and Literature. Price 50 cents a number. New York city: The Aldine Company, 18 and 20 Vesey street.

This publication is of the rarest beauty in typography, engravings, and paper that we have ever seen. It was first published in 1869, and we have recently perused with great care all the numbers since issued, up to that for December, 1875; and it is with the greatest satisfaction that we attest the gradual improvement of the work, from the first number to the last issued, until now, when it has attained a higher standard of perfection than any illustrated journal on this continent. The superb engravings illustrate highly artistic subjects, some from Nature, and others from the paintings of our best American and the most celebrated foreign artists, all of which are executed by our best engravers. The Aldine is to be published twice a month in the coming year, and the publishers promise to give their readers engravings of historical events, appropriate to the Centennial year. We can add, in closing this notice, nothing that gives a more concise and truthful idea of this artistic publication than the words of our honored American poet, William Cullen Bryant. He says:

"In England and Italy we have the best printed books, and I think in England the best impressions of engravings made; but I have never seen anything comparable to the work of THE ALDINE: nothing so fine, the ink put upon the block in such just proportions, not too much, not too little. Impressed on the paper with the greatest care and dexterity; no blot, no blur, no blank—the slenderest, lightest and most delicate lines impressed with the greatest certainty, so that the impression represented the original engraving on the block as it left the hands of the artist, with as much fidelity as a mirror reproduces the lineaments of the human countenance."

HYDRAULIC MANUAL. PART I, consisting of Working Tables and Explanatory Text, intended as a Guide in Hydraulic Calculations and Field Operations. By Louis D'A. Jackson, A. I. C. E. London: W. H. Allen & Co., 13 Waterloo place, S. W.

This is the third edition of probably, to the hydraulic engineer, one of the most useful of professional treatises. It embodies a collection of working tables, based on the most improved modern principles and enough text to set forth both principles and formulae in a manner both clear and concise. The work has been prepared under the auspices and with the assistance of the English civil officials in India; and the second part of the book, now added, consists entirely of hydraulic and meteorological statistics, the former principally, the latter altogether, Indian. The present edition includes, besides the above, many new tables and considerable amplification of the text, and forms, as a whole, a valuable compendium both of the works of many of the best authorities on hydraulic engineering and of several valuable and hitherto unpublished manuscripts. D. Van Nostrand has the book for sale in New York city.

THE POPULAR HEALTH ALMANAC FOR 1876. New York city: E. Steiger, Frankfort street.

This is a laudable effort on the part of Mr. E. Steiger, the well known publisher and importer of German scientific and other works, of this city, to produce a popular calendar which will replace the well known yellow covered pamphlets which now serve the double purpose of almanacs and advertisements of quack medicines.

DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

PATENT BILLIARD TABLE.—LEVI DECKER vs. WILLIAM H. GRIFFITH & CO.,—LEVI DECKER vs. CHARLES SILVERBRANDT.

[In equity.—Before Blatchford, J.—Decision rendered November 5, 1875.] The patent sued on in these cases, being a release granted to the plaintiff, Levi Decker, March 9, 1869, on the surrender of the original patent granted to him December 18, 1866, for an "Improvement in Cushions for Billiard Tables," has been heretofore the subject of consideration by this court in the case of Decker vs. Grote (10 Blatchf., C. C. R., 331). The invention set forth in the specification of the patent has reference to a cushion formed of India rubber.

The claim in this case is for the catgut or other cord E, partially or fully embedded, or otherwise attached at the angle of the rubber cushion C, so as to protect said cushion against the impact of the ball, substantially as herein shown and described, and for the purposes set forth.

The manufacture and use of Winant, prior to the alleged date of invention by Decker of his device, of a strip of spring steel, or equivalent material, with holes in its lower edge, through which wires were passed and fastened to the under side of the rail, said strip being placed in a groove or groove cut in the upper face of the rubber near the angle thereof, and the manufacture by Stevens, prior to 1864, of India rubber cushions for billiard tables, having a French clock spring placed in a slot in the upper face of the rubber, parallel to and near the inner face of the rubber, bringing the upper edge of the spring near the upper corner of the rubber, are substantially the same arrangements of devices used by Decker.

Bill dismissed.

[W. H. J. A. Fuller, for the plaintiff.

Edward N. Dickerson, for defendants.]

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED ELECTRIC CABLE AND CONDUCTOR.

George W. F. Hoogeveen, Haarlem, Netherlands.—This inventor proposes a series of telegraph wires, which are covered with gutta percha, and sewn within a covering of sail cloth made perfectly impervious to moisture and other disturbing agencies, by being impregnated and coated with highly insulating material. The latter is a mixture of paraffin and glycerin, provided on the outside with a coat of coal tar and sulphur, and having on the inside a coat of rubber varnish and benzine.

IMPROVED SWINGING SHIP'S BERTH.

Edward P. S. Andrews, Lisbon, Mo.—This inventor, in order to prevent sea sickness, proposes berths pivoted to the cabin walls, and connected by separate and jointly-swinging governing end plates, of which one is applied to a swinging weight of corresponding size, to produce the level position of the berths. A pivoted hook lever of each berth may be attached to the corresponding end piece, to swing therewith and with the weight, or to a staple of the wall, to assume a fixed position at the wall. By this arrangement, the berths will always remain level; or any one of them may be fastened and held rigidly to the vessel, in accordance with the desire of the occupant.

IMPROVED CRACKER MACHINE.

Charles S. Fowler, Brooklyn, N. Y.—This invention has for its object to improve the construction of the class of machines that are used for cutting dough for crackers, cakes, etc., so as to enable them to be more readily adjusted and more thoroughly controlled than when made in the ordinary way. The arrangements are such as to allow the dough to shrink before reaching the cutters, so that the crackers or cakes will not be drawn out of shape by said shrinkage. The construction embodies many new and ingenious devices.

IMPROVED ENVELOPE OPENERS.

John La Blanc and Xavier St. Pierre, Ophir City, Utah Ter.—The device, which is attached to the end of a pencil, consists of a blade enclosed between guides of india rubber. The latter serves as an eraser, and, when acting as a guide for the blade, adapts itself to envelopes of different thicknesses.

IMPROVED METHOD OF CONCENTRATING TAILINGS FROM QUARTZ MILLS.

Francis E. Mills, Virginia City, Nev.—This invention consists in first causing the mingled sands, sulphurets, quicksilver, and water to flow through a wide and shallow sluice with small transverse slots, called riffles, cut through its bottom. Each riffle opens into a tank filled with standing water. In passing over these water riffles, the coarser and heavier sulphurets and globular quicksilver sink through the water spaces into the tank and are saved, while most of the sand and some of the exceedingly fine and light sulphurets and minute particles of floured quicksilver are carried on through the sluice by the current, which then flows into another sluice of reverse form. Here the sands gradually arrange themselves into different horizontal strata, according to the coarseness of the grains, the fine sulphurets, minute particles of quicksilver, etc., finding their way to the bottom of the sluice among the moving grains of the coarsest sand. Near the bottom of this deep narrow sluice, at the lower end, is inserted a very thin sheet of metal, which divides the running current horizontally, cutting off the lowest stratum of coarse sand, containing the fine sulphurets, etc., from the main body of the flowing sands above it without disturbing the current, so as to discharge the former into a separate vessel. The very fine sulphurets, etc., are separated by passing them through a fine screen.

IMPROVED MUSIC RACK FOR UPRIGHT PIANOFORTES.

Stephan Brambach, New York city.—This is a swinging desk or stand, arranged at the front of an upright pianoforte case, provided with a hinged base strip and extension legs for supporting jointly the music book and holding desk in inclined position.

IMPROVED PAPER BOX.

David K. Osbourn, Baltimore, Md.—This is a neatly shaped box, formed of a single piece of paper and provided with a rear extension, which serves as a cover and as a means of suspension. It also has suitable stiffening pieces within.

IMPROVED SLEEVE ADJUSTER.

Alfred Perrygo, New York city.—In order to hold the cuffs of a shirt away from the hands, while the latter are engaged, this inventor proposes a button-holed tab on the sleeve and a button on the shoulder of the garment. The cuff can thus be fastened up without first removing the coat.

IMPROVED DUMPING DEVICE FOR FILLING GRAVES.

John W. Varney, Crawfordsville, Ind.—This is a device for receiving the soil thrown up in digging graves and dumping it all at once into the grave to fill the same. It consists of a box provided with suitable doors, which stands beside the grave and is filled with earth as the same is excavated. When it is desired to replace the soil the box is tilted, when arms strike against latches which hold the doors, open the latter, and thus allow the earth to be discharged.

IMPROVED SIGN AND ORDER SLATE.

Joseph S. Gold, Washington C. H., Ohio.—This invention is designed for the convenience of professional men, but may be used by all who may find it a convenience; and it consists of a sign having on its back side a sliding slate, which slate is raised by means of a cord, and is covered, when down, by a self-acting lid.

IMPROVED TOBACCO DRYER.

Henry R. Farmer, Ringgold, Va.—This inventor proposes a heating apparatus for buildings, in which tobacco is stored in order to cure the tobacco by artificial heat radiated directly from pipes made to conduct the warmth about the lower part of the room from a furnace outside provided with regulating valves or gates. A valve or register, located directly over the hot air pipes, so tempers the heat at the entrance into the barn that the building is protected from burning.

IMPROVED WIRE FENCE STAPLE.

Homer S. Smythe, Aurora, Ill.—This invention relates to certain improvements in staples for wire fences, and it consists in a staple having a short prong and a long prong, the latter of which terminate at one end in a chisel point, and at the other in a beveled head, and is provided with barbed notches to hold it more securely in place.

IMPROVED CARTRIDGE BELT.

Major David Taylor, Paymaster U. S. A., Leavenworth, Kan.—This invention consists in arranging buttons on a soldier's cartridge belt between sections thereof, making slots near the ends, using clips of the same length as the cartridge or as the width of the belt, and in making the clip with a point and so constructed as to hold the cartridge with muzzle downwards. The first improvement allows a pistol holder or other attachment to be readily applied or detached, the second allows the buckles and clips to be fastened by reversing the end of the holding strap, the third gives a more stable and efficient support to the cartridge, and the fourth allows the clip to extend above and below the cartridge to give the former a greater bearing on the latter.

IMPROVED CARTRIDGE.

George Smith, Brooklyn, N. Y.—This is a strong paper or straw-board tube or shell, in which the charge is confined by a metallic wad at each end. The wad at the outermost end retains the charge without necessitating the folding-in of the outer end of the shell, and, by the explosion, its edges are expanded to such extent that it forces the shell out of the gun. The wad at the inner end is forced out of the shell and left in the gun, to be dropped out after firing.

IMPROVED RAILWAY TELEGRAPH.

Baylus Cade, Scott Depot, W. Va.—The object of this invention is to reduce the risks incident to life and property upon railway lines resulting from an ignorance on the part of the train men of the condition of the road and the position of other trains thereupon. The invention has in view the placing and keeping of all of the trains upon the route in a single telegraphic circuit which is continuous from one end of the line to the other, and is never broken, whereby each moving train is in itself a station which is in communication with all the other trains as well as the terminal and intermediate fixed stations, by means of which arrangement one train may telegraph to the train preceding or following it, or to any one of the fixed stations, and the messages sent from one point to another are reproduced in the usual way upon all of the intermediate trains and stations.

IMPROVED TAILOR'S MEASURE.

Friedrich H. Ulrich, New York city.—This is an improved tailor's measure, by which the different dimensions of the body can be taken quickly, conveniently, and accurately, to enable the tailor to produce a good fit, and furnish a basis for an improved system and apparatus for drafting the patterns. It consists of a graduated belt, with suitable back clasp and sliding hip clasps, to which a detachable measure is hung for taking the different measures required.

IMPROVED TEMPORARY BINDER.

Charles D. Lindsey, Cincinnati, O.—In this device, a notched spring plate is employed to secure or hold one or more fasteners in place upon a suitable block. The paper fasteners are so clamped as to be supported firmly in an erect position.

IMPROVED SAUSAGE STUFFER.

Hugh P. Rankin, Allegheny, Pa.—This invention relates to certain improvements in sausage stuffers, and it consists in a barrel or cylinder pivoted upon trunnions on a framework, and provided with an adjustable nozzle. In said barrel moves a piston, which is rigidly attached to a screw-threaded rod, which said rod is actuated longitudinally in the barrel by means of a bevel gear which operates through a revolving sleeve and an adjustable screw-threaded segment. The latter, by engaging the threads of the piston rod, converts the rotary motion of the sleeve into a longitudinal rectilinear motion of the piston, and a stud upon the framework engages a longitudinal groove of the piston rod to keep the latter from turning.

IMPROVEMENT IN WEATHER VANES.

William H. Pickering, Boston, Mass.—In looking at a weather vane standing "end on," it is difficult to tell whether it is pointing toward or from the observer. To show this, the present inventor suggests attaching to the vane pivot two arms inclined downward, one of which carries a ball, and the other a piece of glass set in a frame. It is then easy to tell, by the position of the ball to the right or left of the vane, in which direction the latter is pointing.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED TYPE WRITING MACHINE.

Philander Deming, of Albany, N. Y.—This invention consists, first, in printing each word with an initial letter different from the others composing it, such initial standing in lieu of a space to distinguish the beginnings of words; and secondly, in the manner of grouping the different sets of letters to admit of the most rapid manipulation of the keys.

IMPROVED RAIL JOINT.

Hermann Weber, New York city.—In this device an auxiliary fish plate is placed upon the bolts, which are provided with wedge-shaped notches on their upper and lower sides, and when moved longitudinally the edges of said plate enter the notches in the bolts, and thus lock the said bolts in place. The plate is made narrower than the regular fish plates, and in its upper edge is formed a number of teeth to receive a pawl, which holds it from working back when it has been driven into place.

IMPROVED WATER WHEEL.

Isaac Mallory, Dryden, N. Y.—This is a turbine wheel having the chutes divided horizontally. The case and the chutes are so arranged that the mouths of the latter open at the top of the case instead of the sides. A horizontal gate is arranged on the top plate, which may be adjusted at any time to close tight without too much friction.

IMPROVED SMOKE STACK.

Darwick Allard, St. Albans, Vt.—The invention consists mainly in the arrangement of a beveled ring, in connection with the vertically adjustable tube, whereby the blast is prevented passing into the space between said tube and the casing of the stack, and also whereby cinders or sparks are deflected into the main ascending current, when they fall into said space.

IMPROVED WATER WHEEL.

James J. Bourgeois, St. Cloud, Minn.—This invention relates to certain improvements in water wheels; and it consists principally in the peculiar construction of the gate or cut-off. Two horizontally moving slides are provided with rack bars with pinions between the same, so that the slides move in unison in opposite directions, to open or close above the center of the wheel.

IMPROVED ORE CONCENTRATOR.

James V. Pomeroy, Col. Ter.—This inventor now improves on the ore concentrator patented to him under date of May 11, 1875, so that the operation of the same is more effective, and the same can be worked with or without the concentrating pans. The supporting table is constructed with a step-shaped bottom, that forms a series of levels for the concentrating pans, the steps and head walls producing a wave action of the water in each level or pan. The center of gravity of the table may be changed, and a heavier or lighter shock be imparted to the same, according to the quality of the material. A level of greater length is arranged at the head of the table, and on the same is placed an endless belt, on which the pulp is fed through a hopper that is hinged at the head of the table, and seated watertight on the belt.

IMPROVED STEAM PLOW.

B. S. Benson, Baltimore, Md.—This invention contemplates the manufacture of a steam plow which shall work with revolving blades that cut the soil with fingers, separate the soil from the growth with pickers, and carry the pulverized earth to the rear. It is also provided with a sifter in the rear and a box to receive the grass, weeds, and roots; also a rear castor wheel journaled in a pulley ring to govern the direction of travel; also an attachment to this wheel, consisting of a detachably clamped frame, so that it may be adjusted to suit the changing line of gravity on lands of different inclination; also with a device for holding up the plows in traveling from field to field, or to graduate the depth at which they shall work.

IMPROVED FURNACE FOR STEAM BOILERS.

Charles E. Robinson, Brooklyn, N. Y.—This invention relates to improvements in furnaces for burning gases of petroleum or other liquid hydrocarbons. The attempts heretofore made to utilize petroleum as fuel for this purpose, more especially in locomotive boilers, have failed of the desired success chiefly because the combustion of gas or gases derived from said fuel has been attempted at too low a temperature; and secondly, for want of sufficiently free admission of air to the furnace chamber. The difficulties are overcome in this invention by dividing the furnace chamber into two parts, by means of a perforated diaphragm, the same thus forming the top of the chamber in which the combustion is begun, and the bottom of the chamber in which it is perfected. The bottom of the primary combustion chamber is formed by a series of inclined perforated plates, which are joined at their upper and lower edges, and by which the air is admitted in the requisite quantity and in a highly heated condition.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED SURFACE PLANER.

Wm. C. Margedant, Hamilton, Ohio.—This invention relates to certain improvements in that class of surface-planing machines which plane both above and below the cutter head; and it consists partly in making the cutter head and its upper adjustable table together adjustable above a lower stationary table. It consists more especially, however, in the construction of the cutter head, which is made with three straight cutting knives, arranged in such a manner as to produce a shear cut. To produce this result, one end of

the cutter head shaft is made larger than the other, and the end of the knives upon the small end of the shaft are correspondingly advanced to compensate for the first inclination, thus producing, by the double angle, a shear cut with a straight knife.

IMPROVED EXTENSION TABLE.

Ansel D. Jones and Samuel L. Jones, Kirksville, Ky.—These inventors propose to connect the legs of the table to a lazy tongs frame for extension purposes. They consider that the frame can be constructed cheaper than can the usual tongued and grooved sliding sections, while its adjustment is easier.

IMPROVED HINGE.

Frederick Toedt, New York city.—This is an improved butt hinge for doors of all kinds, by which the same are raised when being opened, and closed by their own weight, dispensing thereby with the threshold. The hinge has a wing plate with a spindle and fixed inclined washer, on which the correspondingly inclined sleeve end of the other wing plate slides, raising thereby the door. The advantage of the hinge is that it allows the laying of carpets from one room to another on an even surface.

IMPROVED SOFA BEDSTEAD.

John B. M. Fifield, Philadelphia, Pa.—This bed sofa is so constructed that it does not require to be moved away from the wall when it is to be arranged as a bed; it may be changed from one arrangement to the other with one movement, and it is so constructed that, when arranged as a bed, the cushions may be covered with ticking, and thus kept clean. The back is made in two parts, and so arranged that the lower part may be swung forward to enable the upper part to be turned down into line with the seat to form a part of the bed bottom. A piece of ticking is attached to the rear of the seat and to the back, so that, when the latter is turned down, the cloth becomes extended over the entire bottom.

IMPROVED BEDSTEAD AND MATTRESS.

John J. Bowen, Richmond, Va.—This invention relates to an improved construction of bedstead and mattress, each constructed so as to be specially adapted to the other, whereby the cost of the mattress may be considerably reduced. It consists in a bedstead having a raised head support in combination with a mattress shortened by the width of a bolster, and provided with a bolster attached to its upper head end, which rests upon the head support of the bedstead, by means of which all of the comforts of an ordinary bed are available, and the cost of the mattress lessened by dispensing with a transverse section equal to the width of the bolster.

NEW AGRICULTURAL INVENTIONS.

IMPROVED MILK COOLER.

Bruce C. Bort, Chateaugay, N. Y.—This invention relates to improvements in the milk coolers for which letters patent have been granted to B. C. Bort and T. Bryant, under date of June 18, 1872, and November 5, 1872. The invention consists of a water cooler or vat which has a hollow longitudinal partition, with entrance and exit apertures, and lateral perforated partitions, in connection with a detachable pan seated thereon. The milk pan is thus acted upon by the cold water at every part of its bottom, so that an effectual cooling of the milk is produced, while the detaching of the milk pan admits the thorough cleaning of the cooler.

IMPROVED COMBINED DRILL AND FERTILIZER.

Aladan S. Wisbart, Lumberton, N. C.—The object of this invention is to provide a combined drill and fertilizer, or a drill which is convertible at will into a broadcast fertilizer. It consists in a shaft carrying feed wheels or stirrers, located parallel with the axle, and actuated through gear wheels by the driving wheels. An adjustable hopper is arranged upon the frame, so that, when it is disposed longitudinally, a single one of the feed wheels revolves in an adjustable orifice at the bottom to constitute a drill for planting cotton and other seed; and when the said hopper is arranged transversely, or parallel with the shaft, all the said feed wheels revolve in the said hopper and act as stirrers to sow broadcast the guano or other fertilizer.

IMPROVED DITCHING MACHINE.

John E. Landrum, Hebron, Ohio.—As the machine advances, the earth is excavated by an inclined shovel—upon which the loose soil passes—entering an upwardly inclined shoot. In the latter is an endless chain, driven by the wheels of the ditcher, through the medium of suitable gearing, and carrying hoes at intervals along its length. These hoes raise the earth to the top of the machine and deliver it to the discharge spout.

IMPROVED GRAIN BINDER.

John J. Atwater, Medford, Minn.—This is a remarkably ingenious machine, including eleven entirely novel devices. There is an apparatus for collecting the grain, forming it into a gavel, and dropping upon a table, along which twine, leading from a ball of the same, is extended. This done, the cord is carried over the gavel, and both ends brought under a clamp. A portion of the twine enters a slot in a needle, which is suitably manipulated to make a knot. Lastly, the cord is cut clear of the ball, and the gavel thrown out.

NEW HOUSEHOLD ARTICLES.

IMPROVED POTATO MASHER.

Robert Crane, Jr., Columbia, Pa.—This implement consists of a handle, and a wheel-shaped device fastened thereto. The latter is formed of a ring and radial blades, the latter being set spirally or inclined to the plane of the wheel, so as to mash as well as cut when pressed down through the potatoes.

IMPROVED WEATHER STRIP.

Jesse Chandler, Barry, Ill.—This invention consists in retaining a hinged weather strip upon the threshold of a door by an adjustable stop plate, having an inclined cam part at the door casting for retaining the strip securely on the sill.

IMPROVED LAMP PENDANT.

William M. Underhill, Oconto, Wis.—This is a lever attached to a link suspended from the ceiling, having a long arm which terminates in a hook, and a short weighted arm. Directly under the point of suspension of the lever there is a bend in the long arm, to which the lamp is attached, so that the lever remains horizontal while the lamp hangs vertical. When it is desired to lower the lamp, the same is simply slid out to the hook end of the lever, which descends by the weight of the fixture.

NEW TEXTILE MACHINERY.

IMPROVED SPINNING WHEEL.

John J. Kendall, Greensborough, N. C.—The bench consists of a crooked plank set edgewise on the legs, and having a curved standard at the front end. This arrangement allows the wheel standard to be bolted on the sides so as to be held securely, and at the same time be shifted to different positions readily. The general arrangement is such that the whole standard can be shifted up or down to accommodate the height of the wheel, or the head can be turned around its bolt to swing the spindle toward the wheel in suitable position to one standing or sitting at work.

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A valuable patent and improvements for sale cheap. A. McBride, Shiloh, Pa.

The Burglar Alarm, mentioned in our issue of Oct. 23d as being on exhibition at American Institute, N. Y., was patented June 2, 1874, and is manufactured only by the Key Stone Portable Burglar Alarm Co., No. 430 Chestnut St., Philadelphia, Pa.

Send prices of boring mills, drills, lathes, etc.—cheap—to W. X. Stevens Tool Co., E. Brookfield, Mass.

Agricultural Works, Clinton, Ill. Mach. sold on Com.

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Agents Wanted—For Stephens' Combination Rule. See Advertisement elsewhere.

Dealers in Black Walnut, Fancy Woods, and Veneers, send prices to St. Cloud Novelty Works, St. Cloud, Minn.

For Sale—6 ft. Planer, Chuck, & Tools, \$275; 5 ft. Planer, \$200; 17 in. x 5 ft. Lathes, \$175; 48 in. Chucking Lathes, \$195; 36 in. Drill, \$125; 30 in. Drill, \$80; 12 in. x 5 ft. Lathes, \$125. Shearman & Hiles, 45 Cortlandt St., N. Y.

A Bargain—Jackson (Mich.) Ag'l Works for Sale.

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Fine Castings and Machinery, 96 John St., N. Y.

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For best Bolt Cutter, at greatly reduced prices, address B. B. Brown & Co., New Haven Conn.

Diamond Tools—J. Dickinson, 64 Nassau St., N.Y.

Temples and Oilcans. Draper, Hopedale, Mass.

Moles & Queries

P. M. will find directions for bronzing spring steel on p. 253, vol. 31. L. W. R. should use a saturated solution of alum in making the hard cement with plaster of Paris. Door knobs are usually screwed into doors.—F. McN. can use paraffin varnish to preserve his tools from rust. See p. 253, vol. 31.—G. M. R. is informed that nitric acid is commonly used for etching on steel. For directions for cleaning marble, see p. 330, vol. 32.—S. R.

will find a recipe for brown soap on p. 331, vol. 31. T. B. and M. can make emery belts for sand-papery spokes by following the directions on p. 304, vol. 33.—O. S. will find a recipe for paste that will adhere to tin on p. 26, vol. 31.—W. F. H.'s queries should be referred to a physician.—A. J. E. will find a recipe for plumber's solder on p. 58, vol. 30. It melts at 350° Fah.—J. K. W. will find a recipe for a blackboard composition on p. 91, vol. 30.—J. K. N. will find a description of the Stevens battery on p. 87, vol. 31.—F. O. X. will find simple directions for electroplating on p. 133, vol. 30.—T. B. G. is informed that we do not work out school-boys' problems, and political questions are not in our line.—G. W. B. will find a simple process for nickel plating on pp. 155, 235, vol. 33.—A. B. D. will find directions for polishing woodwork on p. 315, vol. 30.—C. S. B. will find good recipes for rendering glass opaque on p. 264, vol. 30. The process for blackening gun barrels is described on p. 208, vol. 26. Files can be renewed by the process described on p. 331, vol. 31, which is a good one.—R. W. K. will find directions for a black finish on wood on p. 293, vol. 30.—C. J. M. can cut his glass jars by using the process described on p. 49, vol. 31.—L. S. will find directions for making plaster casts look like marble on p. 68, vol. 29.—G. E. R. will find directions for bronzing iron castings on p. 283, vol. 31. This also answers J. L. T.—J. L. T. will find a description of the Chuteaux battery on p. 27, vol. 31, and one of the Grenet, on p. 219, vol. 32.—J. C. T. will find directions for waterproofing paper on p. 116, vol. 31.—J. N. will find a recipe for fish glue on p. 408, vol. 24.—W. C. will find a recipe for mica varnish on p. 241, vol. 32.—A. J. will find directions for grinding a parabolic mirror on p. 276, vol. 30.—N. J. will find, on reference, that the proportions of a flywheel are described on p. 288, vol. 28.—P. R. will find a description of the hydraulic ram on p. 309, vol. 31. For an improved arrangement of flouring burrs, see another page of this issue.—J. P. can make battery carbons by the method described on p. 35, vol. 33.—W. C. E. will find that the tap and lead on a steam engine are fully described on p. 101, vol. 32.—D. P. will find directions for preserving wood from decay on p. 313, vol. 31.—M. J. will find directions for making an induction coil on p. 219, vol. 32.—F. C. will find a description of the process of obtaining albumen from blood on p. 344, vol. 31.—J. W. can waterproof his leather boots by the process described on p. 155, vol. 26.—N. K. will find a recipe for fulminate of silver on p. 90, vol. 31.—J. C. K. can fireproof his shingles by the process described on p. 280, vol. 28.—F. J. will find a description of the moon's variations on p. 251, vol. 31.—F. C. can harden tallow by the method described on p. 201, vol. 24.—F. N. will find a description of M. Coignet's artificial stone on p. 124, vol. 22.—J. Q. will find directions for making a hydrogen lamp on p. 242, vol. 31.—J. T. can tan skins with the fur on by the process described on p. 233, vol. 26.—F. J. will find a recipe for solder for gun barrels on p. 333, vol. 27.—J. K. will find directions for stuffing and mounting animals on p. 250, vol. 30.—J. W. is informed that water glass is silicate of soda, frequently advertised in our columns. This also answers J. S.—C. T. will find a recipe for a black enamel on iron on p. 308, vol. 26.—J. W. C. will find a recipe for an indelible ink on p. 129, vol. 28, and for a black, on p. 112, vol. 27.—R. K. will find a recipe for marine glue on p. 43, vol. 32. Muriate of ammonia is prepared for inhalation by the process described on p. 315, vol. 31.—R. Y. will find a description of a pantograph on pp. 99, 179, vol. 28.—W. C. will find the dimensions of the Great Eastern on p. 346, vol. 32. The proportions of safety valves are given on p. 363, vol. 29.—J. W. T. will find a description of salicylic acid on p. 324, vol. 32.—F. J. will find a description of the madstone (the virtues of which are believed in only by the ignorant) on p. 266, vol. 26.—W. C. T. can produce a black finish on German silver by the process detailed on p. 233, vol. 31.—N. T. will find directions for making gelatin relief plates on p. 272, vol. 32.—W. T. S. will find a description of the process of lithography on p. 298, vol. 31.—W. F. can harden his screw-cutting plates by the process detailed on p. 75, vol. 28.—N. P. can repair his millstones by using the cement described on p. 251, vol. 31.—M. W. will find directions for making a sun dial on p. 409, vol. 29.—C. J. will find that a method of wire rope transportation is described on p. 370, vol. 31.

(1) T. W. D. asks: Will putty made of linseed oil and Spanish whiting stand the weather? A. Yes.

(2) J. L. McM. says: 1. I wish to engage in the manufacture of potash on a small scale. Will you please give me the details of the process? A. The substance known in chemistry as potassic carbonate is generally termed potash, because it was formerly obtained from wood ash, which, after lixiviation with water, was evaporated to dryness in cast iron pots. You give no intimation in regard to your source of supply; we can give no method, therefore, until we know from what material you expect to derive your potash. Below we give the sources whence potash is industrially obtained: The inorganic sources of potash.—1. The salt minerals of Stassfurt. 2. Feldspar. 3. Sea water. 4. Saltpeter. The organic sources of potash: 5. Ashes of plants. 6. The residue of the molasses of beet root sugar after distillation. 7. Seaweeds, as a by-product of the manufacture of iodine. 8. The suint of the crude wool of sheep.

(3) W. R. T. of Manchester, England, says: How can I make iodine green, used by calico printers? A. Iodine green is obtained by the following process: One part acetate of rosaniline, 2 iodide of methyl, and 2 methyl alcohol are heated together for several hours under a high pressure, or (on a small scale) in a sealed tube. When the operation is finished, the result is a mixture of violet and green pigments dissolved in methyl alcohol. The volatile substances having been driven off by distillation, the mixture of pigments is put into boiling water, wherein the green is completely dissolved, while the violet remains in-

soluble; the former is precipitated by a cold saturated solution of picric acid in water; the ensuing precipitate—picrate of iodine green—is collected on a filter, rapidly washed with the smallest possible quantity of water, and, after having been partly dried, brought into commerce as a paste. The crystalline iodine green, free from picric acid, has the formula $C_{22}H_{13}N_3O_{12}$.

(4) M. M. G. says: I find in use in Delaware the leaves of a small bush that grows in the swamps and on the borders of lakes and ponds. It possesses the peculiar property of diminishing or preventing the accumulation of fat in persons disposed to obesity. I have been unable to find that it is known to the medical profession, and I do not know what its proper name is; it is called here the swamp shrub. It is a beautiful bush, growing to the height of 2½ or 3 feet, and bears a beautiful purple flower. It blooms in July and August, and is quite ornamental in comparison to the surrounding rubbish among which it grows. My attention was called to it by several corpulent individuals, who stated that they could diminish their proportions at leisure at the rate of 5 or 6 lbs. per week. Being quite lusty, I was induced to try it, with the following result: In five weeks I diminished my weight from 210 lbs. to 190 lbs., when my clothes commenced to feel uncomfortably large, and then I stopped. I took a dose of the infusion when convenient. When my fat accumulates, I take to drinking it; and in a short time the oppressiveness of flesh diminishes. If there is anything in medicine that will do this, I am not aware of it. What is the botanical or medical name of the shrub? A. Your description is insufficient to enable us to determine the plant. Send specimen of shrub and its root, and, if possible, full description of its flower.

(5) G. W. D. asks: Can you give me a convenient and inexpensive process for removing the moisture from common air, without the use of heat? A. Force the air through vessels containing quicklime. The surface of exposure containing the quicklime should be large.

(6) L. C. asks: How can I reduce the black or brown oxide of mercury to a metallic state? I have a quantity, which I have pounded in an iron mortar with water, and a portion of it has been reduced; afterwards I distilled it at a high heat, and but little came over. The remainder is a fine brown powder. Can I reduce it by any means except by the wet process, and how? A. Take equal parts of powdered charcoal and dry carbonate of soda, and heat with the oxide until decomposition ensues. Metallic mercury will separate.

(7) S. R. B. asks: 1. Have fishes an auditory apparatus? Do they hear distinctly? A. "The ear of the fish (almost always entirely within the cranium, on the sides of the brain) consists essentially of a vestibule and 3 semi-circular canals, which receive the vibrations of the integuments and cranial walls; there is rarely anything that can be called an external ear, drum, or tympanic cavity; loud, sudden, and strange sounds frighten fish; in ancient, and even in modern times, they have been taught to come and receive food at the tinkle of a bell, or the pronunciation of pet names."—*American Cyclopaedia*, vol. 7, p. 533.

(8) H. D. M. asks: Will you mention a good cheap way to powder copper (sheet or ingot) so that I can obtain the pure powder? A. There are four methods: 1. Granulate the copper by allowing the molten metal to fall through a sieve into cold water. 2. By dissolving up the copper in sulphuric acid, and adding scraps of iron, the copper will be precipitated in the metallic state. 3. By bringing the acid solution in the galvanic current in such a manner that spongy metallic copper will be precipitated at the negative pole. 4. By heating oxide of copper in a stream of hydrogen gas.

(9) C. F. T. asks: How can I dye powdered chalk or tripol to a dark pink or carmine, so that vinegar or alcohol will not change the color? A. Use rouge.

(10) A. asks: Can cider be pressed from the fruit, boiled down to one half, then stored away, so as to keep any length of time, and then be diluted and fermented, and distilled into a good article of apple brandy? A. We see no objection to the process, provided that, during storage, air be excluded and the other usual precautions taken. Is the manufacture of oxalic acid from sawdust, in a country where sawdust is cheap, practicable? A. If the sawdust be mixed with a solution of caustic potassa, and exposed to a heat considerably above 212° Fah., it will be partially decomposed and converted into oxalic acid, which will be found in combination with the alkali. Much of the oxalic acid of commerce is made in this way.

(11) L. R. asks: Is there an instrument that will indicate the degree of moisture in the earth? A. There is no instrument for this purpose? The moisture may be determined as follows: Weigh out ¼ lb. of the earth immediately after taking it from the ground; transfer to an oven where the temperature is maintained at 212° Fah. until the earth is completely dried. After cooling, weigh; the difference in the two weights gives the amount of moisture.

(12) J. W. N. says: Open coal fires are certainly desirable things; but as they are not very common, I infer that, for some reason, open coal grates have not yet been made successful. Please inform me wherein they fail. A. The coal grate fire is very common here. No failure.

(13) S. A. F. says: I am building a boat 28 feet over all, and 25 feet 6 inches on the keel; she is 5 feet 10 inches wide, and draws 14 inches forward and 30 inches aft. Her engine is 14x35 inches, with a surface condenser and a boiler 30 inches diameter by 54 inches high, with 40 two inch tubes. She has a 30 inch propeller. Please tell

me what speed I can get out of her. I carry 100 lbs. pressure. A. That question can best be answered after the boat is done. We will hazard a guess, however, that, if the boiler steams well, the speed of the boat will be about 6¼ miles an hour in still water. Let us hear from you after you have made a run.

(14) H. J. S. says: A. claims that if 100 tons pressure compresses 2 bales cotton to half their thickness, when placed side by side, about half the pressure or same force will equally compress said cotton if the bales are placed one on top of the other. I claim that it will not. Please decide. A. We incline to A.'s opinion.

(15) W. S. says: 1. I propose to build a cylindrical copper boiler, the shell to be made with a butt joint, a strip of copper being placed on the inside over the seam and riveted. Will this joint be as strong as a double-riveted lap joint? A. Yes, if properly proportioned. 2. What is the greatest strain per square inch of section that should be placed upon copper, when used in a boiler? A. With a double-riveted joint, 3,500 lbs. 3. Can you give me a formula for calculating the strength of copper boilers, similar to the formulae in use for iron boilers? A. Use the constant for working strength of copper, as above, in the formula for iron boilers. You will find rules given at length in "Wrinkles and Recipes."

(16) L. H. P. asks: Where can I find a rule for the proper number, size, and arrangement of tubes for a modern tubular boiler? A. You will find some useful hints in Forney's "Catechism of the Locomotive."

(17) C. W. C. says: I have a composition steam cylinder which I use for an hydraulic engine to blow an organ; but I have not pressure enough to give the required speed, which is 20 strokes per minute under 20 lbs. per inch pressure. I propose to use carbonic acid gas as a substitute for water, and to use a cylinder 2 feet by 4 feet filled to 200 lbs. per square inch pressure. Is the following calculation correctly based? Capacity of cylinder $24 \times 48 = 2,314.72$ cubic inches; capacity of engine $3 \times 3 = 21.24$ cubic inches = 1014.6 half strokes + $2 = 507.3$ whole strokes. 507.3×200 (lbs. pressure of cylinder) + 20 (lbs. pressure of engine) = $5073 + 20$ strokes per minute + 60 minutes per hour = 4 hours 13 minutes +. A. The calculation is correct; on the assumption that the pressure of the gas is inversely as the volume. You can scarcely expect to realize the performance as given by this calculation, which does not take into account some practical considerations. 2. Would the gas corrode the engine? A. We think not.

(18) H. S. M. says: I am about to build a small boat. I have 2 engines, connected on one shaft at quarter centers, of 3 inches bore and 6 inches stroke, cutting off at ¾ stroke. The boiler is large enough to make all the steam they can use; it is of an upright tubular form. Will these engines do for a boat that will carry the necessary machinery and about 15 persons? If so, please tell me the proper dimensions of the boat and wheel. A. Make a boat 30 feet long, and of 8 feet beam. Use a propeller 30 inches in diameter and of 42 inches pitch.

(19) L. S. C. says: 1. In the sugar-growing portion of Louisiana we use our boilers only two months in the year. During the other ten months we find that much injury, resulting from our damp climate, is sure to ensue. The under side flues, and portions where the brickwork touches cannot well be painted. What can you recommend to protect such boilers? A. It might be well to remove the brickwork (a portion at a time, if more convenient) and clean and paint the whole boiler. Then, in replacing the brickwork, set it with hydraulic cement, taking care to make a tight joint. 2. As between two boilers, each of suitable size to furnish 15 horse power, one being two flue, the other a plain cylinder, about what percentage more fuel would the latter require than the former, steam being used at 80 lbs., and fuel required to raise cold water to 80 lbs. not being counted? A. The difference would be trifling, if each boiler was acting in an efficient manner.

(20) R. C. T. asks: How much friction is there between iron and ice, as in skating? How do you calculate it? A. It can only be determined by experiment. If any of our readers have any data bearing on the subject, we would be glad to hear from them.

(21) A. W. says: I have had experience in running stationary and locomotive engines, and I would like to qualify myself for the position of master mechanic. How shall I proceed? A. There are schools in this vicinity and elsewhere, in one of which it might be well for you to spend a year or two; and after that it would be advisable to go into a shop or drawing room. We think the expenses at one of these schools, including board, tuition, books, etc., would be at least \$400 a year.

(22) W. A. asks: How large a boat can be driven with a pair of cylinders 4x6 inches, at the speed of 10 miles an hour, pressure of steam being 80 to 100 lbs.? What size of propeller wheel will be suitable for the boat and engines? A. You can use a boat 30 feet in length, and a propeller 32 inches in diameter. We think it doubtful, however, whether you will realize the speed named.

(23) C. M. B. asks: Will a float, with just sufficient buoyancy to support 10 lbs. in cold water when not confined, support more weight if placed on the water in a steam boiler, with a pressure of steam of 200 lbs. to the inch? A. It will not support quite as much, because water expands when heated, and has less weight for a given volume.

(24) A. M. asks: In grinding rolls by means of an emery wheel, what should be the travel of the roll and of the wheel? A. It depends on the size of the rolls and the size of the emery wheel employed, and is easily discovered by experiment.

(35) H. W. H. asks: Is there any means by which I can find the pressure of steam in a boiler with the safety valve alone, without the use of a steam gauge? A. You will find rules for such calculations in Bourne's "Handbook of the Steam Engine."

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

L. A. S.—It consists of heavy spar or sulphate of baryta, along with oxide of iron.—J. E. H.—It is pyrites.—R. W. H.—All the specimens are composed of scales of mica and small crystals of hornblende, which give them their sparkling character, imbedded in felspar and quartz.—W. M.—One specimen is pure quartz sand; the other is quartz sand mixed in with clay. Of no value for shipment.—G. W. L.—No. 1 is mispickel. No. 2 is pyrites. Nos. 3 and 4, pyrites in quartz rock. No. 5 is quartz rock which, like the foregoing, is very possibly auriferous. It would require a larger quantity to determine this, and a careful gold assay would be required.

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 Measurement of Light. By H. H. On the Tails of Comets. By C. E. M. On Spiritualism. By F. W. E. On Burning Coal Dust. By W. F. S. On Gear Indices. By B. P. G., by S. M., and by G. B. K. On Coprolite Beds. By E. K. On the Gateways of Nations. By W. T. S. On "Etheric" Force. By J. P. H.

Also inquiries and answers from the following:

S.—H. P.—J. A. B.—R. B. S.—W. S. O'G.—P. J. R.—J. C. H.—E. L. W.—H. J. T.—J. F. D.—E. J. D.

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.

Inquiries 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 inquiries analogous to the following are sent: "Who sells aniline black? Where can flat-bottomed steamers be purchased? Who makes steel springs, suitable for use in a spring power? Who sells magnetic chains for medical purposes?" 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.]

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DESIGNS PATENTED.

8,836.—COOK STOVE.—N. S. Vedder, Troy, N. Y.
8,837.—STOVES.—N. S. Vedder, Troy, N. Y., et al.
8,838.—COOK RANGES.—N. S. Vedder, Troy, N. Y., et al.
8,839.—STOVES.—N. S. Vedder, Troy, N. Y., et al.
8,840 & 8,841.—STOVES.—N. S. Vedder, Troy, N. Y., et al.
8,842.—COOK STOVE.—N. S. Vedder, Troy, N. Y., et al.
8,843.—STOVES.—N. S. Vedder, Troy, N. Y., et al.
8,844.—COOK STOVES.—N. S. Vedder, Troy, N. Y., et al.
8,845.—PAPER BOX.—I. Birge, Philadelphia, Pa.
8,846.—CUTLERY HANDLES.—E. L. Brittin, Derby, Conn.
8,847.—TOY BALLOON.—H. S. Kerr, Philadelphia, Pa.
8,848.—LAMP CHIMNEY.—F. S. Shirley, New Bedford, Mass.
8,849.—BOTTLES.—B. Simon, Scranton, Pa.
8,850.—RANGE.—N. S. Vedder, Troy, N. Y.
8,851.—STOVES.—N. S. Vedder, Troy, N. Y.

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On application for Design (7 years)..... \$15
On application for Design (14 years)..... \$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,
December 4 to December 14, 1875.

5,463.—D. W. De Forest, Brooklyn, N. Y., U. S. Meech
anion for propelling sleds. Dec. 4, 1875.
5,464.—C. W. Williams, Rochelle, Ill., U. S. Hay loader,
Dec. 4, 1875.

5,465.—R. L. Webb, New Britain, Conn., U. S. Box
coffee mill. Dec. 4, 1875.
5,466.—F. N. Du Bois, New York city, U. S. Machine
for making plumber's traps. Dec. 4, 1875.
5,467.—D. L. Chase, Boston, Mass., U. S. Steam gov-
ernor. Dec. 4, 1875.
5,468.—O. Jall, Orangeville, Ont. Turbine water wheel,
Dec. 4, 1875.
5,469.—E. A. Rice, New York city, U. S. Seats for ve-
hicles. Dec. 4, 1875.
5,470.—T. Snell et al., Toronto, Ont. Paint brush brid-
ler. Dec. 4, 1875.
5,471.—I. Milette, Three Rivers, P. Q. Self-acting sluice
doors and lock gates for canals. Dec. 4, 1875.
5,472.—S. Lee, Ottawa city, Ont. shoe rack. Dec. 4,
1875.
5,473.—D. N. B. Coffin, Jr., Newton, Mass., U. S., et al.
Chain stopper. Dec. 9, 1875.
5,474.—A. S. Dennison et al., Watertown, N. Y., U. S.
Paper bag. Dec. 9, 1875.
5,475.—A. S. Dennison et al., Watertown, N. Y., U. S.
Waterproof bag. Dec. 9, 1875.
5,476.—J. P. Taylor, Elizabethton, Tenn., U. S., et al.
Machine gun. Dec. 9, 1875.
5,477.—D. N. B. Coffin, Jr., Newton, Mass., U. S., et al.
Capstan and windlass. Dec. 9, 1875.
5,478.—J. Shedd, Waltham, Mass., U. S. Window blind-
fastener. Dec. 11, 1875.
5,479.—D. E. Lillis, Jackson, Miss., U. S. Foot treadle,
Dec. 11, 1875.
5,480.—A. Marland, Pittsburgh, Pa., U. S. Making nuts,
Dec. 11, 1875.
5,481.—I. Casgrave, Chatham, Ont. Machine for pump-
ing water out of vessels, etc. Dec. 11, 1875.
5,482.—H. Knight, Liverpool, England. Manufacture of
certain oxides and sulphides. Dec. 11, 1875.
5,483.—J. Lang, Arnprior, Ont. Mop wringer. Dec. 11,
1875.
5,484.—R. Forward, Cincinnati, Ohio, U. S. Paddle
wheel. Dec. 11, 1875.
5,485.—J. E. Nute et al., New Glasgow, N. S. Pumping
water from ship holds, etc. Dec. 11, 1875.
5,486.—J. C. Schoonmaker, Hamilton, Ont. Combined
stove pipe shelf and dryer. Dec. 11, 1875.
5,487.—H. Reed, Vineland, N. J., U. S. Tanning appa-
ratus. Dec. 11, 1875.
5,488.—W. Dippert, Des Moines, Iowa, U. S. Harness
pad press. Dec. 11, 1875.
5,489.—J. McLean, St. George, N. B. Scale pan, etc.
Dec. 11, 1875.
5,490.—J. C. Schoonmaker, Geddes, N. Y., U. S. Making
lightning conductors. Dec. 11, 1875.
5,491.—J. E. Pisk, Salem, Mass., U. S. Whitening and
buffing leather. Dec. 14, 1875.
5,492.—J. R. Lantz et al., Marrowbone, Ill., U. S. Ad-
justable wagon axle. Dec. 14, 1875.
5,493.—R. K. Boyle, New York city, U. S. Electric tele-
graph. Dec. 14, 1875.
5,494.—W. Ellard, Skeads Mills, Ont. Cutting belt nip-
pers. Dec. 14, 1875.
5,495.—A. C. Snowden, South Norwalk, Conn., U. S.
Horse overshoes. Dec. 14, 1875.
5,496.—E. Gray, Chicago, Ill., U. S. Transmitting mus-
ical sounds telegraphically, etc. Dec. 14, 1875.
5,497.—W. H. Newton, Chicago, Ill., U. S. Hydraulic
and peat excavators. Dec. 14, 1875.
5,498.—J. Foley, Orangeville, Ont. Printer's quoin.
Dec. 14, 1875.
5,499.—G. Lepton, Indianapolis, Ind., U. S. Sheet metal
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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XXXIV.—No. 4.
[NEW SERIES.]

NEW YORK, JANUARY 22, 1876.

[\$3.20 per Annum.
[POSTAGE PREPAID.]

NEW RAILROAD DEPOT.

We present herewith a view and a plan [see page 51] of the depot recently erected at Worcester, Mass., for the joint use of the Boston and Albany, the Norwich and Worcester, and the Providence and Worcester Railroads. The design, as will be seen in our engraving, is picturesque and effective, and the work is remarkably solid and substantial. We extract the following particulars from the *Worcester Gazette*:

"In the center of the front is the main passenger entrance to the building. About 15 feet from the entrance, and directly in front, is a granite archway supported by double columns of granite. This is connected with the round part by a trussed roof, making three archways. The two at the sides are to be used as a driveway, thus enabling passengers to arrive and depart at all times without being exposed to the weather. On the outside of the round part a stationary awning has been built, which will cover a walk 10 feet wide, which is to be built under it. At the northwest corner of the building is a stone tower, the cap stone of which is 159½ feet from the ground. Above this rises a wooden extension covered with slate, 40 feet in height, and surmounted with a rod and vane of 13 feet, making a total of 212½ feet. In the construction of the stone work of the building and tower, there were used 600,000 brick, 12,000 tons of stone, and 3,000 barrels of lime and cement. Near the top of the stone work of the tower a large clock room has been built. It has not yet been decided what kind of a clock will be placed in it. A strong effort is being made to have one with an illuminated dial.

"The roofs of the two sections are each supported by eight heavy trusses, one end resting on the walls of the building, the other on the girders running over the heavy iron pillars placed through the center of the building. These two roofs are covered with slate, except a part of the two sides where they join in the center of the building. Over this part of the roof there has been built a second roof which begins at the east and west ends of the building where it is about 3 feet wide, and ascends with a gentle slope to the

center of the building, where it is about one third the width of the building covered by the two roofs. This roof is made of concrete, and is built to catch the snow from the inner slopes of the two roofs, which would, but for this, slide down to the bottom of the pitch. The two roofs are surmounted with ventilators running the entire length of each. On the top of each is an ornamental iron railing, while over the top of each arch is a large vane. The roofs of the ventilators are covered with 7,200 panes of glass, 12 by 34 inches in size, set in 360 sashes."

The offices and waiting rooms are conveniently and handsomely fitted up, and the whole work reflects credit on the architects, Messrs. Ware and Van Brunt, of Boston, Mass. These gentlemen, and Mr. E. S. Philbrick, the engineer, have done their work under some difficulty, as the uniformity of their design has been broken by the arrangement of the side entrance for the Boston, Barre, and Gardner and the Nashua and Worcester Railroads. The *Railroad Gazette*, from whose pages we select the engravings, is our authority for stating that this unfortunate arrangement is due to the managers of these two railroads, who declined to accede to any other plan.

"Composito" Vessels for the Coast Survey.

There was recently launched at Baltimore, for the United States Coast Survey, a "composito" vessel—that is, a vessel built partly of iron and partly of wood. It appears that this vessel was built upon recommendation of Captain Patterson, of the Coast Survey, whose views on the subject are of interest in adding to our knowledge of the important questions affecting the shipbuilding trade. He says that experience has shown composito vessels to be more economical and more durable than vessels built either entirely of iron or entirely of wood, and that this is more especially the case in our Southern waters. In the composito hull, the frame and beams are of iron, and the planking of wood. The waters of the Southern coast are found to seriously affect iron hulls, so that after about eight years the iron fails. Five or six

years ago two small composito vessels were built for the Coast Survey, in Baltimore, and they have proved very successful; one of these, the *Bibb*, withstood the terrible cyclone which recently destroyed Indianola. She was subject to its full severity for ninety hours, but passed through it unscathed. In the period of nearly six years that they have been afloat, the repairs to these two schooners have not exceeded \$600. Subsequently another composito schooner of 125 tons was built, and afterwards a composito steamer of 200 tons. Captain Patterson thinks that this class of vessels will in time be generally used, on account of their much greater durability than wooden vessels, which much more than balances the somewhat heavier first cost.

Spontaneous Centennial Celebrations.

There is considerable significance in the hearty welcome about to be given in big and little towns all over the country to the Centennial year. Preparations are making in scores of cities, villages and hamlets for illuminations, processions, salutes, and other appropriate ceremonies, and we have yet to hear of one in which there has been the smallest difficulty as to the collection of necessary funds.

It is evident that the people everywhere are ready to second efforts for voluntary and spontaneous Centennial ceremonies; so evident, indeed, that Congress can do the international exhibition no greater service than by declaring on the day of their reassembling that the exercises at Philadelphia shall be voluntary and not perfunctory. When Congress shall have said distinctly that no appropriation of government money shall be made to the exhibition, the people will not be slow to contribute every dollar needed for the proper conduct of the enterprise. So long, however, as the commissioners shall depend upon a government subsidy, they can expect little from the spontaneous enthusiasm of the people. This element of spontaneity is essential to the highest success of the exhibition, and there could be no surer way of destroying it than that for which the direct sponsors of the exhibition are mistakenly praying.—*New York Evening Post*.



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VOLUME XXXIV., No. 4. [NEW SERIES.] Thirty-first Year.

NEW YORK, SATURDAY, JANUARY 22, 1876.

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WORKING MEN'S VISITS TO THE CENTENNIAL.

According to present indications, the cost of living in Phila-
delphia during the Centennial is going to be high. It is but
natural that the citizens will avail themselves of the golden
opportunity offered by the immense influx of transient visi-
tors, and hold temporary accommodations at prices which will
severely tax the average purse. While this state of affairs
may not work as a hindrance to the visits of those living with-
in a moderate distance of Philadelphia, and who will there-
fore avoid heavy traveling expenses, it doubtless will be the
means of keeping away a large number of others residing
in more distant parts of the country, and especially working

men, who will probably be the most appreciative visitors but
whose funds to spare for the occasion will be closely
limited. It seems to us that, of all classes which, it is ex-
pected, will be benefited by the Exposition, the working men
stand first. We do not believe that any intelligent work-
man can examine the display without being improved there-
by, and that even the dullest individual will leave the
grounds with his ideas widened and with some useful know-
ledge of the skill and progress of others, in at least his own
trade.

The tendency of the present time is to dignify labor, to con-
vince men that to work is not degrading, and that the edu-
cated worker with hands is the peer of the educated worker
with brains. Mr. Gladstone in a recent admirable address on
Science and Art, says to working men: "Blend the beautiful
with the useful, and the distinction between what is manual
and what is mental will be lost, to the manifest gain of your
class, to the unspeakable benefit of all." "Enoble your work,
and it will ennoble you" is the translation of the above into
shorter terms: but to ennoble or improve work without edu-
cation is impossible; and in that subtle and most effective
form of education which instructs by arousing the desire to
strive and do likewise, the education afforded by the museum
of art, and the exposition of other men's consummate skill,
this country has been sadly lacking. With the Centennial,
however, begins our greatest attempt to supply this need,
and by the Centennial is offered to working men of every
class, such an opportunity to study and to emulate as no
other exposition heretofore held has ever paralleled, even in
point of magnitude. We need not argue further to show that
what elevates and raises the working men likewise affects
the whole community, and that, by benefiting the one, we
indirectly, though none the less surely, benefit the other.

To come back to the practical side of the subject, it must
be admitted that, if excessive prices at Philadelphia are going
to act as a prohibition to working men visiting the exposition,
and thus act as a bar to their acquiring the benefits referred
to, then it is not only in the interest of the men themselves,
but of those who directly gain by the work, to devise means
of avoiding unnecessary expenses. And here we think is an
opportunity for the unions and trade societies to come for-
ward and benefit their members. Some of the unions have
large and influential memberships and possess considerable
funds. A small tax would greatly augment the latter, and
perhaps in this way a sum could be raised to put up and
maintain buildings especially devoted to working men's ac-
commodation. These edifices need be but temporary struc-
tures on rented ground, and the charges for occupying them
should be but slightly above actual cost of maintenance. If
the large unions would each erect their own structures, and
the small ones club together and build, all the trades would
be represented, and working men of all classes would be
provided for. For non-union men a slight extra charge, equal
to the tax imposed on the society men, might be made, and
thus in the end the unions, besides benefiting all workmen,
would profit pecuniarily by the operation.

It would be a wise plan for large employers and societies
to confer with railroads and other transportation companies,
and arrange special rates for transporting working men at
prices below the reduced excursion tariff offered to the gen-
eral public, and to issue special working men's tickets, to be
bought through employers and societies. In the same way
the unions or any association of individuals may erect work-
men's accommodations and issue tickets for a certain number
of days' board and lodging.

As regards the action of employers themselves, we pre-
sume that nearly all will see the benefit of affording their
men as much opportunity as possible to visit the Centennial.
Where it is out of the question to afford holidays sufficient
for all to go, the privilege might be granted to the most
deserving, or held out as a reward for special effort. It
might be well for those who approve such a course to
notify their men now that the two workmen in each depart-
ment of the works, for example, who should show the best
record for attention to duty, etc., between the present time
and, say, July 1, would then be furnished with tickets to and
from Philadelphia, and lodging tickets while there, and given
as many holidays as the employer might fix upon. A report
from these men might be requested on their return, or they
might be given to understand that each would be desired to
explain before his comrades whatever he had seen of interest
in their especial branch of trade. Another suggestion we have
to make is that an employer should, when he is likewise an
exhibitor, and displays some object which, like an engine or
steam pump, requires attention and care, instead of keeping
one man at that duty, if it be anywise possible, send a dif-
ferent one from the works every week, or every three days.
In this way a large number of working men may see the Ex-
position without the employer's incurring any considerable
expense.

THEORY AND PRACTICE.

We published an article on page 8 of our current vol-
ume, in which we showed how the results obtained in prac-
tice, in regard to the effects of expansion of iron in bridges,
did not agree with those of the theoretical calculations; and
this is only one instance in which theory and practice ap-
pear to disagree. Some persons go so far as to assert that
they never agree, while others even say that they cannot
agree. We, however, maintain that they must invariably
accord, and that, if this is not apparent, the practice is de-
fective or the theory incomplete. This opinion is founded
on an experience of many years, by carefully investigating
all cases where such disagreement appeared to exist; and
our faith in theory has proved to be well founded in every
case in which the theory was complete, and the practice, if

not perfect, at least of such a nature that the imperfections
could be ascertained.

A case wherein an incomplete theory was taken as the
basis of a calculation is found in the article already men-
tioned, in regard to the effects of expansion of the iron in
bridges. The data, on which the theoretical calculations
was founded, were obtained from experiments concerning
the expansion of metals by heat while the specimens were
not under compression, and their contraction by cold when
not under strain by extension. In order to use such data as
the base for calculating the effects of expansion and contrac-
tion in iron structures, it will be necessary that the experi-
ments be repeated, and new coefficients of expansion and
contraction be obtained by experiments in heating and cool-
ing metals while under great strain; in this way we may ul-
timately ascertain the law which modifies the figures now in
use, which must be varied according to the compression or
extension which is brought to bear on the expanding or con-
tracting metals. Notwithstanding that this expansion and
contraction are exceedingly powerful and able to overcome
very great resistances, it cannot be maintained that such re-
sistances are without any influence on the amount of expan-
sion and contraction, and it is for the determination of these
amounts, for different degrees of resistance, that new experi-
ments are required. This is only a single instance of the
great work which yet has to be done by engineers in settling
the data for calculations as to the strength of materials, cal-
culations on which depend the success, scientific as well as
economical, of the labors of the many great men in the pro-
fession of civil engineering.

DRAWBRIDGE INCONSISTENCY.

It has always seemed to us that no one could stand by the
great bridges which span the Hudson river at Albany, and
witness the immense fabrics slowly swing their huge draws
open to admit the passage of some puffing little tug not a
hundredth part of the size of the whole structure, without
being struck with the incongruity, if not absurdity, of the
proceeding. A passenger train may be delayed on each bank
of the river, and crossers innumerable may wait as patiently
as they may on each approach of the bridge: all this is of
less consequence than the passage of a tow of slow canal
boats, or of some solitary sloop or schooner. The Albany
bridges are, however, but a sample of drawbridges in gen-
eral, and the question why draws should exist in a great
number of instances, or why should vessels have the right
of way, applies to the entire class. Once upon a time, when
railroads were not, and the principal traffic of mankind was
done by water, it was important that the path of vessels
carrying on commerce should not be barred. Public policy
gave them a right of way over the stage coach, and bid the
latter wait until the more important conveyance had passed.
The law recognized this, and courts in their decisions wisely
sustained the law in its strict interpretation. But as the
times changed the law did not, and justice, proverbially
blindfold, was especially so in this regard, and entirely
failed to perceive that the railroad had supplanted not mere-
ly the stage coach, but the freight vessels as well, and that
rapid transportation was and has been for some time past
the last thing expected by those who ship their goods via
river schooner or canal. Consequently justice or law has
stupidly persisted in making the railroad train at forty miles
an hour give way to the sailing craft at four knots, that is to
say, cars loaded with perishable freight perhaps, or impa-
tient passengers to whom time is money, or the fast mails of
the public, must stand a longer or shorter time on the brink
of a river and wait the passage of a schooner load of brick
or lumber. Why? If there be any sound reason for the
preference, we confess our inability to perceive it.

Nor is this all. Although it presumably may be supposed
that, for the protection of their own property, railroad com-
panies will avail themselves of the most approved means of
avoiding disaster and accidents, the fact nevertheless re-
mains that, despite such means especially adapted to warning
trains approaching drawbridges, trains have run headlong
into the open gulf again and again. On most roads engi-
neers are cautioned to bring their locomotives to a full stop at
a certain point just before reaching the bridge; but here is
delay again, coupled with the probability of the rule, like
every other based on human fidelity or prudence, being
slighted or neglected.

If a bridge barred a great harbor, like that of New York
for example, or even a less port, where the commerce by
water was of major importance, it would be wise to give ves-
sels the right of way; but such a condition of affairs practi-
cally negatives the existence of a bridge as a means of cross-
ing, since the repeated interruptions to travel would speedily
cause a resort to tunneling or other means, as a cheaper and
far more convenient alternative. It is, therefore, very rarely
that we find the railroads blocked by drawbridges for really
important causes. In the case of Albany, no ocean vessels as-
cend so far up the river, and nothing larger than the regu-
lar river steamers for Troy have occasion to go under the
bridges. On scores of railroads, there are draws which serve
no more useful purpose than the admission of a chance
schooner into some short arm or inlet. It would be a much
better policy to abolish drawbridges altogether wherever the
condition of affairs is such that a steamer by knocking down
her funnel, or sailing vessels by lowering their upper masts,
can pass under: or else to alter the laws to conform to
those now in existence in Holland, which forbid any vessel
approaching a drawbridge when a train is due. It is a very
easy matter to house topgallant masts in large ships, or to
lower topmasts in a fore-and-aft; as for dropping funnels,
it is done, by every penny steamer that plies along the Thames
at London, dozens of times daily. Bridges without draws

moreover, are very much cheaper to build and maintain than those with them; and in cases where the draw is unavoidable, it is very much easier to signal and warn off a slow sailing vessel, or even a steamer, than a lightning express train.

THE CENTENNIAL EXHIBITION.

"The prospects of the Philadelphia Exhibition are so gloomy just now that its friends are filled with alarm. Every effort has been made to stimulate the people of the United States to enthusiasm in its favor, but there is a very widespread feeling across the Atlantic that exhibitions are a nuisance; and the requisite funds cannot be obtained for the completion of the undertaking from a people who refuse to respond to the most pressing invitations for subscription. As a last resource, the Exhibition promoters are going to Congress for a vote of \$1,500,000, or, say, £300,000. The applicants state very plainly that it is their last resort, having failed to get what they need from the people directly, and that without this aid their enterprise may be limited and delayed. There appears thus far to be no party feeling upon this measure, and probably there will be none. The want of money is, moreover, not the only trouble in store for the management.

It will be remembered that foreigners refused to send their goods to America, unless they were permitted to affix the prices at which they could be sold if admitted duty free. This point was conceded without much opposition at the time, but the native manufacturers now find that they cannot possibly compete with foreigners in price, and they are now beginning to utter indignant protests against the publication of any prices. In a word, the protectionists are afraid that the people of the United States will learn so much at the Exhibition that they will rise en masse and crush the party. Already it is rumored that, if the price rule is adhered to, many of the leading houses in the States will not exhibit, while, on the other hand, if the rule is broken, foreigners will not put in an appearance. Altogether things do not look well for the Centennial; and if we may be allowed to use an expressive Yankeeism, it is not impossible that the whole thing may end in a gigantic 'fizzle' after all."—*The Engineer*.

Our esteemed cotemporary is evidently not posted in respect to the "hard pan" of the Exposition. He does not realize that all the buildings are nearly done, that all will be ready before they are actually wanted, that all the arrangements are complete to ensure the success of the Exhibition, and that there is not the remotest possibility of its becoming a "great fizzle."

The Exhibition Company has, it is true, applied to Congress for a grant of \$1,500,000, which, if allowed, will be a convenient plum for the managers, ought to augment the greatness of the affair, and add to its renown. But whether the payment is granted or denied will not materially affect the fact of the success of the Exhibition, since that is already assured.

In applying for this grant, it has been necessary, we presume—it is always necessary in such cases—to make use of a little special pleading. Our cotemporary has probably allowed his ideas of the state of the enterprise to be more affected by this pleading than by the astonishing magnitude of the works and labors that have been actually realized, and which, as stated, place the final success of the Exhibition beyond question.

We regret that our British friends have thought it undesirable to take any very prominent part as exhibitors; but we feel sure that they will flock here in thousands as visitors, and we shall welcome them most cordially. We hope to surprise them by the extent and extraordinary novelty of the display. If good old England is not a great contributor, her people, when they come, will find that her descendants have not been lacking, and that they have appreciated the glorious industrial lessons which she taught them in 1851.

BAMBOO AS A SOURCE OF PAPER STOCK.

The steadily increasing demand for fiber for papermaking has driven our manufacturers to the ends of the earth in search of new fibers. Not a few have looked with longing eyes upon the wealth of raw material going to waste, the world over, in bamboo thickets; and many attempts have been made to convert such fiber economically into paper stock.

Mr. Thomas Routledge, a progressive papermaker, claims that the slow progress made with this plant has been due not to any inherent unfitness of the bamboo, but to the fact that insufficient attention has been paid to age of material used.

Like the asparagus plant, the bamboo is succulent and tender when young, but rapidly becomes hard and woody with age. When mature, it is, as all know, exceedingly dense, and in most varieties the outer part is so hard and silicious that it will strike fire like flint. To convert stems at this stage into pulp, they must be subjected to long-continued boiling in strong solutions of caustic alkali, at high temperature, under a pressure of ten or eleven atmospheres; a process at once difficult, costly, and dangerous.

Mr. Routledge finds that these objections may be obviated, and the bamboo made to furnish excellent fiber cheaply, simply by using the plant when young and green. Before the stems become indurated and woody, a very mild treatment of alkaline baths, at atmospheric pressure, suffices to dissolve the mucilaginous and extractive compounds combined with the tissues, so that the fibers may be readily separated pure and free.

For many years Mr. Routledge has devoted much time to the investigation of new fibers for papermaking, testing both chemically and practically as a papermaker nearly every

known fibrous material; and he does not hesitate to say that no other fiber can approach the bamboo in economy of production, and very few if any in the quality of the stock it yields for the manufacture of paper. And it has the further advantage of being practically inexhaustible in quantity. The bamboo is of extremely rapid growth, and it flourishes in every tropical country. Grown under favorable conditions of climate and soil, it excels every other plant in amount of available fiber to the acre, and there is no plant which requires so little care for its cultivation and continuous production. The estimated yield is twenty times that of flax, hemp, jute, or cotton.

In view of the threatened exhaustion of the supply of esparto, owing to the greed of the native collectors, the utilization of the bamboo promises to be a great public advantage, even if the paper produced from it falls far short of Mr. Routledge's anticipations. The sample furnished—Mr. Routledge's pamphlet on "The Bamboo Considered as a Paper-Making Material" being printed on bamboo paper—shows it to be fully equal, indeed superior, to much of the common and cheap news paper in use. In fineness and strength it surpasses any made use of by our great dailies, and in color all but the *Herald*. It has, however, the serious fault of semi-transparency, the letterpress showing through.

As an essential point in the proposed plan of utilizing the bamboo for papermaking consists in the use of young and preferably freshly cut stems, it will be necessary to have the fiber prepared where the bamboo grows, thus adding a new industry to tropical regions.

OUR WATER SUPPLY.

In 1870 the average daily consumption of water in New York city was 85,000,000 gallons; in 1871, 87,000,000 gallons; in 1872, 90,000,000 gallons; in 1873, 100,000,000 gallons; in 1874, 102,000,000 gallons; in 1875, 107,000,000. As the Croton aqueduct is now used to nearly its full capacity, the demand for water threatens to exceed ere long the amount which the aqueduct can deliver.

About 340 square miles of territory are drained by the Croton river above the dam. On this area the rainfall is sufficient to furnish an average daily supply of 300,000,000 gallons. The actual yield of the river is very much greater, showing that many of the springs which supply its tributary streams are fed from without the Croton water shed. Croton lake, which covers some 400 acres, has a storage capacity of 500,000,000 gallons. The old reservoir in Central Park holds 150,000,000 gallons; the new reservoir, 1,000,000,000, and the distributing reservoir on Fifth avenue, about 20,000,000 gallons: making a total of about 1,670,000,000 gallons. At or near the sources of the tributaries of Croton river, in Putnam county, there are many small lakes, some of them of great depth, which have been converted into natural reservoirs by lowering their outlets. Of these, Lake Glendon covers 182 acres, and will supply 168,000,000 gallons, when drawn down 3 feet; Lake Gilead, 122 acres, drawn down 12 feet will supply 396,000,000 gallons; Lake Mahopac, 603 acres, drawn down 3 feet will supply 584,000,000 gallons; Lake Kirk, 101 acres, lowered 20 feet will supply 528,000,000 gallons; Lake Barrett, 70 acres, lowered 10 feet will supply 198,000,000 gallons; Lake China, 50 acres, lowered 10 feet will supply over 132,000,000 gallons: a total of over 2,000,000,000 gallons.

Besides these natural reservoirs, there is an artificial reservoir at Boyd's Corners having a storage capacity of 2,700,000,000 gallons, and an unfinished reservoir on the middle branch of the Croton which will have a storage capacity of 4,000,000,000 gallons. Thus the supply of storage water amounts to the enormous quantity of nearly 6,000,000,000 gallons, to be increased by the new reservoir to 10,000,000,000. In 1868 there were 9 days when the daily flow of Croton River did not furnish a full supply of water for the city; in 1869, 80 days; in 1870, 107 days; in 1871, 35 days; in 1872, 30 days; in 1873, 109 days; in 1874, 85 days; in 1875, 39 days.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE LARGEST GLASS CYLINDER IN THE WORLD.

Mr. Thomas Degan, of the Union Glass Works in Somerville, Mass., recently made an enormous glass cylindrical shade or cover for a statue which is to be exhibited at the Centennial. The process began by inserting a long hollow iron tube into the pot of molten glass, and by careful manipulation about 75 lbs. of the latter was caused to adhere to the tube. This was then taken to a wooden mold of semi-circular form, in which it was rolled a few times by three men, and thus brought to a white heat. It was then taken to a wooden cylinder placed beneath the floor of the factory; and after it was placed therein, Mr. Degan began the work of fashioning the cylinder to its proper proportion, which he did by blowing through the iron tube and into the body of the glass; while at the same time, two men, guided by a wave of his hand, raised and lowered the glowing cylinder gently but quickly until it came forth finished, and measured 5 feet in height and 74 inches in circumference.

CLEANSING WATER MAINS.

It frequently happens in iron water mains that deposits of rust are formed, sufficiently thick to reduce materially the diameter of the pipe. To clean the interior, Mr. E. Dodds, an English engineer, has lately devised a pipe scraper, which operates as follows: The pipe is cut, the scraper is inserted, temporary joints are made, and the water is turned on at highest pressure, which drives the scraper on at great speed. In the first experiment, a distance of 300 yards of pipe was thoroughly cleansed in 2 minutes and 20 seconds.

CONDENSED MILK FOR CHILDREN.

Dr. Edward Smith, author of an excellent work on "Foods," thinks that condensed milk is not a suitable food as a substitute for pure milk for infants. It is more fattening but less nourishing, and greatly reduces the child's power of resisting diseases. Dr. Smith states that children brought up on impure London-fed cows' milk will resist an attack of acute disease better than children fed on condensed milk.

A NEW REFRIGERATOR CAR.

Very good success has been obtained in preserving grapes by means of a new refrigerator car which has been recently tested on the Union Pacific road. A fan blower attached to one of the axles forces air through ice, and the blast subsequently passes into the car through a perforated pipe at the bottom. After circulating among the fruit, the current returns to the blower and is again cooled. The advantage is the uniform temperature of about 40° Fah., which is maintained inside the car.

JADE.

A number of sales of Japanese and Chinese curiosities have recently taken place in this city, in which were included objects made of a material little seen in this part of the world, and about which little is here known. It is a precious stone, valuable not on account of its scarcity, because in China and Burmah large mines of it exist, but for the great difficulty encountered in cutting and carving it, necessitating an amount of patience and manual dexterity rarely found save among the inhabitants of the celestial kingdom. It is a silicate of alumina called jade, and is obtained in Tartary, various parts of China, and in the Mogoung districts of North Burmah. The true jade is hard enough to cut glass or quartz, and the most valuable pieces are of an intensely bright green hue, the ordinary material being pink and yellow. As many as 1,600 men are engaged in the jade mines of Burmah, and the substance is sometimes found in huge blocks, which three men can hardly move. The crude fragments are cut by means of thin copper disks, used in conjunction with fine silicious grit, composed of quartz and little particles resembling ruby dust. The boring of earrings and bracelets is effected by a revolving cylinder tipped at the free end with the same silicious mixture. The Chinese, with their proverbial ingenuity, make an almost perfect imitation of jade out of rice, the quality of hardness alone being absent.

AN EXPLOSIVE COPPER COMPOUND.

It has long been known that acetylen copper is a very dangerous explosive, detonating on the slightest percussion, and, worse than all, forming spontaneously on the copper pipes formerly employed to convey illuminating gas.

Recently another salt of copper has been prepared, which forms, when mixed with chlorate of potash, an explosive which may be used to fill percussion caps, torpedoes, etc. To a solution of sulphate of copper is added enough hyposulphite of soda in solution to entirely destroy the blue color. Tetrathionate of the suboxide of copper is formed, and dissolved in excess of hyposulphite of soda. To another portion of the blue vitriol solution, aqua ammonia is added until the blue precipitate, at first formed, dissolves to a dark blue solution of ammonio-oxide of copper. The two solutions are now mixed; and after long standing, a violet-colored salt crystallizes out of the beautiful blue liquor, and it is this salt which becomes explosive when mixed with chlorate of potash. The *Polytechnisches Notizblatt*, from which we obtain the above, does not state the composition of the violet salt above referred to, or the probable reason of its explosiveness, whether due to the nitrogen imparted to it by the ammonia, or to the large excess of sulphur, which latter substance, it is well known, when in a free state forms with chlorate of potash a mixture that detonates by percussion.

DEEP RED GLASS.

Pettenkofer, who analyzed the intense red glass used in antique mosaics, proposed to make it by fusing lead glass with about 9 per cent of oxide of copper and 3 per cent protosulphate of copper as a reducing agent. In this case, however, some of the lead is also reduced, giving a dark brown or black color to the glass, and hence Dr. Kayser employs borax as the flux. The following proportions are taken: Clean quartz sand, 60 parts; oxide of copper, 10 parts; protosulphate of iron, 3 parts; calcined borax, 10 parts; calcined soda, 10 parts. A high temperature should be employed during the fusing and reduction, and then it should be moderated to a dark red and kept there some time. When cold, the red glass will be covered with a thin layer of green copper glass.

ACTION OF PROTOCHLORIDE OF TIN ON CHLORATE OF POTASH.

When 2 parts by weight of stannous chloride and 1 part of potassic chlorate, both in powder, are triturated together in a porcelain mortar, the mass becomes heated in a few minutes very strongly. Beside chloric acid, large quantities of vapor of water are given off, and a yellowish white residue remains, which, when dissolved in boiling water and allowed to cool, deposits hypochlorite of potassa in splendid brilliant crystals, while the supernatant opalescent, milky mother liquor contains oxychloride of tin.

TUNGSTATE OF ZINC AS A WHITE PIGMENT.

When a solution of tungstate of soda is mixed with a solution of some zinc salt, the tungstate of zinc is precipitated as a snow-white pigment, that covers well and is recommended to artists that work in oil colors as deserving the preference over all other white pigments.

IMPROVED HAT-MAKING MACHINERY.

The manufacture of felt is a very simple process, and so ancient that it was probably in use long before textile materials, prepared by the comparatively complicated processes of spinning and weaving, were invented. Tradition states that St. Clemens, the patron saint of the hatters, put wool on his sandals to protect his feet, which had become sore by long marches; and he found that, after a short time, the wool became felted together into a fabric. He commenced making cloth by a similar process, and applied the material to the manufacture of hats. But there is reason to believe that the capability, which some kinds of hair and wool possess, of being felted, was known long before St. Clemens' time, as felt goods have been very long in use in China, and the ancient Greeks and Romans unquestionably wore felt hats.

If the hair or wool is capable of being felted, if it will adhere together when subjected to pressure or friction, the process is a very simple one. An examination with a microscope will at once tell if the hair is suited to the purpose: if the hair be smooth, consisting of a single cylindrical fiber, it cannot be felted at all; but the hair of beavers, rabbits, hares, and some other animals possesses, on each principal fiber, points which project obliquely, as shown in Fig. 1. When a mass of such hair is moistened and subjected to heat, pressure will cause the oblique fibers to entangle, and in a short time the hairs will be so intimately connected that a fabric equal in durability to a woven stuff will be formed.

The best hats are made of beaver hair, and hence the cheap silk imitations of the finer kinds are commonly called

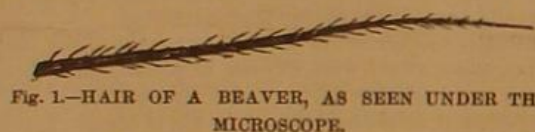


Fig. 1.—HAIR OF A BEAVER, AS SEEN UNDER THE MICROSCOPE.

beavers; commoner qualities are made from the hair of otters, musk rats, and other small animals; and others, still inferior, are made from sheep's wool, but this requires a treatment different from that for hair. Some kinds of hair, notably that of the hare, needs to be treated with a solution of the nitrate and chloride of mercury, and arsenic is applied to the skin before the hair is removed, to better adapt the hair to the felting operation. A very excellent felt for hat-making purposes is made from the fur of a large species of water rat, somewhat resembling an otter; it is a native of South America, and more than a million of the skins are annually exported from that continent for the purpose.

Originally hair was felted by being pressed together into a loosely adhering mass, and then suddenly plunged into hot water. The heat and moisture caused the hair to curl slightly, and the oblique fibers to interlock and hold the mass together in a tough fabric, which was then laid on a flat surface and repeatedly rolled with a round stick; it was then dipped again, and the rolling operation repeated. By this means a very solid sheet of felt was obtained, which, moreover, was quite plastic, and could be shaped over any smooth block, and was therefore well adapted for use in making hats. However, it was long since found that this process was tedious and expensive, and it has been abandoned in all countries where the hat manufacture is of any importance, such as the United States, England, France, and Germany. In these countries, where the trade is one of great extent and value, very expensive and elaborate machinery is employed; and the method now in use in the factories was originated by MM. Laville and Crespin, hatters of Paris, France. It consists mainly in mixing the hair in a series of large boxes communicating with each other. The hair is first conveyed on an endless belt of cloth to a cylinder, provided with fans, and rapidly revolved in the first box, in the sides of which are placed glass windows, through which the hair can be seen kept in violent commotion by the wind from the cylinder fans. The finer hairs soon adhere together, and the coarser, which are unsuited for felting, fall in a drawer in the bottom of the box, from which they are readily removed. The mass of finer hair is then placed on a felting machine, called in French *une battuseuse*. This is done by women, as shown in our Fig. 2, who spread the hair on an endless belt of linen, T, by

which it is carried forward to a pair of rollers, V, which deliver the hair to a large rotary brush placed in the lower part of the case, A. The action of this brush is peculiar, and it forces the hair through the end of the case, A, in which is a long perpendicular slit, in front of which stands a cone, C, made either of sheet copper perforated with holes, or of fine wire gauze, and covered with a cloth which is kept moist. The cone is revolved by a vertical axis, and the air is exhausted from its interior, through the box-shaped base on which it stands, by an air pump. The hair ejected

After the hat is thus made, it needs to be shaped, dyed, and finished, the last operation consisting of polishing, ironing, and trimming. The polishing is done on a machine represented in our Fig. 3, the conical felt being drawn over a metal form and manipulated till it fits tightly. The edge or brim is then worked into shape, and trimmed to the proper dimensions; the hat is then placed on a rapidly rotating block, F, and a wire brush is pressed against it to remove superfluous hair. Pumicestone is applied to smooth the fabric, and sealskin to produce a polish. The lower side of the

brim is finished by putting the hat, inverted, in a hollow form, the rim resting on a projection. The loose hair is removed by an air blast, through pipes, T, by which the hat is kept free from dust, etc., while under treatment.

Although this system, somewhat varied and improved, is in use in this country, the hat-making operations have never been exhibited in any of our industrial exhibitions. The process was shown in Paris, in 1867, and in Vienna, in 1873, and was in each case a very interesting and attractive display, finished hats being placed before the spectators in 15 or 20 minutes after the commencement of the operation. Good practice, however, requires much more time, as the dyeing and subsequent drying are slow processes; and if the felt be hurriedly made, it will not possess much durability. If any

Fig. 2.—HATTER'S FELT-MAKING MACHINE.

through the slit in case, A, is attracted to the cone by the suction; and the revolution of the cone on its axis soon causes it to be uniformly covered with a fine felted fabric. The slit can be closed with a sliding board, by manipulating which the operator is enabled to direct the stream of hair to any desired zone on the conical mold, as shown in the engraving; by this means, any part of the fabric can be made thinner or thicker than the rest. While the right hand of the operator is thus occupied, the left hand is applied to the felt to ascertain its thickness and uniformity; and when the cone is sufficiently and equally covered, the pneumatic action is stopped, and the felt is covered with a wet cloth, or, better, a tightly fitting copper cone, similar to the one within the felt. The cones and the felt are then taken away together, and plunged into a bath of hot acid, which (as before described) causes the hair to become so coherent that it may

of our hat manufacturers have sufficient enterprise to exhibit the system at the approaching Centennial Exposition, they will be likely to interest a very large proportion of the millions of visitors who are expected to throng the buildings.

A Sensible Christmas Present.

The Studebaker Brothers Manufacturing Company, of South Bend, Ind., deserve credit for a very sensible as well as generous proceeding. Just before Christmas, they printed a little circular which was distributed among the seven hundred employees of the concern, and which reads as follows: "In view of the approaching New Year and the coming Centennial Anniversary, it is our desire to present to each of you a copy of some weekly paper (such as you may select) for the year 1876. The year itself will be a memorable one, and full of incidents and interest to you all. We feel also that it will tend to encourage in many of you an increased desire for information, and will be altogether better appreciated by you than the ordinary gift of a Christmas turkey, to be eaten and forgotten." Of course the workmen took advantage of this liberal offer, and as one result a club of new subscribers appears on the rolls of the SCIENTIFIC AMERICAN.

The company suggests that we may approve this course. We do, cordially; we wish more employers would adopt the same plan. We have repeatedly advocated it, and pointed out that employers can do their workmen no better service than to render accessible to them the means of self-education and improvement. This benefits the men directly, for it gives them information both instructive and valuable, and at the same time indirectly, though none the less surely, benefits the givers themselves. Half the strikes and labor troubles between employer and employees have for their basis an ignorant unreasoning spirit existing among the latter. Open up the avenues of knowledge; put in the men's way the newspapers, whereby, under the guise of self-entertainment, they are really educating themselves; and, our word for it, there will be very much less heard of obstinate controversies and uprisings. To give a man a newspaper which keeps him posted as to the progress of his fellow beings, which tells him of new ideas and thoughts, is to lift him superior to his dull routine of every day work. By so doing, you give him something to think about, something which carries his mind far beyond the narrow horizon of his every day existence, and perhaps leads him to the development of new and useful ideas engendered in his own brain. Employers will find money thus expended well laid out; and certainly, viewed as a

gift alone, none could be suggested as more appropriate than one which confers a benefit on the recipient every week in the year.

With four weights of respectively 1 lb., 3, 9, and 27 lbs any number of lbs. from 1 to 40 may be weighed.



Fig. 3.—HAT MOLDING AND SHAPING MACHINERY.

safely be lifted away from the molds. But the felt requires to be made still more dense, which is done by a mechanical process, a kind of kneading being performed upon it by wooden blocks in a machine. This not only condenses the fibers, but causes the cone to diminish in size, till it is sometimes less than one third of its original dimensions.

THE KNOWLES HORIZONTAL MINING PUMP.

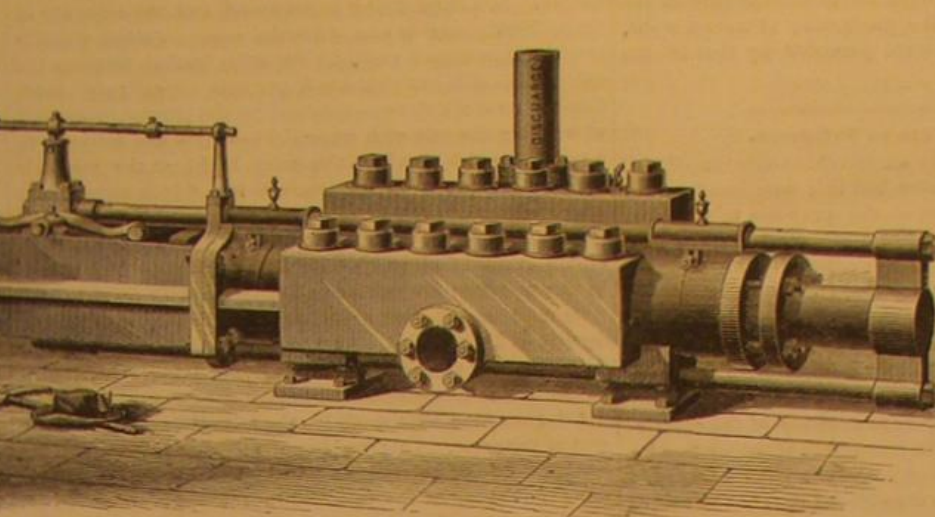
An accidental interchange of the engravings illustrating our article on the Knowles steam pump, in our issue of January 8, exhibited a cut of a different style of pump from that intended to be described, in connection with so much of the description as relates to Fig. 6. The present illustration represents the correct double acting plunger pump referred to. The absence of joints at the water end is here clearly observable. The various parts are accessible, and there is a novel arrangement of valves, by which not only the valve, but also the valve seat, is instantly removable by simply unscrewing the cap nut. These pumps are now working on lifts equal to 1,600 feet vertical column without causing shocks or pounds of any description. Full details regarding the manufacture and trial tests of these excellent machines are given in the article above mentioned.

STEAM HORSE FOR STREET RAILWAYS.

Mr. S. R. Mathewson, of Gilroy, Santa Clara county, Cal., has recently devised a new motor for street cars, an illustration of which is given herewith. The following description, by the inventor, will explain its operation: "The design is to make a machine resembling a horse in form, so as not to frighten the horses on the streets. To this end the form shown is chosen. The motive power is steam, generated in a tubular boiler of from four to five horse power, located inside of the horse and forward of the cab. This drives a rotary engine of my own patenting, which is geared to the driving shaft of the machine. I also propose the use of gas as fuel, so as to do away with smoke. The steam is condensed in cold water carried in a tank of sufficient capacity on top of the cab. Gas is compressed in suitable tanks to a pressure of from 80 to 100 lbs. per square inch, and is used as fuel. The boiler is so constructed as to receive a supply of hot air to feed the flame, the gases from which, after passing around the boiler, are conducted around the engine to prevent loss by condensation. The water is forced into the boiler from the condensed steam chamber. The engine is provided with a brake capable of stopping the apparatus within a space of twenty feet, while under a speed of eight miles per hour."

The inventor points out that the engineer could easily control the machine, and also collect fares and perform other duties usually done by conductors. He claims that the cost of running the apparatus will not exceed one dollar per fifteen hours, that it may be very cheaply constructed,

and that its use would be productive of a very large saving to street car companies. He also states that the weight of the machine will be from 2,800 to 4,000 lbs., and that it will

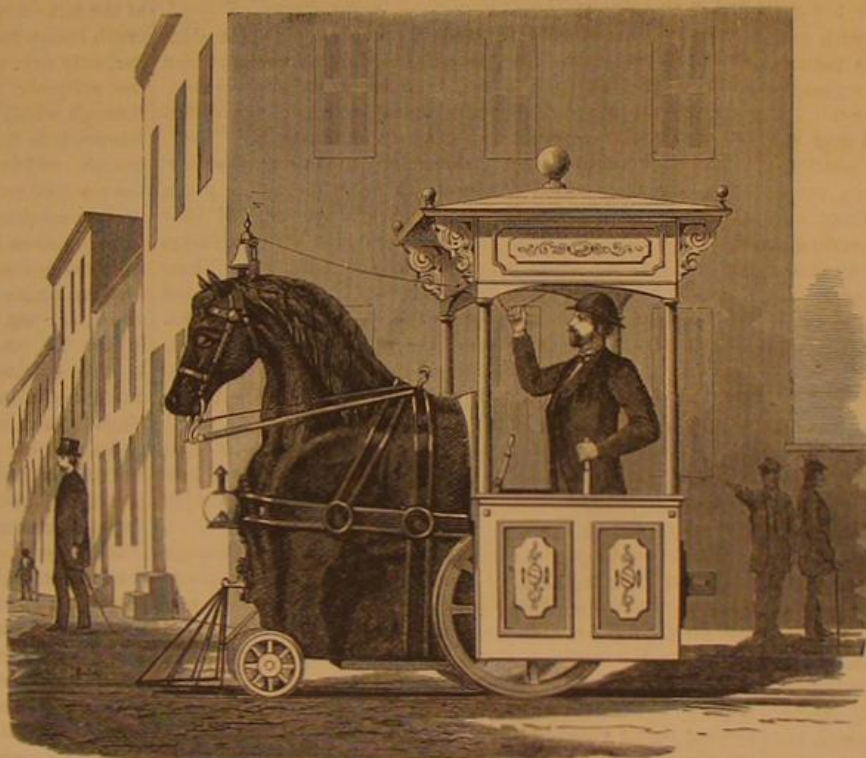


THE KNOWLES HORIZONTAL MINING PUMP.

run at from 4 to 20 miles per hour. A cow catcher is provided, and suitable devices arranged for attaching cars.

A signal bell is fixed above the horse's head; and a lantern in front serves as a head light to give warning of its approach, when the machine is running on dark streets at night.

For further information, address the inventor as above



MATHEWSON'S STEAM HORSE FOR STREET RAILWAYS.

(P. O. Box 110), or Levi Doane, Esq., San Francisco General Post Office, San Francisco, Cal.

The Type Writer.

At a recent meeting of the Society of Arts, London, a machine was exhibited, intended to enable persons to write, or rather print, without using a pen. The *Journal of the Society of Arts* says:

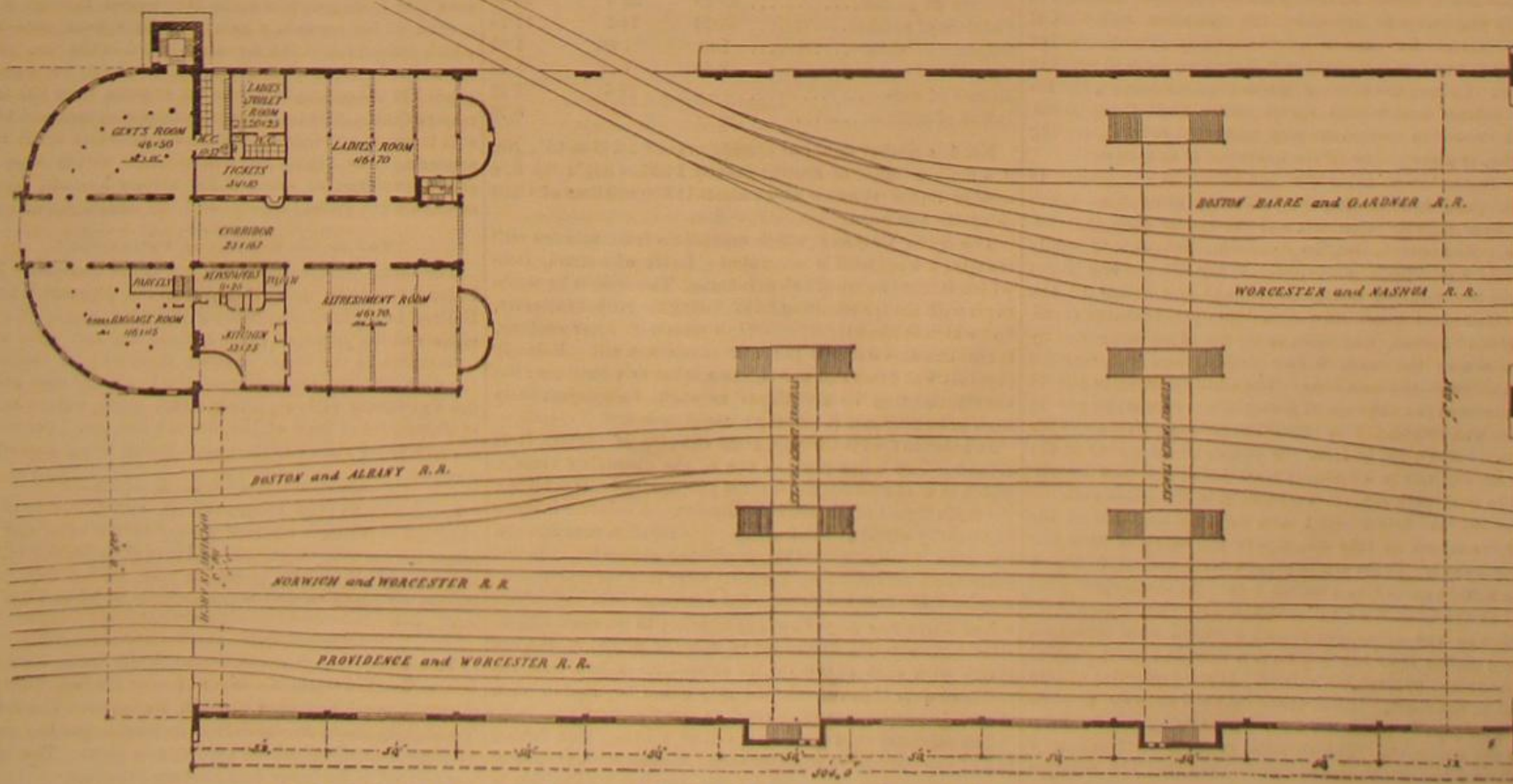
The machine in appearance somewhat resembles an ordinary sewing machine, being mounted on a stand of the size and appearance of a sewing machine stand. In front there is a keyboard with the letters of the alphabet, numerals, etc., upon it; and on pressing one of the keys, a small lever bearing the corresponding letter is caused to strike against a ribbon saturated with a prepared ink, over which the paper is held on a roller. Each letter strikes in the same spot, but the roller with the

paper moves a space forward after each letter, so that it appears on the paper in its proper place. The mechanism is very simple, the levers carrying the letters being actuated by a similar arrangement to that of a piano, and strung on a circular wire so that they all strike into the centre of the circle. By the action of a treadle, as soon as a line is finished, the roller is traversed back to its original position, and at the same time it is revolved one tooth of a ratchet wheel, so as to bring a fresh line under the operations of the apparatus. The type is all small capitals, and the printing is perfectly regular and even. It is stated that, after a little practice, any person can work twice as fast as an ordinary writer, and that a skilled operator can gain a very much greater speed. The machine can be used for manifolding with the ordinary thin paper and carbon paper, some nineteen or twenty legible copies being obtainable. It is an American invention, and has been brought out in London by the Remington Sewing Machine Company.

[Our cotemporary is correct in stating that the improvement originated in this country. It is the invention of Mr. A. E. Beach, of the SCIENTIFIC AMERICAN, patented here in 1856, in which year the American Institute awarded its gold medal for the exhibition of the instrument at the Crystal Palace, this city. The invention is rapidly coming into use in all parts of the world. The original patent has expired. The machine as now made is very effective, and fully realizes all that is said above.—Ed.]

Hydrated Cellulose.

It has long been remarked that, under the influence of acids, cellulose becomes extremely friable. Paper bleached with a too large excess of chloride of lime, and linen submitted to the action of sulphurous acid, which transforms itself into sulphuric acid, may by the least pressure be reduced to powder. M. Girard, after a series of elaborate ex-



PLAN OF THE UNION RAILROAD DEPOT, WORCESTER, MASS.—[See first page.]

periments, concludes that this transformation is due to the fixation of an equivalent of water by the cellulose, and he has produced the hydrate synthetically. It is a white substance, very easily pulverized. M. Girard considers that this hydration of cellulose plays an important part in the economy of nature, and that the production of rotten wood, ulmine, and ulmic acid is always preceded by that of the newly discovered hydrate.

The Manufacture of Saltpeter.

The niter beds of Chili yield an inexhaustible supply of nitrate of soda or Chili saltpeter, but this compound is, unfortunately, unsuited for most of the purposes to which its analogue and near relative, nitrate of potash or common saltpeter, is employed in the arts, and especially in the manufacture of gunpowder. The immense deposits of potash salts at Stassfurt and Kaluss furnish the means of converting the inexpensive nitrate of soda into the highly important nitrate of potash. The following description of a saltpeter manufactory at Semmering, near Vienna, as given by S. Pick, will prove interesting as an example of the contrivances usually employed and the magnitude of the operations.

1. Raw materials: Chloride of potassium from Kaluss and Stassfurt, containing not less than 80 per cent of the salt, is employed. That from Kaluss is very pure and perfectly free from magnesium salts; it is also better to work, because it is not calcined so hard, while the Stassfurt salt often comes in hard lumps which are difficult to decompose. The poorest quality of Chili saltpeter contains 93 per cent nitrate of soda; generally the guaranteed 95 per cent is all there. It is kept in a magazine lined with asphalt, the floor of which has an inclination toward one side of 1 in 100. Along this side is a gutter, likewise covered with asphalt, which leads to a vat, where the lye is collected that drains from the saltpeter, and which is more abundant in winter. The sacks, from which this salt has been poured out, still contain 2-2 to 3-3 lbs. each of salt, and are washed out in vats connected with each other like a Shanks' apparatus, four constituting a battery. As soon as the lye, which is of a dark brown color, marks 42° B., or 1.41 specific gravity, it goes into the factory.

2. The manufacture: The factory is so arranged that the liquids shall flow down automatically as much as possible; hence the reservoirs for water and lye are at the top, somewhat lower down are the dissolving vats and refining and evaporating vessels, then follow the salt filters, the crystallizing pans, and the basins for lyes, from which they are pumped into the highest reservoir again. These basins are on the ground. The room where the crystallization takes place is also covered with asphalt, so that what spatters over can easily be collected.

The decomposition of the chloride of potassium and nitrate of soda is conducted in round cast iron vessels, 8 feet 4 inches in diameter and 6 feet 8 inches deep. They are covered with strong cast iron lids made of three segments and bolted together. A man hole in the lid, which can be closed, permits of the introduction of the raw material and lyes. From another opening a tube 6½ inches in diameter carries off the vapor, and conveys it under the double bottom of the mother liquor reservoir. Through the middle of the lid passes the shaft of the stirrer, which consists of three horizontal arms. The heat is communicated by a stout coil of copper steam pipe 2½ inches diameter, making 8 windings quite near the sides and representing a heating surface of 107½ square feet. The joints are made tight with red lead or plates of copper, caoutchouc, paper pulp, and lead lute last but a little while. To draw off the solution with the chloride of sodium formed, there is a cock of 4 inches opening, which can be blown out by means of a small steam cock attached near the top. Beside this, there are two open 1 inch steam pipes, opening into the bottom of the kettle on opposite sides, which serve to blow out the last portions of the salt and liquor at the end of the operation; and also, if the stirrers get fast and will not move in consequence of putting in the raw material too rapidly, they help to set it in motion. In case the heating worm requires repairs, the solution can be heated with direct steam from these pipes. These dissolving vessels are also employed for evaporating the lyes, and the course of the operation is as follows:

The apparatus is filled with lye which is evaporated to 50° B. (1.53 specific gravity.) During this time much chloride of sodium separates, and the lye, as soon as it becomes concentrated, begins to foam, but this is easily avoided by putting in some oil. When the lye has about reached the required concentration, and has fallen to the level of the first or second worm, decomposition takes place. The crude material is brought to the top of the apparatus by means of a rolling chair, in iron tilting carts and emptied into it through the man hole. The Chili saltpeter is put in first and then the chloride of potassium. It must be put in gradually, because, if it is thrown in too rapidly, it stops the stirrer. From 6,000 to 7,700 lbs. of nitrate of soda and the equivalent quantity of chloride of potassium are decomposed in one operation. After putting in the crude material it is boiled for half an hour; then the total contents of the boiler are drawn off into the filters belonging to each dissolving vessel. These are wrought iron vessels, 8 feet 4 inches square and 5 feet 4 inches deep. At the deepest point each has a discharge cock 3 inches in diameter, which has, like that in the dissolving vessel, a steam cock attached. About 4 inches from the bottom is a wooden bottom pierced with holes and covered with linen. It rests on strips of iron riveted to the sides. In the space between the two bottoms is a steam pipe to warm the filter before using and to keep the wash water hot. The solution remains in this filter 2 or 3 hours; the salt settles to the bottom, and the solution flows off clear into the crystallizing vessels; it has now a

density of 1.63, or 56° B., at a temperature of 203° F. The salt which remains in the filter, and which still contains 12 to 20 per cent nitrate of potash, is next covered with lye from the dissolving vessel, which is filled with mother liquor and heated. In a short time it is drawn off, and has a density of 48° to 50° B., and is run with the other solution directly into the crystallizing vessels. For still further washing the salt, which still contains 6 to 8 per cent of saltpeter, those lyes are used which were obtained by the previous operation of washing the salt with water. These lyes are collected in a receiver which stands at the same height as the reservoir for mother liquor. In the reservoir is a 6 inch copper pipe which conveys exhaust steam from the engine and raises the temperature to 176° F., and thus produces a not inconsiderable evaporation and separation of chloride of sodium. In this reservoir are received all the lyes which are saturated with common salt, but are weak in saltpeter, and have a density of 25° to 30° B. As a rule the salt is washed twice with this, and after the second washing it has a density of 35° B., and is put with the mother liquor for evaporation.

After washing with weak lye, the salt still contains 4.5 per cent of saltpeter. This residue of saltpeter is removed by rinsing it two or three times with hot water, and the solutions thus obtained are collected in the reservoir above described. After the second of these washings, the remaining salt is heaped up to drain; the dry salt is then removed from the filter, and the remaining inconsiderable wet residue goes through again with the next batch. The salt when finished contains 0.6 to 0.9 per cent nitrate of potash, say 6.5 per cent saltpeter and 6.5 per cent water. It is stored in a magazine lined with asphalt, where a good deal of liquor runs off and is collected in a buried reservoir. On account of the large amount of nitrate of potash, it is worked over, so that a considerable part of the saltpeter which was not washed out of the salt is recovered. The author found from 7 to 13 per cent in this liquor.

The solution of saltpeter, made from chloride of potassium and Chili saltpeter, flows, through half round wrought iron gutters provided with sieves, into the crystallizing vessels. They are all provided with mechanical stirrers of two different constructions, part round and part quadrangular.

The quadrangular reservoirs, formerly used for another purpose, vary from 8 feet 4 inches to 12 feet 8 inches in width and 10 feet 8 inches to 24 feet 7 inches in length; and they are 2 feet 7 inches deep. They are provided with pendulum stirrers, making about 12 oscillations per minute. These have the advantage of requiring but very little force, but need an attendant, say one man for all the vessels, to remove the saltpeter attached to the sides of the vessels. It is also unavoidable that, on the bottom, where it is impossible to remove it, a solid crust of saltpeter should form, which does not permit the mother liquor to run through.

The round crystallizing pans are of wrought iron, 13 feet 5 inches in diameter and 2 feet 10 inches deep, and the bottoms are fastened by sunken rivets. They are provided with stirrers attached to an upright shaft.

When cold, the mother liquor is drawn off; it flows, through cast iron gutters united by flanges, into an iron reservoir placed lower down, from which it is pumped into the reservoir on the top floor for evaporation. This reservoir is not heated by the escaping steam from the dissolving vessels alone, but also by the exhaust steam of the engine after it has passed through the lye used to wash the salt. The cold mother liquor should properly have a density of only 35° B.; usually it stands at 37° to 38°, especially in summer. This is because of the chloride of magnesium in the Stassfurt chloride of potassium, which collects in the mother liquor and increases its density, and also because a small excess of Chili saltpeter is used to make the decomposition easier. One hundred volumes of mother liquor contains:

Nitrate of potash.....	29.40	25.5	26.40
Chloride of sodium.....	25.72	14.2	17.18
Sulphate of soda.....	1.31	1.06	1.81
Chloride of magnesium.....	2.10	6.20	8.19
Nitrate of soda.....	—	19.6	7.19
Iodide of sodium.....	—	—	0.76

No. 1, a mother liquor of specific gravity 1.348 at 66°; No. 2, a mother liquor of specific gravity 1.395 at 54½°; No. 3, a mother liquor through which about 11,000,000 lbs. of Chili saltpeter had gone.

The crude saltpeter which crystallizes from solution still contains a considerable amount of chloride of sodium, from which it must be freed before refining. This is done by washing it with the lye resulting from rinsing the refined saltpeter, and which is likewise collected in a reservoir. After washing, it still contains 0.8 to 2 per cent of common salt. Recently this salt was dried and put on the market as a fertilizer; but notwithstanding its usefulness as such, its comparatively high price prevents it making a rapid inroad.

In order to free it entirely from chloride of sodium, it is refined. This takes place in one of the dissolving vessels, which is used exclusively for this purpose, the solvent being the wash liquor of the refined saltpeter. A solution is made of a density of 50° or 51° B., hot. This solution runs through the filter belonging to this dissolving apparatus, remains there two hours, and runs perfectly clear into the crystallizing vessels. As these are of iron, the saltpeter that crystallizes out of them has a yellow appearance; to prevent this 3½ ounces ultramarine suspended in water is mixed in the solution with each 10,000 lbs. of saltpeter. When cold, the mother liquor is drawn off, and may either be used to wash the crude saltpeter or evaporated as occasion requires.

The saltpeter that crystallizes out of this contains from ½ to ¾ of one per cent of common salt. A small amount, in solid lumps, adheres to the teeth of the stirring wheel; this is

picked out and again refined, while the rest of the saltpeter is thrown on the adjacent filters and covered with water. These filters are of wrought iron lined with thin sheet copper, 5 feet high and 8½ feet long, have perforated double bottoms covered with linen cloth, and are provided with a discharge cock. The first rinsing is made in this way; the cock is closed, and enough water run in to completely cover the saltpeter; after a few hours, the lye is run off clean, and a second washing with a little water suffices to render the saltpeter perfectly free from chlorine. The washing is stopped as soon as the wash water shows a density of 10° to 11° B. The crystallization of the refined saltpeter takes place exclusively in the round pans above described, and from 10,000 to 11,000 lbs. of saltpeter is crystallized at once.

When liquor no longer drips from the saltpeter in the filters, it is dried, and then contains from 2 to 3 per cent of water. The drying vessel is a circular pan, 8 feet 6 inches in diameter and 10 inches deep. The cast iron bottom is planed on the upper surface and cast hollow with steam channels through it for heating it. The dried material is taken out through a hole in the bottom 6 inches square, which is usually closed by a slide. In the center of the drying pan is an upright shaft, protected by a ring from contact with the saltpeter to be dried. This carries a series of knives which are pressed against the bottom by means of springs; it also has a scraper, movable vertically to push the dried saltpeter towards the discharge hole; and finally there is a conical iron roller, covered with sheet copper, in a frame that turns with the shaft. This roller is to crush the larger balls of saltpeter.

When the saltpeter is ready for drying, it is conveyed in a tilting cart to the drying pans and dumped into them, while the stirrer is set in motion, the discharge slide closed, and the scraping plate raised up. The stirring knives, by their motion, spread the saltpeter evenly over the heated bottom, and at the same time prevent its burning, while the heavy rollers crush lumps that are caked together. When the saltpeter is perfectly dry, the discharge hole is opened a little way and the saltpeter falls slowly through into a shaking sieve, through which the powder alone falls into a wooden box, whence it is transferred by a copper spiral into a wooden trough, and is then carried by an endless chain elevator to the top floor and emptied into barrels. When the drying pans are almost empty, the slide is opened all the way, and the scraping plate let down so as to sweep the remainder of the saltpeter to the opening. It is impossible to entirely prevent its burning fast and forming crusts, and hence, every 10 or 12 hours, all the burnt saltpeter must be pounded loose. It breaks off readily in large plates. This apparatus, which is also employed in Stassfurt for drying chloride of potassium, has a large capacity; the four pans will easily dry 33,000 lbs. in 24 hours.

Besides this powdered saltpeter, it is also made in sticks, but only in small quantities. Its uses are very limited; it is principally in demand by metal workers, who think its crystalline form a guarantee of its purity.

Refined Chili saltpeter is also made in large quantities and is chiefly employed for pickling meat; it is mostly in large crystals. For this purpose Chili saltpeter is dissolved in the apparatus used for refining other saltpeter, to a concentration of 44° to 45° B., then filtered and crystallized in covered vessels protected on the sides from cooling. As the Chili saltpeter is, besides, very pure, the mother liquor can frequently be used for fresh solution.—*Polytechnisches Journal.*

Recent Balloon Ascent.

MM. Albert and Gaston Tissandier made a balloon ascent from Paris lately, and after a three hours' trip alighted near Illiers, about six miles from Paris. At 800 meters above the ground they entered a solid stratum of cloud 700 meters thick, the temperature being four degrees (centigrade) below zero. At 1,500 meters altitude they passed through a succession of ice crystals, a galaxy of little hexagonal stars, which danced round the car and sparkled in the sun. These did not exist in the lower stratum of cloud, but were suspended in the atmosphere over an expanse from 150 to 200 meters thick. The temperature here was at zero, and higher still it was at six degrees, the masses of white cloud below appearing like Alpine glaciers. Cumuli clouds were perceived overhead at about 2,300 meters altitude, but the aeronauts did not go higher than 1,700 meters, about 1 mile.

The Dutch Exhibit at Philadelphia.

The Dutch Government will show at the Centennial Exhibition a collective model illustrating the progress made by Holland in hydraulic engineering, and consisting of groups of models of the principal great reclamation and other works undertaken by the State. Among them will be shown the Haarlem drainage, the new canal, the Dordrecht steel bridge, the Kuilenberg railway, a new steam pump, copper models of sluices, relief map of the Zuyder Zee, etc. The objects are now being shown to the public before being packed for America.

SOUTHERN STATES AGRICULTURAL AND INDUSTRIAL EXPOSITION.—We have received a copy of the rules and premium list for this exhibition, which is to be opened in New Orleans on February 26, to remain open for ten days. The classes of goods in which competition is invited are very numerous.

THE artesian well at the Collier White Lead Works, St. Louis, Mo., has attained a depth of over 700 feet, nearly all of which depth has been through limestone. The drift is but slightly above the encrinital limestone, and has passed through but little of either sandstone or chert. The boring commenced in the lower Archimedean limestone.

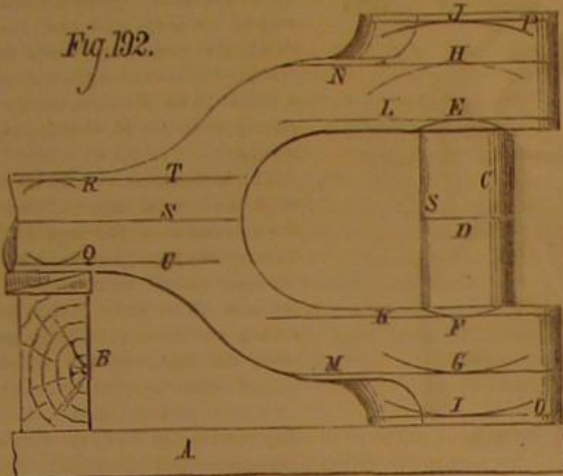
PRACTICAL MECHANISM.

BY JOSHUA ROSE.

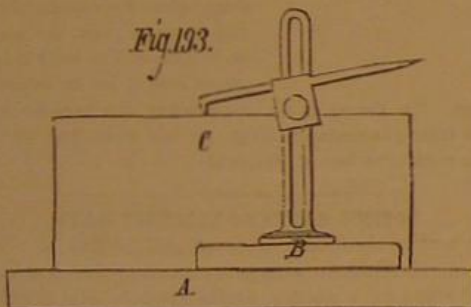
NUMBER XL.

LINING OUT A DOUBLE EYE.

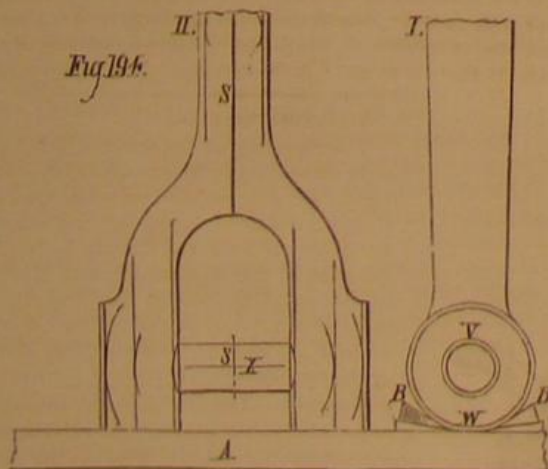
After measuring the dimensions of a double eye to ascertain if there is, upon the outline, surplus metal sufficient to permit of its clearing up all over, we apply an L square upon the outside surfaces, and a T square, with the blade between the jaws, to test if the inside and outside faces are at about a right angle to each other, or if the marking will have to be thrown to one side of the work to accommodate a want of truth in the latter. Presuming that, as is usually



the case, the work is reasonably near to being true, we proceed as follows: Placing the double eye upon the marking-off table, as shown in Fig. 192, we block up the stem end with the pieces of wood, B, so that the horizontal faces of the work will stand about true with the surface of the table, the manner of testing the same being shown in Fig. 193, A representing the marking-off table, and B the scribing block, with the needle placed so that the point of the



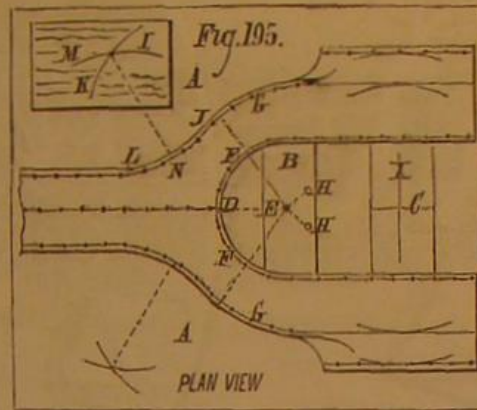
bent end barely touches the surface of the work. The operation is to move the scribing block from end to end of the work and on both sides of it, packing it up until the upper surface is level, and taking care, if the work does not lie level and steady upon the table, to insert wedges in the necessary places so that the work will lie firmly and not move during the operation of marking. If there are projections upon the face of the work which rests upon the table, as is the case in our double eye, it is necessary to pass the scribing block along the under as well as the upper surface of the work; and if the two vary much, we may choose the one that is most true with the other surfaces of the work and set it true; or if, in such case, there would not be enough metal to clean up the work on both sides, we must divide the difference between the two. We then put between the jaws of the double eye, the center piece, C, and find the center of the jaws, as shown by D; then, setting a pair of compasses to half the required width between the jaws, we scribe upon both the jaws the segments of a circle, E and F, using D as a center; then opening the compasses to allow for the requisite thickness of each jaw, we mark the segments of a circle, G and H; and again setting the compasses to the requisite thickness of hub, we mark the segments of



a circle, I and J. We now take a scribing block, and, setting the point just to intersect the extreme diameter in each case, we draw the lines, K and L, M and N, and O and P, thus defining the widths and thicknesses of the jaws and hubs. We then set the scriber point even with the center, D, and then draw the line, S S, which should run a long way up the stem of the double eye, because the shortness of the other lines, running parallel to it, renders it difficult to set the

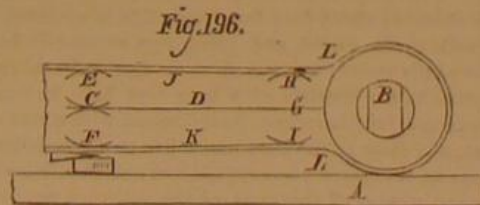
work true by them, and S S is made long to supply the deficiency. After setting the compasses to half the required thickness of the stem, we mark, using the line, S S, as a center, the segments of a circle, Q and R, and from them mark the lines, T and U, which define the required thickness of the stem or rod of the double eye. Our next operation will be to mark off the hole and the circle of the hub, which is done as shown in Fig. 194. Setting the eye upon the marking-off table, A, we wedge it upright, as shown in view 1, by the wedges, B; applying the blade of an L square to set the line, S S (in view 2), true by, we mark off on each side of the double eye the center of the boss or eye, and from that mark off the circles, V and W, denoting the finished sizes of the hole and the eye; then setting the scribing block needle point even with the center from which the circles, V and W, were struck, we mark on the center piece, (shown in view 2) the line, X.

We have now to complete the marking-off of the face shown in view 2, Fig. 194, which could not have been done before, because there was nothing determinate wherefrom to mark off the half circle of the outline between the jaws. Placing the double eye upon the table, as shown in Fig. 195,

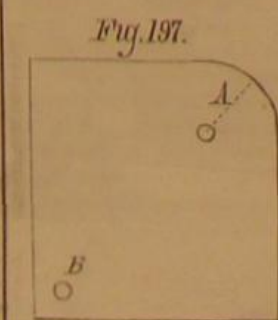


and blocking it up so that it lays level with the face of the marking-off table, and with the face that has been marked off uppermost, we insert between the jaws the center piece, B. We next mark from the center, C, the requisite distance of the crown of the curve, between the jaws, thus obtaining the center mark, D, from the center, C; and setting the compasses to half the required width between the jaws, we use D as a center, and mark upon the center piece, B, the center, E, and strike the half circle, F F, which completes the marking between the jaws. Our next procedure is to mark off the segments of circles, G, G, which are struck from the centers, H, H, respectively. Then taking the block of wood, I, which should stand at about the same height from the marking-off table as does the body of the double eye, and setting the compasses to the required radius, we rest one point on the circle, G, at about the point, J, we strike the mark, K; then placing one leg of the compasses at about the point, L, we strike the line, M, the junction of the lines, K and M, forming the location of the center from which the segment of a circle, N, is marked. Placing the block of wood, I, on the other side of the double eye, we repeat this latter operation, and the marking on that face is complete.

After defining the outline of our work by light center punch marks, we pass it to the machinist's hands to be turned and cut down to the lines, after which we place it upon the marking-off table in the position shown in Fig. 196, A representing the table. At each side of the double

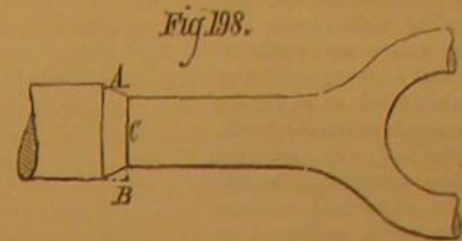


eye we place a center piece, B, and mark thereon the center of the hole with the compass callipers. We then find the center of the shank, C, and, wedging that end up with wood as shown, we set the needle of the scribing block even with the center of the hole, and so adjust the double eye with wedges that the needle point will strike the center of the hole marked on B, on each side, and also the center, C, whereupon we may mark the line, D; then setting the compasses to the requisite distance, we mark from the center, C, the segments of circles, E and F, and from the center, G, the segments of circles, H and I; and resetting the double eye so that the needle point of the scribing block will intersect the extreme outline of H and E, we draw the line, J; repeating the operation on the under side, we produce the line, K, and the operation is complete. The curves, L L,



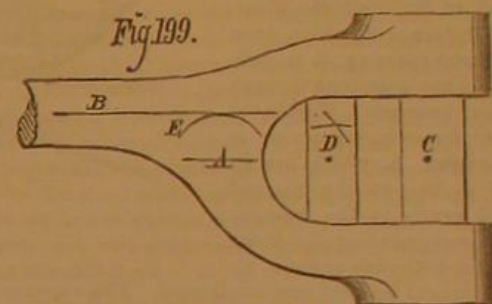
are made to a gage, such as is shown in Fig. 197; it is made of sheet iron about one sixteenth of an inch thick, the outline being carefully marked out and filed up neatly, the corner, A, being made of the necessary sweep, and the hole, B, being used to hang the gage up by. It is well to have an assortment of such gages for use in lining out, as well as for use as guides to the machinist in cutting out the curves or sweeps

When a double eye is forged separate from the rod, the intention being to weld it to its rod after the finishing is complete, which method is adopted for ease in handling the double eye, and because it can then be operated upon in a small lathe or shaping machine, the end of the cut on the stem should be beveled off, as shown at A, in Fig. 198, and



not left square, as denoted by the dotted lines at B, because, if the corner be left square, the jar of the blows given in welding the double eye to its rod would cause the metal to bend in the neck, C, and the resetting with the blacksmith's flatter would be liable to jar the eyes or jaws of the double eye out of true one with the other. Furthermore, if the body of the rod is intended to be forged down to the finished size, and either left rough or merely ground and polished by the grindstone and emery wheel, leaving the corner sharp (as shown at B) would cause the forging to leave a mark round the body of the stem, at C, giving it the appearance of being cracked.

To assist the operator in marking out, the centers from which all curves and circles on detail drawings are struck should have a small circle in red ink marked around them, and a dotted red line marked from the center to the circle or segment of circle struck from it, as shown in Fig. 195. If the double eye is, however, intended to have an offset, as shown



in Fig. 199, we draw from the centers, C and D, the line, A; and setting the compasses to the amount of the offset, we draw the segment of a circle, E, using the line, A, as a center; and from the extremity of that segment, we draw with the scribing block the line, B, which will represent the center line of the stem of the double eye, the rest of the operation being as shown in Fig. 192, and described in the accompanying explanation, from the point at which the line, S S, in that figure was drawn.

Rising in the World.

Experience continually contradicts the notion that a poor young man cannot rise. If we look over the list of rich men, we find that nearly all of them began life worth little or nothing. To any person familiar with the millionaires of the United States, a score of examples will occur. On the other hand, the sons of rich men, who began life with the capital which so many poor young men covet, frequently die beggars. It would probably not be going too far to say that a large majority of such moneyed individuals either fail outright or gradually eat up the capital with which they commenced their career.

And the reason is plain. Brought up in expensive habits, they spend entirely too much. Educated with high notions of personal importance, they will not, as they phrase it, stoop to hard work. Is it astonishing, therefore, that they are passed in the race of life by others with less capital originally, but more energy, thrift, and industry? For these virtues, after all, are worth more than money. They make money, in fact. Nay, after it is made, they enable the possessor to keep it, which most rich men pronounce to be more difficult than the making. The young man who begins life with a resolution always to lay by part of his income is sure, even without extraordinary ability, gradually to acquire a sufficiency, especially as habits of economy, which the resolution renders necessary, will make that a competence for him which would be quite insufficient for an extravagant person. It is really what we save, more than what we make, which leads us to fortune. He who enlarges his expenses as fast as his earnings increase must always be poor, no matter what his abilities. And content may be had on comparatively little. It is not in luxurious living that men find real happiness.

THE Belgian *Moniteur Industriel* says that an engineer, having a piece of very hard bronze of large diameter to turn in the lathe, could not succeed in cutting it with a tool of any kind or temper, until he kept the tools constantly moistened with petroleum, when they cut with readiness. He says, that by using a mixture of petroleum and spirits of turpentine, steel with a straw-colored temper can be worked perfectly well. The experiment certainly can be easily tried, say in turning chilled car wheels.

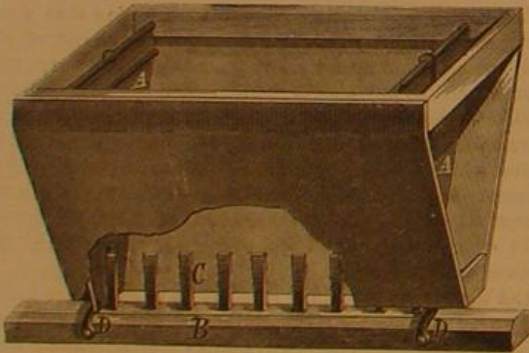
The Hon. George Bancroft told a reporter of the *Philadelphia Item* recently that the coming Centennial Exhibition would in every respect excel any international exhibition ever before given. He thinks it will drive away hard times and encourage immigration to an astonishing extent.

IMPROVED COTTON PLANTER.

In the annexed engraving is represented an improved cotton planter, which plants two rows at a time in drills, distributing the seed in the same manner as a grain drill distributes grain. The rows may be made three, three and a half, or four feet apart at pleasure. The drill teeth for planting cotton are easily removed, and as many cultivator teeth substituted as to fill the entire space between the teeth, the latter of any required form, thus converting the machine into an efficient cultivator. The teeth preferred by the inventor are of his own construction, and can be set either to run shallow and just shave the top of the ground or to penetrate to a depth of six or eight inches. Ordinarily one horse is able to draw the machine. When deep cultivating is to be done, a pole may be used so that two horses may be attached. By leaving out one or two of the middle teeth, two horses may be used in cultivating young cotton or corn, by straddling the row.

A general view of the implement in use is given in Fig. 1. Fig. 2 represents the improvement in the hopper, designed to facilitate the planting of cotton seed, which, from its fibrous covering, it is difficult to cause to descend through ordinary passages. Within the hopper are swinging plates or diaphragms, A, which are pivoted to bars at the top and extend nearly to the bottom. B is a reciprocating stirrer rod provided with pins or teeth, C, which project upward into the hopper. The object of these pins is to facilitate the working down of the seed. The stirrer rod is hung in stirrups in the lower ends of pendent bars, D. By means of the cam arrangement, E, on the wheels, Fig. 1, the stirrer rod, B, is vibrated, and also the diaphragms, A. The seed in the hopper is, by the latter, given an alternate vibrating action from end to end of the receptacle, this movement increasing in intensity toward the bottom, at which point the ends of the plates have the greatest

Fig. 2



swinging motion. The seed is thus freely delivered; and when mixed with fertilizers, its distribution is in no wise hindered.

Patented October 28, 1873. For further particulars, relative to rights to manufacture, etc., address the inventor, Mr. Pierpont Seymour, East Bloomfield, Ontario county, N. Y.

IMPROVED VISE.

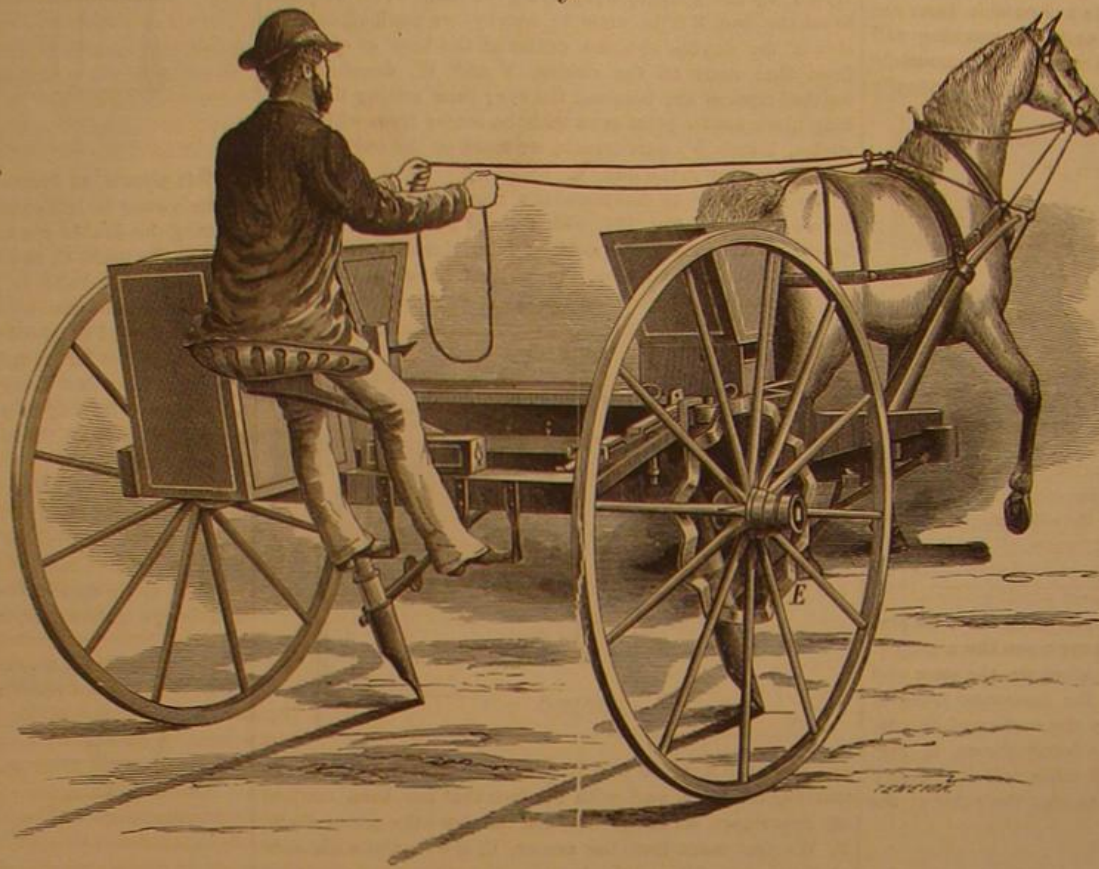
The vise is one of the oldest and most familiar tools extant, and has been the subject of great numbers of patents. The following is a description of one of the best improvements on this indispensable appliance. A vise, to attain and retain a position as a standard with mechanics, must supply the following qualifications: Strength to allow of chipping or filing the work without a possibility of the vise breaking; the inertia of the anvil should be sufficient to absorb the effect of blows; the jaws should move parallel and freely, and should be arranged in such a manner as to get the whole power of the screw; all parts should be durable; and lastly, the tool should be furnished cheaply.

The accompanying engraving represents an excellent form of vise devised by Mr. H. B. Smith, one of the earliest and most successful patentees of woodworking machinery. An inspection of the engraving will show how the foregoing requirements are supplied. The jaws are steel-faced by welding, and massive strength and inertia are secured by a proper and plentiful use of metal. The motion is direct, and all

surfaces exposed to sliding friction are chilled, thus gaining parallel action, durability, and increased strength. The chill is shown by the mottled appearance, seen on the beam, and is one of the principal improvements claimed. Cheapness is secured by special machinery, which enables

killing the fish outright; but occasionally the animal is not sufficiently hard hit, and its capture is not so easily effected, as it dashes away at a tremendous speed, dragging the steamer after it.

Fig. 1.

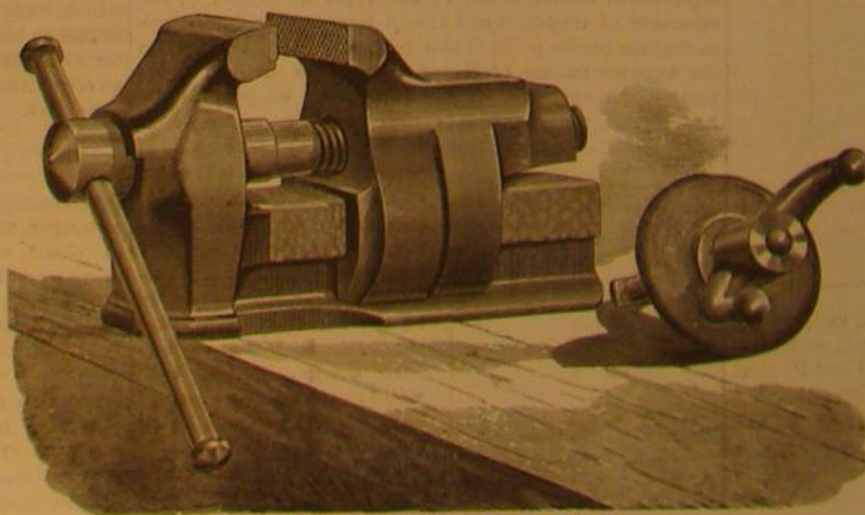


SEYMOUR'S COTTON PLANTER.

the vises to be quickly and economically made. The manufacturer can be addressed at Smithville, Burlington county, N. J.

Whale Artillery.

On a small island opposite to the town of Wadso, in the extreme north of Norway, there exists an establishment the like of which is probably not to be met with in any part of the world. Its most appropriate designation would be, perhaps, a slaughter yard for whales; and Mr. Foyn, its proprietor, conducts the business of capturing and cutting up the monsters in a manner peculiarly his own. Instead of fitting out the usual sized vessels, intended to make long voyages and bring home only the most useful parts of the animal, Mr. Foyn employs small—one hundred and fifty to one hundred and eighty tons—screw steamers, shoots his fish with a cannon, and has them towed back, one by one, as they are captured, to the shambles at Wadso. As the fishing grounds are within easy reach of the latter, the steamers, as a rule, secure and return with a prize within twelve hours' time. With respect to the cannon employed, it is a gun having a chamber about four feet long; this is mounted on the fore-castle of the vessel, and, being very accurately balanced, can be easily moved to allow an exact aim to be taken. The projectile in use consists of a long iron bolt, having at its extreme end four harpoons, bound round with a line so as to be flat, and close to the harpoons a five or six pounder shell. As soon as the steamer has approached sufficiently near to the fish—and whales off that part of the coast are not over shy, allowing a vessel to come within shot—the bolt is fired off, and, if well directed, penetrates deeply into the flesh and blubber of the animal. The whale then naturally rushes off at a furious pace, thinking thus to elude his pursuers. Unfortunately for him, however, no step could be more suicidal, for the effect of his rapid movement is to make the bolt slip back a little, thus setting free the four harpoons from the lines, and, by means of a mechanical arrangement, causing a shell to explode. This generally proves the coup de grace.



SMITH'S IMPROVED VISE.

Pedestrian Training.

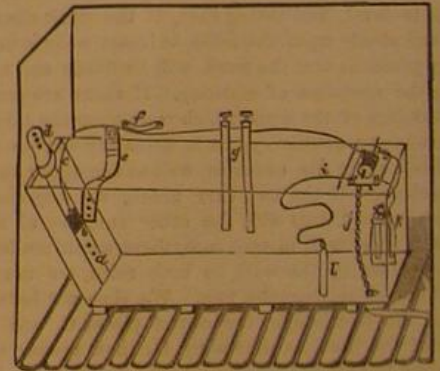
Pedestrianism, as an athletic exercise, has become deservedly popular. There is no course of gymnastics so well calculated to develop a large number of muscles, or to produce so beneficial an effect upon the system. There is a right way and a wrong way of walking—the one beneficial, the other negative in its result. What the right way is, a writer in an English contemporary tells us in the following:

The body must be held erect, with head well thrown back; the movement of the legs must be from the hip downward, and the body should be carried motionless. The arms should be swung well forward in harmony with the legs, and the elbow should, when in front, be nearly on a level and at almost right angles with the chin, the hands being open and extended. The leg should be brought well round from the hip, and the heel deposited on the ground in line with the rear foot, so as to leave your footmarks pretty nearly in a line. But above all things hold your head up and the body erect.

Stitches and other kindred annoyances are common in learning to walk, but the beginner would do well to walk it off, and never ease if he is seized with distress. To do so is to throw away the pace he has acquired from the commencement of his walk, and to knock all the regularity out of his stride.

POTIN'S GALVANO-ELECTRIC BATH.

The bath is blue slate, grooved and bedded in with red lead, and cramped up with iron cramps or nuts and bolts; it should stand on a wooden cradle either of elm or oak, and be protected by matchboarding all round; the floor should be tiled if on the basement, and covered with zinc if above. *a* is a board with holes to raise or lower the zinc plate; it is



grooved at the sides, and enters into the slate at the bottom of the bath by two iron pegs. *b* is a zinc plate; *c* a copper wire; *d* a flannel cushion for the head; *e* is a three inch webbing to support the head or nape of the neck; *f* is a handle, *g* hot and cold water taps with gutta serena tubing attached; *h* is a coil resting on the board; *i* is a copper wire in connection with carbon; *j* is a chain to lift up the plug; *k* is an acid and zinc cylinder, etc., which can be fitted up outside of the bath if there is room; *l* is the carbon.

Scientific Surveys.

The Secretary of the Interior, in his annual report, says: The results of the geological and geographical survey of the Territories, conducted during the past session by Messrs. Hayden and Powell, under the direction of this department, will, it is believed, equal in interest and importance those of any previous year. The survey, under F. V. Hayden, continued its labors of the two preceding years in the Territory of Colorado. The survey of the southern and southwestern portions of Colorado has been completed. The total area surveyed was about 30,000 square miles, portions of which were rugged. The exploration of the remarkable pre-historic ruins of Southern Colorado, glimpses of which were obtained the preceding season, was continued with great success. The survey under J. W. Powell continued the labors of the preceding year in the Territory of Utah. Nearly 10,000 square miles of country were surveyed during the season just closed.

THE GARDENS AT SCHONBRUNN.

The gardens at Schönbrunn, the Emperor of Austria's palace, situated about 1½ miles from Vienna, are renowned for their extent and beauty, and also for their completeness, the botanical collection being one of the finest in the world. They also contain a large and important menagerie, and a system of waterworks and fountains. We give herewith a view of the gardens, selected from the *English Garden*; and a correspondent accompanies it with the following remarks:

"The creation of ornamental gardens in all parts of Europe, and, in fact, throughout the world, is becoming a matter of common occurrence. Not only are private gardens, of great importance in an artistic point of view, being formed, but also public parks and gardens of great extent; and this is calling into requisition the highest talent at command in that department of horticultural art. In the gardens of the Château of Schönbrunn, cropped masses of trees serve as grand walls of verdure, in which niches are cut for statuary; and one of these artificial avenues, that represented in the illustration, leads to the beautiful spring *Schöne Brunnen*, from which the name of the original castle was derived. The spring is now enclosed in an elaborately wrought marble framework, and the center of the basin is decorated with statuary, after the manner employed at Versailles. The gloriollette, a temple displaying a colonnade, is seen in the distance, rising above several lofty walls of foliage, in front of each of which are shrubs of lower stature, which are left to assume their natural growth; and the contrast between the trimmed and the untrimmed forms is far from displeasing. The magnificent gardens attached to the Château Schönbrunn, from the great height of the vast walls of verdure above alluded to, the profusion of statuary, and other decorative objects, so placed as to produce the best possible effect, form grand models of the formal style of treatment, and are well worthy of the careful study and earnest attention of every practitioner of the art of decorative gardening on a large scale."

Electric Pile in Sesquioxide of Iron.

This apparatus is contained in a square glass jar. The pile is composed of a prism of charcoal which contains sesquioxide of iron in its pores, and a small rod of amalgamated zinc. The latter passes through the stopper, to the under surface of which is fixed the charcoal. A solution of ammonium chloride is used as the exciting fluid. The reactions are the same as in Léclanché's couple, in which oxide of manganese is used. When the circuit is closed, the chloride of ammonium attacks the zinc, forming a double chloride of zinc and ammonium. The latter, on being set at liberty, decomposes the sesquioxide of iron, carrying off a part of its oxygen and forming free ammonia, which disappears by evaporation. This pile ceases to act so long as the circuit remains open. Its durability and force are large. Its electromotive power is as 12 to 10 of the sulphate of copper bat-

tery, and it is thus well adapted for industrial purposes. The inventors are MM. Clamond and Gaiffé, and it is manufactured by the latter gentleman.

The Chilian Exhibition.

The annual festivities in commemoration of the National Independence of Chili have this year commenced with the formal opening of the International Exhibition at Santiago. The ceremony of inauguration was held in the beautiful park in front of the main building, the guests assembling in a spacious and ornamental pavilion erected for the occasion. Passing through the vestibule, the first impression on entering the central hall is a little disappointing. The interior is spacious, but rather cold in its decoration. It is 150 feet in length, about 60 feet broad, and 50 feet in height; it is well lighted, and, had it been filled with more artistic manufactures, would have formed the center of attraction. The space, however, is devoted exclusively to German goods, and the show is decidedly poor and wanting in effect. A trophy of leather in an oak case breaks the vista down the centre; on either side are pianos and some organs, and further on are glass cases containing toys, and ornamented above by bird cages. There is hardly time to examine the objects exhibited in the remoter parts of the hall, but a glance towards the sides shows that, beyond the toys and other bazaar-like articles, are displays of goods from German manufacturers which will compete with Sheffield, Birmingham, and other industries. In the south gallery are displays of needlework and embroidery by the pupils of various charitable institutions. And beyond there is a splendid collection of Chilian mineralogy, prepared by Señor Domeyko, who has been indefatigable in his efforts. The excellence of the classification and display causes the visitor to be immediately impressed with the variety and richness of the mineral products distributed throughout the republic. In the same gallery is exhibited a collection of all the native woods, with a description of their properties and uses. In the quadrangle, under an iron roof, the educational apparatus is displayed, which includes the exhibition of the College of Agriculture, and the space is filled with working models of farming machinery, skeletons and diagrams of animals, and cognate aids to instruction. In the quadrangle on the corresponding side are objects from San Salvador and Brazil. The machinery annexe is of corrugated iron with the sides open, in length 500 feet, and about 60 feet across. A central platform over the revolving shafting passes from one end of the building to the other, and enables visitors to inspect the machinery working below. The machines exhibited are multifarious; the sawing mills of the Canadian Watercourse Company attract a good deal of attention. Mining, hauling, pumping, pressing, and farming machinery occupies the whole of the space. At the end of this building is an annexe belonging to Messrs. Robey & Co., where they exhibit agri-

cultural machinery, and further to the west is the machinery of Ransome, Sims, & Co. Crossing over the grounds to the eastern side, we come upon the annexe of Messrs. Rose-Innes & Co., similar to the building on the west, but closed at the sides. This is the only part of the exhibition which is absolutely completed. On entering we come into a large room ornamented with trophies of steel tools and manufactured articles. A fine stand of plated goods of James Dixon & Sons, of Sheffield, is prominent; beyond, a stand of Rodgers' cutlery, crucibles of the Plumbago Crucible Company, and articles of dozens of other well known English makers attract the attention. Side by side with the English tools of Firth and others are those of the Douglas Axe Company and other American makers. Two small doors lead into the machinery department, and here again the display is representative from the number of English manufactures brought together. Here are the ponderous thrashing machines of Clayton, Shuttleworth & Co., and near stands a Pitt's thrasher, less substantial, but much more easily moved. Besides the agricultural machinery, there are mining pumps, sawing machinery, and presses, all in full work; four or five small steam engines are under steam, besides the one driving the central shafting. Emerging at the further end, we come upon a small model of a mineral line, with a tiny train making the ascent of a very steep incline, carrying with it the operator in the car. The line has a center cogged rail, and the locomotive an extra cog wheel to supplement the ordinary driving wheels when a severe gradient has to be passed. The model is exhibited by Clark & Co., the concessionaires of the Transandine Railway, which is to connect Valparaiso with Buenos Ayres; and the last annexe is occupied by English and American machinery imported by that firm.

German Exhibition in 1878.

An exhibition of somewhat unusual character will be opened in Berlin in 1878, the plans for it being already under discussion by an executive committee. Its object being to show Germans what Germans can do, and therefore in what points head can be made against foreign competition, the whole arrangements will be strictly national. The exhibition will be classified in twenty-one groups, and prizes will be awarded in medals distinguished as for production, manufacture, commerce, art, science and education. Workmen's models will also be issued.

Exhaustion of the Soil by Apple Trees.

The author calculates that, in a life of sixty years, an apple tree removes from the soil 60 lbs. of nitrogen, equal to 11,500 lbs. of farmyard dung. To maintain the soil in condition, therefore, about 175 lbs. of dung ought to be annually given per tree during the fifty years that it is in bearing.—*M. I. Pierre.*



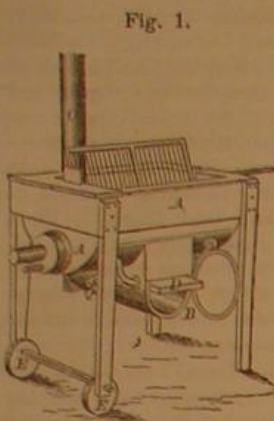
THE IMPERIAL GARDENS AT SCHONBRUNN, AUSTRIA

CHEESE AND CIDER MAKING AND LARD RENDERING.

Continuing our series of abstracts from Knight's "New Mechanical Dictionary," we give herewith illustrated descriptions of various apparatus used in the operations named in the above heading. The necessity for preserving a certain temperature in

CHEESE VATS

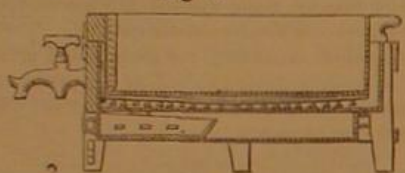
has given rise to numerous devices, among which may be cited that illustrated at A, in Fig. 1. The vat is here semi-cylindrical and double walled, water being contained between the shells. Under the vat is a furnace, B, for heating the water, the smoke escaping by chimney, C. D is a damper for regulating the heat applied to the water, and said heat is equalized by a coil of circulating pipes connecting the water space at the center and ends of the vat. To aid in drawing off the water and whey, and discharging the curd, the machine is set on eccentrics at E. The wire frame shown cuts the curd into small blocks and sweeps it from the inner surface of the receptacle. The vat used in making Parmesan cheese in Italy is also represented in Fig. 1. It is a copper caldron slung from a crane over a conical fire place. In this the milk is heated and coagulated, and, without removing, is broken by a stick having cross wires. The curd is then again heated, taken out,



Cheese-Vat.

drained, salted, pressed, and in forty days is moved to the cheese loft.

Fig. 2.



Cheese-Vat.

In Fig. 2 the pan is hinged to the vat and rests upon pins within it. The contents are warmed by a furnace beneath, and the whey is drawn off by a strainer. Adjustable legs permit the inclination of the vat.

Fig. 3 represents two

CHEESE PRESSES.

the upper one of which is constructed of iron. The hoop containing the curd is placed in the bottom plate, A, and the upper plate, B, is made to descend upon it. On the axis, C, of the wheel, D, there is a pinion of eight teeth which works in a rack, R. On the axis, E, there is another pinion of eight teeth which acts in the wheel, D, of twenty-four teeth. This axis, E, may be turned by the crank handle, H, three turns of which will make the rack descend through a space equal to eight of its teeth. In this way the plate, B, may be lowered to touch the cheese, and to commence the pressure; but when the latter becomes considerable, the second method of acting upon the rack is resorted to. On the axis, E, besides the pinion before mentioned, there is a fixed ratchet wheel, F; the lever, I, which embraces F, is also placed on this axis, but turns freely round it. A pawl, turning on the pin, may be made to engage in the notches of the ratchet wheel, F. By means of this arrangement, when I is raised up and the pawl engaged in F, the axis and its pinion will be turned round with great power on depressing the end, I, of the lever; and by alternately raising and depressing I, any degree of pressure required may be given to the cheese, and continued by the suspended weight, W.

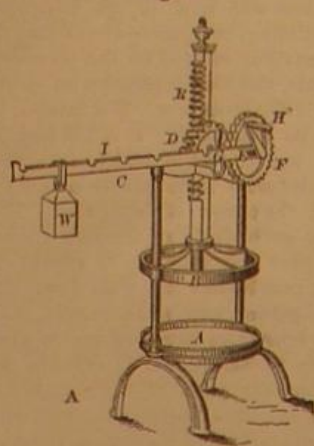
The pneumatic cheese press, B, shown in the lower part of the same figure, consists of a stand about three feet high, on the top of which is a metallic vessel, a, forming a hoop for the curd. This vessel has a loose corrugated bottom covered with wire cloth. The bottom of the vessel communicates by a pipe, c, with a receiver, d, which is exhausted of air by means of an air pump, b, and pipe, e. The curd being salted and placed in a cloth in the vessel, a, the pump is worked, and the pressure of the atmosphere drives the whey down through the curd, and collects it in the receiver, whence it is discharged by the faucet, f. Another form of press, shown in Fig. 4,

involves the use of the toggle, as the leverage increases as the platen descends. The weight is suspended by a chain which runs over the pulley on the end of the long arm of the toggle. A hand lever operates the screw for quick movements. A variety of

CIDER MILLS

is given in Fig. 5. The common cider mill, a, used in the

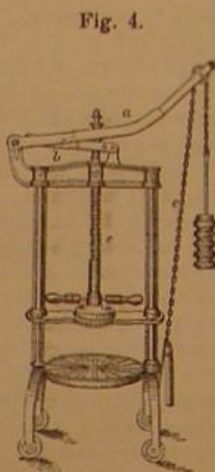
Fig. 3.



A



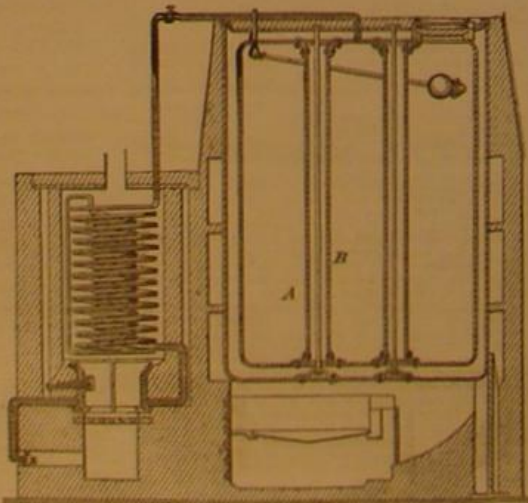
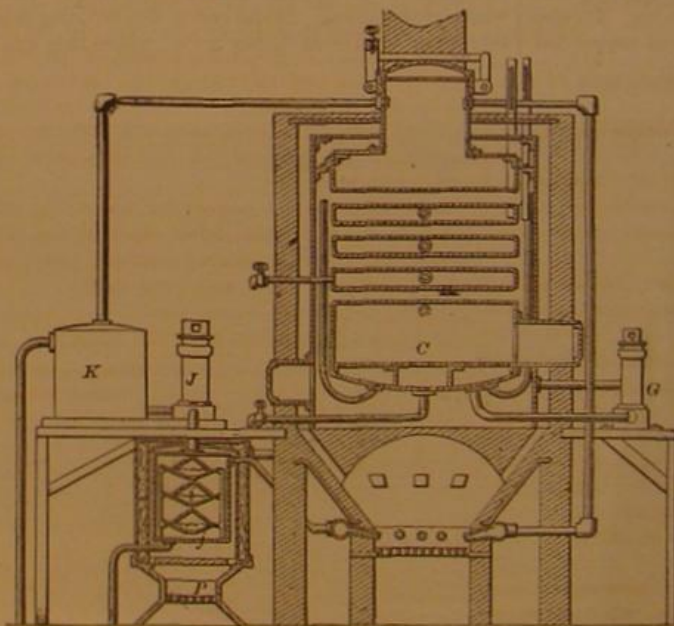
Cheese-Presses.



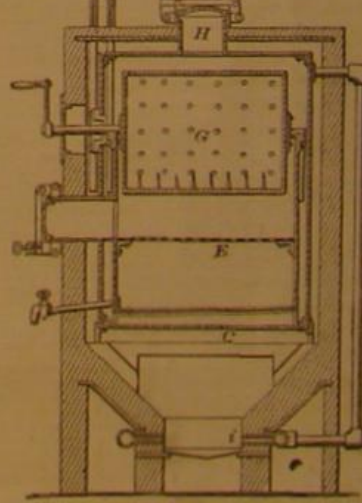
Cheese-Press.

southwest of England, has a cylindrical stone, weighing one or two tons, and rotating in an annular trough of masonry. The axis of the stone is connected by arms to a sweep, which is pivoted on a central post, and revolved by a horse. In some cases the central space forms compartments for holding apples. The cider mill, b, used in the south of France, has a platform of boards framed together, and is traversed

Fig. 6.



Everett's Lard-Rendering Tank.



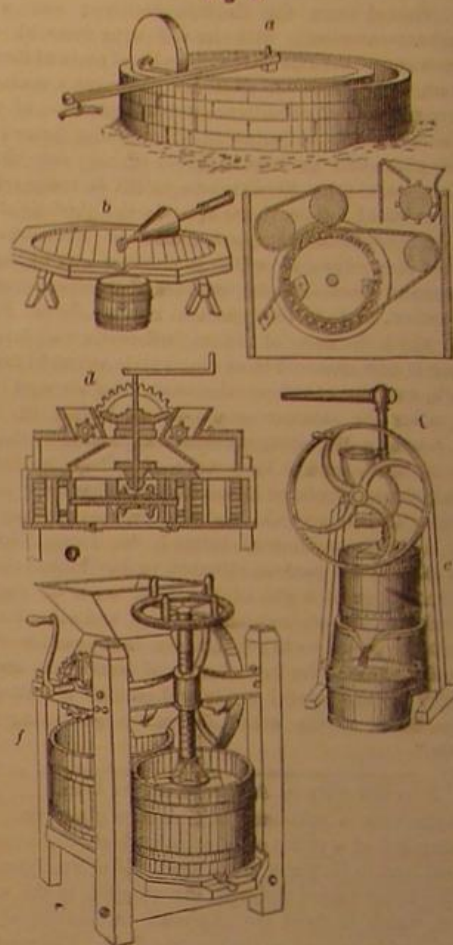
Broadnax's Lard-Tank.

by a conical frustum of cast iron. The axis of the latter is hooked to a rotating eye in the center of the platform, and is swept around by manual power, crushing the fruit in its passage.

The mill, c, has a grinding wheel and concave, and an apron which carries the pomace between two pressing rollers, and a wire screen through which the juice runs. d has

alternate grinding portions, and a double-headed platen which presses the pomace against the ends of the box alternately, one end of the box is filling while the other is pressing. e has a metallic grinder and a hoop with a screw. f has a grinder and presser which may act simultaneously. A hoop filled with grindings is pushed from below the hopper to be

Fig. 5.



Cider-Mills.

neath the screw, and an empty hoop substituted beneath the former.

LARD TANKS

are vats in which fats are cooked to obtain them free from watery matters and membrane. We give three forms of the apparatus in Fig. 6. Everett's tank (left lower part of figure) has a digester containing the fat, which is surrounded by an outer shell constituting a hot water and steam space, to which it is connected by stay rods, which unite the water space at bottom with the steam space at top, and pass through the vertical flues, A B. The vapors from the digester, charged with odors and organic matter, pass through a pipe at the top of the apparatus into a superheating coil over the furnace, into which they are finally discharged to be consumed. A spiral flue surrounds the outer case of the boiler.

Broadnax's apparatus consists of an exterior casing, in which the digester (which may be of the form shown either in the upper or lower part of the figure) is placed. In the first it is stationary, and consists of an inner and outer shell, between which and through the flues in the inner one, A A, the heat circulates. The rendered fat in a fluid condition descends from shelf to shelf, and is strained through the perforated bottom, C, whence it is drawn off. The furnace has an inclined flue at each side, through which the products of combustion pass to and around the digester. Gases from the latter are delivered into the furnace. This may be effected as shown in the upper figure by an air pump, J, and condenser, K, by which the gases are forced through a cylinder, heated by grate, P. In the cylinder the watery particles are condensed by a series of plates, i j, and drawn off by a pipe. The dry vapor ascends through another pipe, to assist in heating the furnace. In the lower figure the perforated digester, G, is mounted on trunnions and rotated by a crank. The oil exuding is strained through the diaphragm, E, and the gases pass through the pipe, i, to the furnace. H is the charging manhole, situated on the top of the apparatus.

Inventor of the Piano.

A committee has been formed at Florence for the purpose of celebrating, next May, the centenary of Cristofori, the inventor of the piano. The principal feature of the celebration will be international concerts on a grand scale. The Abbé Liszt has promised to play.

(For the Scientific American.)

THE NATURE OF THE NEWLY DISCOVERED FORCE.

BY GEORGE M. BEARD, M. D.

In my letters to the *Tribune* and in my lecture before the Polytechnic Club, I advanced a theory of the force recently discovered by Mr. Edison, that might perhaps ally it to electricity, though not to any known form, and account for its non-polarity and other phenomena exhibited by it. This theory I suggested and used merely as a temporary working hypothesis. At the present time, the weight of evidence in my mind is in favor of the theory that this is a radiant force, somewhere between light and heat on the one hand and magnetism and electricity on the other, with some of the features of all these forces. Experiments of the following kind are of themselves powerful arguments in favor of this theory:

When the wire conducting the force from the battery to the dark box is divided in the air, and the ends are separated even a sixteenth of an inch, no spark appears in the dark box. Lay these ends of the wire on a semi-conductor, as wood, and the force will pass when they are separated a moderate distance. Place small pieces of tinfoil about these ends as they are suspended in the air, and the force now passes one inch or perhaps several inches through the air. Place pieces of tinfoil of larger surface about these ends, and separate them a wider distance, and the force will yet pass. Make the surfaces of tinfoil larger still, until they are a foot square or more, and the force will travel several feet through the air. Prepare three large pieces of tinfoil, place one piece on each end of the divided wire suspended as before, and the other piece about equidistant between them; and still the spark may be seen (though faintly and irregularly) in the dark box. The force must jump from the piece of tinfoil at one end of the wire to the middle piece, which acts as a kind of resting place, and thence to the piece at the other end of the wire. The spark has been obtained (though with difficulty, and only after very nice adjustment of the pencil points in the dark box) after having passed through four pieces of tinfoil, the distance from the first piece to the last being eight feet. The highest tension static electricity, as generated by Holtz' machine, could not do this; and electricity prefers to pass by points. Through experiments of this kind we have learnt one important law of this force, namely, that it prefers to pass through surfaces; and the larger the surface, the better it passes through any bad conductor, at least within certain limits.

Phenomena of the kind here described suggest magnetism more than induction or dynamical electricity; but this force does not respond to the test of magnetism, the power to attract iron; and moreover it exhibits phenomena that do not belong to magnetism. It is attracted by iron and other metals, as conductors, but it does not itself attract iron.

The points which favor the radiant theory of this force may be thus recapitulated:

1. It does not respond to any of the physical tests of electricity, except the spark.
2. It produces no perceptible or demonstrable physiological effects, like electricity.
3. It is not resisted by non-conductors as air, water, glass, rubber, and paraffin, to the same degree as electricity.
4. It gives no evidence, in any of its phenomena, of polarity.
5. It passes through non-conductors, as air, rubber, glass, etc., most readily by large surfaces at the terminals, while electricity prefers to pass by points.
6. It diminishes in strength with the distance from the battery, possibly in some definite ratio, although that is not yet demonstrated.

Any form of electricity giving a spark like the spark of this force would respond to some of the physical tests of electricity, would produce readily perceptible physiological effects, would be powerfully resisted by the air, and would in all its phenomena suggest polarity, even if rapidly reversed.

Again, the four facts regarded by me as favoring the theory that this force is allied to electricity, are, when severely analyzed, not so convincing as they might at first appear. The spark of this force resembles the spark of dynamical electricity; but so also does the spark produced by combustion. The velocity of this force is great, but so also is that of light. This force is best conducted by metals; but so also is heat. This force is resisted somewhat by non-conductors, but so also is heat, and both to a less degree than electricity.

If it be, as I have suggested, a kind of electricity which, after the manner of the shuttle, returns to its source by rapid forward and backward movements, it would yet be electricity under very different conditions from those under which we are wont to consider it, and would be practically a new force. The more I experiment in this department, and the more closely I reflect on the results of experiments, the farther I seem to be driven from the electrical toward the radiant theory of this force; and there would appear to be no ready escape from the conclusion that we have here something radically different from what has before been observed by Science. The relation of this force to the other forces may be thus represented:

Light, Heat . . . New Force Magnetism, Electricity.

The above would represent Mr. Edison's theory of a radiant force, nearer to light and heat than to magnetism or electricity.

The theory I have suggested would bring the force nearer to magnetism and electricity than to light or heat, as follows:

Light, Heat New Force . . . Magnetism, Electricity.

The discovery that broad surfaces at the terminals are ne-

cessary to conduct this force through non-conducting solid bodies, as glass, rubber, paraffin, etc., was made but a few nights ago. That the force passed through air when large surfaces were at the terminals had been proved previously by Mr. Edison's experiments and by my own. A large surface of tinfoil (6x6 or 12x12 inches) was connected with one end of the divided wire, and laid on a table. Over this were placed broad pieces of hard rubber, glass, or paraffin, and on the top of these was placed a similar piece of tinfoil connected with the other end of the divided wire, through which the force was to be conducted to the dark box. In this way, it was proved that the force could pass through 2½ inches of dry wood, 2 plates of glass, each ½ of an inch in thickness, ½ of an inch of hard rubber, ½ of an inch of solid paraffin, and 5 layers of paraffin paper. When the surfaces at the ends of the wire were reduced in size, or when the tinfoil at one end was removed, the force passed less easily. When the tinfoil at both ends was removed, and only a few inches of fine wire constituted the surface, the force passed, but through thinner resistance. When only the terminals of the wires were applied to the resisting body, the force would not pass at all, or but a very short distance. The force passed through 8 inches of water, and was apparently but little diminished even when the surface at the terminals was but an inch of fine wire.

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

A new compound for polishing and cleaning metals is composed of 1 oz. carbonate of ammonia dissolved in 4 ozs. water; with this is mixed 16 ozs. Paris white. A moistened sponge is dipped in the powder, and rubbed lightly over the surface of the metal, after which the powder is dusted off, leaving a fine brilliant luster.

A new alloy for bell metal is proposed, which does not tarnish, is less liable to crack, gives a better sound, and is much lighter in weight than the alloy usually employed for the purpose. It is prepared as follows: Nickel 1 lb. and copper 6 lbs. are melted and cooled. Add zinc 2 lbs., aluminum ½ oz. Melt and cool. Melt again, and finally add ½ oz. quick-silver and 6 lbs. melted copper.

A very beautiful application of electro-metallurgy is to apply a coat of silver by electro deposition on natural leaves and flowers. By this means very delicate ornaments are produced, since the precise form and texture of the natural leaf are produced under the thin silver film.

Lemons can be preserved by varnishing them with a solution of shellac in alcohol. The skin of shellac formed is easily removed by rubbing the fruit in the hands.

J. Q. R. B. says: Varnish made with alcohol will get dull and spongy by the evaporation of the alcohol, which leaves water in the varnish, as all commercial alcohol contains water. Take thin sheet gelatin, cut it in strips, and put it in the varnish; it will absorb most of the water, and the varnish can be used clear and bright till the last drop. The gelatin will get quite soft; it can then be taken and dried, and used again. "I have used this plan for the last two years in photographic varnish, and have never had to throw away one drop."

There is no simpler remedy for preventing cider growing sour than mustard seed. After the cider has fermented and reached the desired palatable condition, put 1 pint mustard seed to a barrel of cider, and bung tight.

DECISIONS OF THE COURTS.

United States Circuit Court—District of New Jersey.
PATENT SKATES.—GEORGE D. TURRELL vs. EDWARD SPARTH AND CHARLES GUELICKER.

[In equity—Before Nixon, J.]

NIXON, J.: This suit is for the infringement of a patented letter patent, dated April 6, 1875, for "Improvement in Skates," of which the complainant became the owner by assignment on the 15th of April, 1875. The bill was filed July 6, 1875, charging the defendants with infringement, and praying for an injunction, and for an account of the gains and profits made by the defendants, and of all the damages sustained by the complainant from the said infringement.

The complainant is taking testimony to prove his *prima facie* case, and has issued a subpoena *duces tecum* to one of the defendants, Edward Sparth, requiring him to produce before the Examiner all "books, papers, and documents whatsoever, that will show the number of skates made or delivered by the defendants, or their employees, since the 4th day of April, 1875." The defendants complain that this is not an honest inquiry into their acts to sustain the charge of infringement, but an attempt, by an abuse of the process of the court, to ascertain the nature, extent, and direction of their business affairs. While they express themselves willing to make a full exhibit of all their manufacture and sale of skates from the date of the last release of the patent to the commencement of this suit, they protest that the complainant is not entitled at this stage of the proceedings, and before a decree against them for infringement, to compel an exposure of their business matters since the last-named date. They have accordingly applied for, and obtained, a rule upon the complainant to show cause before the court (1) "why the subpoena *duces tecum* should not be modified by inserting the clause 'and until the commencement of this suit' after the words and figures '4th day of April, 1875,' and (2) "why the defendants should not be excused from disclosing to the complainant, in the complainant's *prima facie* case, what defendants have or have not done since the commencement of this action."

The counsel for the complainant justifies the questions propounded, and the call for the books, exhibiting the amount and character of the business of the defendants since the filing of the bill, on the ground that the complainant's patent is for a combination; that it already appears in evidence that the defendants have a contract to manufacture the skates, which are sworn to be an infringement of the complainant's patent, and to deliver them to persons who are not licensees of the patentee; that a number of such skates are yet to be made and delivered under said contract; that it further appears that the defendants are accustomed to make large quantities of the parts of skates interchangeable, and to put them together afterward; that it is admitted in their testimony that some of these parts were manufactured before the commencement of the suit; and the object of the present inquiry is to ascertain whether the other parts of the skates have not been manufactured since, and whether the parts made before filing the bill have not since been united to form skates, so that what was done after the release and before the suit has been contradictory to the infringement.

The released patent owned by the complainant, and for the infringement of which the suit is brought, is undoubtedly for a combination in the specifications. The inventor states that the nature of his invention consists in the combination, with a before and the lateral-acting clamps, of mechanism that operates to move the clamps toward each other with sufficient force to cause them to grasp the sole, and hold the skate to the boot or shoe.

The first claim of the release is for—
The combination, in a skate, of clamps for grasping the sole, a plate or rest for the foot, and mechanism for moving and holding the clamps.

The second is for—
The claims for grasping the heel and the clamps for grasping the sole, combined with mechanism operating and holding both sets of clamps, substantially as specified.

And the law is well settled that such a patent is not infringed by the use of some of the parts which make up the combination, the other parts being omitted, unless the place of the discarded constituents is supplied by something substantially equivalent.

As was remarked by Mr. Justice Nelson in delivering the opinion of the Supreme Court in *Van Ness vs. Campbell* (1 Black, 429):
Unless the combination is maintained, the whole of the invention falls.

The combination is an entirety; if one of the elements is given up, the thing claimed disappears.

Hence, also, it was held in *Gould vs. Rice* (34 Wall, 194), that "where the defendant, in constructing a machine, omits entirely one of the ingredients

of the plaintiff's combination, without substituting any other, he does not infringe; and if he substitutes another in the place of the one omitted, which infringe; and if he performs a substantially different function, or if it is old, is new or which performs the same function as the plaintiff's invention as a proper substitute for the omitted ingredient, then he does not infringe."

The complainant seeks to establish his *prima facie* case of infringement by putting one of the defendants on the stand as a witness, and proving by him what the defendants have done. He calls his attention to Exhibit No. 1, and asks whether he has made skates substantially like that. The witness admits that he has, and that the defendants have a contract to furnish such skates to the firm of Peck & Snyder. He is then requested to produce the contract, which he properly declines to do, alleging as a reason that he does not wish to disclose to rivals the price which they were to receive, nor the number to be manufactured; but he again admits that it was a contract to deliver skates very nearly like Exhibit No. 1 of complainant. The sole pertinent inquiry now is the fact of the infringement, and that fact will not be made any more evident by producing the contract than it has been by the admissions of the defendants. The extent of the infringement is a different question, and will only arise, if at all, upon a reference for an account after a decree for the complainant.

He then continues the defendants' examination as follows:
Q. 23. Do you keep books of account which show how many skates like Exhibit 1 you make, the deliveries of such skates, and the dates of such delivery?

A. Yes.
Q. 24. Will you produce those books of account at the next adjournment (Objected to, because complainant has no right to compel the witness to produce his books at this stage of the suit, and because he has not served any subpoena *duces tecum* upon him, and he has no right to such subpoenas.)

A. I decline throwing our books open to the complainant.

Q. 25. In manufacturing skates under your contract, has it been your practice to make considerable numbers of each of the different parts of the skates, and keep them until such time as you may desire to put them together?

A. We always have made those parts at the commencement of the year, as that is work we keep boys on to fill up time when we are doing nothing else.

Q. 26. During the period of time between the reissue of the patent and the filing of the bill, did you have on hand a considerable number of each of the parts constituting the clamping mechanism like that in Exhibit No. 1?

A. Yes; we always do have such parts in the factory.

Q. 27. Since that time, have you used any of the parts that you then had in store in the construction of skates substantially like complainant's Exhibit No. 1?

(Objected to as immaterial and irrelevant to any issue in this suit; and because the question ought to be limited to the time of the commencement of this suit, and counsel instructs witness not to state what he has done since that time.)

The design of these questions is apparent. They are put on the theory that, in a patent for a combination, he is an infringer who makes or sells only one or two of the parts of which the combination is composed, if done with the intent that the purchaser shall unite them with the other parts, procured either from the same or other sources, and at the same or at different times.

That seems to be the principle decided in *Wallace vs. Holmes*, (9 Blatch., 55), on which the counsel for the complainant relies in support of his right to ask the question, and to call for the books of the defendants, exhibiting their business since the commencement of this suit.

In that case, where there was a patent for a new and useful improvement in lamps, which consisted of an improved burner in combination with a chimney, and the proof was that the defendants had manufactured and sold the burner alone, leaving the purchaser to supply the chimney—without which the burner was useless—the late Judge Woodruff held that the manufacture and sale of the burner by the defendants without the chimney was an infringement of the patent.

It cannot be (he says) that, where a useful machine is patented as a combination of parts, two or more can engage in its construction and sale, and protect themselves by selling the parts separately, in an effort to produce the same machine and sell it, and bring it into extensive use, each makes and sells one part only, which is useless without the other, and still another person, in precise conformity with the purpose in view, puts them together for use. If it were so, such patents would indeed be of little value. In such case all are tort-feasors, engaged in a common purpose to infringe the patent, and actually by their concerted action producing that result.

Each is liable for all the damages.

Without thereby intending to intimate an ultimate opinion in regard to its relevancy to the pending one, I propose to adopt its spirit in the order which I shall make on the present motion.

Let the subpoena *duces tecum* be modified as the defendant requests, by inserting the clause "and until the commencement of this suit" after the words and figures "4th day of April, 1875;" but at the same time let the defendant, and any other witnesses, answer question 27, and all other questions tending to show the subsequent use of any of the parts of skates like Exhibit No. 1, which defendants had on hand when the suit was commenced.

This order is made upon the supposition that the answer to question 27 will serve the purpose of complainant as to present proof. If the evidence as to the fact of what the defendants have done since the commencement of the suit in the matter of uniting the constituents of the combination should not be satisfactory to the complainant, and it is supposed that the book of the defendants will shed more light on the subject, the court will hear an application hereafter, on notice to defendants, in regard to exhibition of the books of account.

[Charles F. Blake for complainant.
J. Van Santvoord, for defendants.]

NEW BOOKS AND PUBLICATIONS.

TINNITUS AURIS, OR NOISES IN THE EARS. By Laurence Turnbull, Ph.D., M.D., Physician to the Eye and Ear Department of the Howard Hospital, Philadelphia, Pa., etc. Second Edition with Cases. Philadelphia, Pa.: J. B. Lippincott & Co.

Dr. Turnbull sends us a very readable and interesting pamphlet on a very common and little understood malady. He shows that noises in the ears are the effects of causes widely different, and that sometimes the sounds are merely hallucinations, produced by abnormal action of the cerebral organs. Many remarkable instances of tinnitus are cited, and serve to render the book of value to the medical profession.

BRIDGES AND TUNNEL CENTERS. By John B. McMaster. Price 50 cents. New York city: D. Van Nostrand, 23 Murray street.

SAFETY VALVES. By R. H. Buel, C. E. Price 50 cents. New York city: D. Van Nostrand, 23 Murray street.

These two excellent volumes are Nos. 20 and 21 of Mr. Van Nostrand's Science Series. The work on safety valves is especially commendable for its clearness and accuracy, and such a work, judging from our multitudinous correspondence, has long been needed in our workshops and factories.

ADVENTURES OF A DEAF MUTE. By W. B. Swett. Marblehead Mass.: Published by the Author.

An interesting and well written account of some journeys and adventures in the White Mountains, the profits from the sale of which are devoted to the author to the benefit of his brethren in affliction.

THE ORIGIN OF LIFE AND SPECIES, A NEW THEORY. By J. B. Pool. Price 10 cents. Pittsfield, Mass.: W. H. Phillips.

The author of this pamphlet deserves credit for courage in attacking a very large subject, and for the clearness with which he states his views.

THE GROCER. Volume I, No. 1. Published Weekly. Subscription \$2 a year. New York city: The Grocer Publishing Company 163 Chambers street.

A valuable and well edited trade journal, replete with accurate information and original articles.

THE ILLUSTRATED ANNUAL REGISTER OF RURAL AFFAIRS FOR 1876. With 170 Engravings. Price 30 cents. Albany, N. Y. Luther Tucker and Son.

An excellent handbook of agricultural and gardening matters, accompanied by a calendar and much useful information.

ACROBA BRASILEIRA is the name of a new monthly scientific and mechanical periodical, published in the Portuguese language by Mr. J. C. Alves Lima, at Syracuse, N. Y. The journal is intended principally for Brazilian circulation, and as a medium for trade between the United States and the Portuguese-speaking population of South America. The first number before us is well illustrated, and contains an interesting variety of articles. The subscription price, 10,000 reis, is somewhat startling unless one appreciates the minute unit of Brazilian money, and translates the total into \$5.45 United States currency.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From December 3 to December 16, 1875, inclusive.

ARTIFICIAL LEATHER.—A. W. Pope (of Boston, Mass.), London, Eng.

BOOT SEWING MACHINE.—D. Mills (of Brooklyn, N. Y.), Aston, Eng.

BUILDING STRIPS.—T. H. Buckler, Baltimore, Md.

CHECK FOR FIRE ARMS.—W. D. Miller, Pittsburgh, Pa.

CLOTHES HORSE, ETC.—C. T. Rowe, Brooklyn, N. Y.

GRINDING BANK.—S. R. Thompson et al., Portsmouth, N. H.

LOCK NUT, ETC.—P. M. F. Castin, Colorado.

METAL CAR FRAME, ETC.—B. J. La Mothe, New York city.

ONE-ROASTING FURNACE.—R. M. Fryer, New York city.

PREPARING PAPER FOR PRINTING.—H. M. Hoe, New York city.

REPEATING FIRE ARM.—E. B. Hotchkiss, Paris, France.

SHIP'S TABLE.—E. F. W. Andrews, Maitland, Cal.

Recent American and Foreign Patents.

NEW HOUSEHOLD ARTICLES.

IMPROVED CLOTHES LINE PROP.

Christian C. Schwaner, Winterset, Iowa.—The upper ends of the prop pieces are slotted for the purpose of forming a groove, for retaining the clothes line, which is stretched across the props in any suitable manner. The legs of props may be spread to bring the line down to the convenient altitude for fastening the clothes thereon.

IMPROVED SAD IRON.

Albert L. Parcell, Oneonta, N. Y.—The handle is provided with one rigid hooked standard and one jointed standard, the hook terminating the lower part of the latter. The hooks enter eyes on the back of the iron, and are bound by moving a cam on the jointed standard.

IMPROVED BREAD CUTTER.

Maurice Walsh, Sillery Cove, and Maurice Ahearn, Ottawa, Canada.—This device includes a knife frame, provided with a projecting arm engaging in the notch or fork of the pivoted swinging gage piece, for lifting the same out of the way, to allow a removal of the out pieces. The downward or cutting stroke of the knife throws the gage out of the way for dropping the slice in the basket or other receptacle. The invention has been entered for exhibition at the Centennial.

IMPROVED PROCESS OF PRESERVING FRUIT.

John F. Bassford, New York city.—This invention consists in preparing fruit by mixing water and starch with the fruit when in the form of preserves. The seeds, pits, or stems are removed, and the fruit is put in a kettle, and sugar added, according to the tartness of the fruit. The fruit and sugar are then boiled for fifteen minutes, more or less, and to one quart of the preserved fruit is added one quart of water, and the whole is brought to a boil. An ounce of starch is then added to each quart of the diluted fruit, the starch being first wet in enough cold water to reduce it to a thin paste. The mixture is then stirred for two or three minutes, to thoroughly mix it, the stirring being continued until the foam disappears. The fruit is then ready for use when cold.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED PAPER DRYING MACHINE.

Culver S. Clark, New York city.—This inventor aims to provide for paper manufacturers an improved machine for drying sized and unsized paper in a rapid and superior manner. He proposes suitably arranged casings, through which the continuous sheet of paper is conveyed by feeding and carrying cylinders made of open rods, to expose the paper at top and bottom sides to hot air drafts thrown thereon from blowers or fans in the same direction in which the paper is traveling. The continuous action of the air blasts on both sides of the wet paper traveling through the casing produces the even and uniform drying of the same. The air blasts also assist the easy forward motion of the paper over the carrying cylinders, and prevent any sticking of the paper thereon.

IMPROVED SAFETY AND RELIEF VALVE.

John William Melling, Birkett Bank, Wigan, Eng.—In ordinary safety valves, the lift, and consequently the orifice for the escape of steam, is very limited, more particularly with high pressures. The present invention aims to obviate this defect by making the valve and seat with two faces, and by exposing only a part of the area of the valve to the pressure of the steam when the valve is closed. When the blowing-off point is reached and the valve is slightly raised, the steam escapes in the ordinary way through one of the faces, and is admitted under the other face, thus acting on a greater area. The steam that is admitted under the second portion of the valve is allowed to escape through a hole in the valve.

IMPROVED GAGE ATTACHMENT TO WOOD-BORING MACHINES.

George S. Hudson, Ellensburg, N. Y.—This is an improved gage, which is adjusted upon the bed of an ordinary horizontal boring machine into the exact position to be required by the work. A block slides in either direction from the center of the back piece of the table, through whose central aperture the bit passes, and is held in position by a double spring pawl, which engages either adjustable lugs or rack teeth, according as the holes are to be made at irregular or variable distance from each other. The stuff is fed in accurate manner to the bit or auger, and thereby a superior fit at a saving of time and labor obtained.

IMPROVED SAW GUMMER.

John W. Parker and Thomas Parker, Chicago, Ill.—This is an improvement in the class of gummers whose cutter shaft bearing is adjustable in a slotted way, which is in turn adjustable around a fixed axis located on a lower portion of a circular frame that is provided with clamps to adapt it for attachment to a saw blade. The novel feature consists in means for automatically interrupting the feed of the cutter shaft and producing reciprocation of the same simultaneously with its rotation.

IMPROVED VIBRATING PROPELLER.

John D. Cornell, Jersey City, N. J.—This inventor proposes two sets of paddles, carried on pivots at their upper ends in horizontal frames, located under and partly in the bottom of the vessel between two keels. They are carried backward and forward by cranks. The paddles swing up nearly horizontal, and move partly edgewise against the water when going forward, and swing down vertically and move sidewise against it when going back. This is claimed to give the necessary area of propelling surface, with much simpler apparatus than the common paddle wheels and screws.

IMPROVED LINING FOR MACHINING BEARINGS.

Lebbeus W. Lathrop and Theodore A. Weber, New York city.—This is an anti-friction cloth, either canvas, silk, or any other woven fabric, or paper or skins. Upon it is spread an even covering of anti-friction material composed of graphite and sugar, and the sheets so covered are passed between compressing rolls, the upper one of which is heated sufficiently to soften and spread out, and at the same time condense and unite the compound, and press it on or into the sheets to effect the requisite adhesion. The sheets are then used as linings for bearings.

IMPROVED UPRIGHT TUBULAR BOILER.

Nathan C. Heaton, New York city, assignor to Ward B. Snyder, same place.—This relates mainly to a cap for an interior boiler and its casing, which cap is attached by a screw-threaded flange. An illustration of the boiler will be found on page 371, volume XXXIII.

IMPROVED VALVE INDICATOR.

John S. Wallace, Bretland, O.—This inventor proposes a stem connected to the valve and projecting out through one end of the steam chest, and carrying a pointer along an indicator scale, by which to set the valve without opening the steam chest.

IMPROVED ADDING MACHINE.

Dennis L. R. Butt, Pilot Point, Texas.—This is an ingenious combination of a toothed wheel with suitable mechanism, by adjustments of which sums in simple or compound addition may be quickly calculated.

IMPROVED RAILROAD RAIL.

George H. Mayer, Jr., Shamokin, Pa.—This relates to an improved railway rail that may be relaid without drawing a single spike, preserving thereby the cross ties and producing a saving of iron. It consists of a base rail with top rail resting on a square seat at the side, and overlapping the curved top of the same, to be retained thereon by fastening bolts and nuts.

IMPROVED FLOCK-WASHING MACHINE.

Asa C. Russell, Great Barrington, Mass., assignor to Parley A. Russell, same place, and Clinton H. Blake, New York city.—This is an apparatus for separating the flock from the water as it escapes from the washer, and preserving the flock, while allowing the water to flow away. It is formed of an outer box, made with an open top, and provided with a discharge opening at its bottom. There is an inner box, made smaller than the outer box, with open bottom and top, supported with its lower edge a little above the bottom, and its upper edge a little above the top of the said outer box, having the space between it and the outer box at one end separated from the spaces between the sides of said boxes. There is also a screen at said end, in combination with the discharge spout of the washer.

IMPROVED MACHINE FOR FINISHING HORSESHOE NAILS.

Harry A. Wills, Chicago, Ill., assignor to Julia A. Wills, same place, and Lucy S. Kingsland, Burlington, Vt.—In order to return the sheared blanks from the shearing die into the carrier again, to be afterward carried to point-beveling dies to be beveled, a pusher or follower is provided, in connection with the shearing die, which follows close behind the punch when it withdraws, and pushes the nail immediately after it is sheared back into the notch of the carrier. In order to prevent the blanks from turning in the trimming die, or while moving from or back into the carrier, another new feature is added in the shape of a little vibrating guider, with a slot on the under side, so arranged that, just before the blank comes to rest in front of the shearing dies, the head will pass into the slot, which will hold the blank from turning.

IMPROVED SCREW CUTTING DIE.

Virginus J. Reece, Greenfield, Mass.—This invention consists of a die which has a spreading pin inserted at the split part of the circumference, and an adjusting screw passing through the edge of the die to bear at right angles on the pin. The one adjusting screw and pin takes the place of four set screws heretofore used, so that the number of screws and die holders is reduced, and thereby the cost for die stock and die diminished.

IMPROVED HORSESHOE CALKING VISE.

William Weaver, Greenwich, N. Y.—This relates mainly to a new arrangement of a cam, which connects with a treadle and serves to lock the vise. The invention is strong and simple in construction.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WHIFFLETREE FASTENING.

Hannibal R. Jackson, La Fayette, Ind., assignor to himself and Thomas J. Roads, same place.—This is a new way of detachably fastening the whiffletree of vehicles to the double tree; and it consists in a plate having a rearwardly opening T-shaped groove, with enlarged end, in combination with a second plate attached to the whiffletree, having a pivot provided with a head.

IMPROVED FIRE PLACE.

Robert Thompson, Stapleton, N. Y.—A forward-projecting angular part or shelf of the wall, made of bricks or metal plates, forms, in connection with the front wall, an air chamber, which is supplied with cold air by suitable air flues from the outside. The apex of the angular rear wall is below the angle of the fire wall, and approaches close to the same, so as to form a narrow air flue, that connects the lower part with the upper part of the air chamber, and throws, by the lower inclined part of the shelf, the cold air directly on the heated fire plate.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED BAG FASTENER.

Charles W. Harvey, Waterloo, Iowa.—The invention relates to a mode of securing the end of a bag's string fastener without making a tie, the latter being liable either to work loose or draw into a knot, thus occasioning waste of contents or loss of time. The invention consists in loosely journaling upon a screw bolt a pair of stiff metallic disks, inclined and adjustable toward each other, one being placed on the inside and the other on the outside of the bag. The string is thus held by its own compressibility between the bag and outer disk.

IMPROVED SHAVING CUP.

Philipp Schauble and Louis Dohm, Elizabeth, N. J.—In order to hold the soap in shaving cups so that it will not come out when the cups are washed, the above inventors propose making a screw thread in the lower part of the cup, and a similar thread in the soap. The soap can then easily be screwed in place by a simple key.

IMPROVED NECK TIE FASTENER.

Johann Waehner, New York city, assignor to Daniel Richter, of same place.—This device has a hook at one end for catching over the collar band. The other end is arranged to pass through holes in the neck tie, bend over, and, by being pressed back, fasten thereto. In the center is a coiled spring to give the requisite elasticity. The three portions may be worked out of one piece of metal without break.

IMPROVED COMBINED CLEAT AND HAWSER CLAMP.

Ferdinand W. Hofele, New York city.—In docking a vessel it frequently happens that the full length of a hawser is let run out because a sufficient hold cannot be had as it nears its end; and to obviate this difficulty, this inventor has constructed a cleat, having a clamp set within it, by which the end of the hawser may be gripped and held secure until released by the person in charge.

IMPROVED FENCE.

William A. Couch, Hannibal, Mo.—This relates particularly to the construction of a detachable batten to the panels of the fence, which may be readily detached by simply turning buttons to a position parallel to the rails.

IMPROVED WIRE FENCE BARB.

Henry N. Frentress, Dunleith, Ill.—This consists in barbs formed by cutting thin sheet metal into diamond form, slitting them from the acute angles nearly to the center, and bending the prongs at each end at an angle with each other to adapt them to be twisted into a two-strand wire cord.

COMBINED TWINE CUTTER, LETTER OPENER, AND STAMP MOISTENER.

John Eitel, Sacramento, Cal.—The invention consists of a pair of small scissors, which are protected within an operating guard spring, to which, also, a spring device for attaching it to the ball of twine, a letter-opening knife, and a pivoted sponge holder, for moistening the stamp, are applied.

IMPROVED ABDOMINAL CORSET.

Catharine A. Griswold, New York city.—This is an improved abdominal corset, which combines, with a perfect fit, a comfortable support for the abdomen, so as to relieve the same from any strain or drawing, and throw the weight of the same on the shoulders.

IMPROVED MARINERS' LOG.

George E. Elliott, St. Andrews, Can.—This is an improved mariners' log, which registers correctly the speed of a vessel without requiring any particular skill in its use or special calculations. It consists of a concave disk or drag, that acts with greater or lesser force, according to the speed of the vessel, on a rack bar and spring, which moves, by suitable actuating gearing, the index hand along a face dial. The index hand is retained by a ratchet and pawl, for reading off the log, and returned to its position by a tension spring on releasing the pawl.

IMPROVED LIFE PRESERVER.

Beall Hempstead, Little Rock, Ark.—This life preserver is made of wood, in sections, connected and hinged to each other by rubber strips, and provided with a rubber band around the waist, and with rubber strips around the neck, waist, and arm holes.

IMPROVED BASE BALL BASE.

John C. O'Neill, St. Louis, Mo.—This is a case or box, with sockets for elastic columns that support a cap plate, having corresponding sockets. The fact of the runners having touched the base is announced by the sound of a bell, caused by the depression of the cap plate.

IMPROVED VENT.

Edward R. Behlers, St. Louis, Mo.—This is an improved vent that is closed perfectly airtight at all times, but supplies air as soon as the faucet is turned. It consists of a rubber tube, which is supported by an interior spiral spring, and fitted, by a perforated closing knob, into a receiving tube, that communicates by a downward extending tube driven into the bung or barrel with the interior of the same. A slit in the rubber tube, above the connecting tube, supplies the air on opening the faucet, closing airtight on shutting the same.

IMPROVED AUTOMATIC LIGHTER FOR GAS BURNERS.

Henry B. Stockwell and Albert R. Weiss, Brooklyn, N. Y.—This invention consists in the connection of the gas cock with a ribbon-feeding slide piece, and a spring hammer operated thereby. The burner socket, magazine guide, and anvil are cast of one piece, to which the fulminate ribbon, slide piece, and hammer are applied, so as to feed the ribbon, and ignite, simultaneously, one of the pellets by the opening of the gas cock.

IMPROVED ORE CONCENTRATOR.

John Longmaid, Bingham, Utah Ter.—The object of this invention is to separate ores from worthless substances with which they may be mixed, by causing such minerals, in a finely powdered condition, to flow, by means of water, over a large revolving table, fixed at a certain inclination, and washing the same by means of a thin sheet of water, and finally discharging the washed ore at the lower portion of the table by means of jets of clean water.

IMPROVED FAUCET.

Willis L. Brownell, Brooklyn, N. Y.—In this faucet a valve acts upon a cam portion of a lever shaft in such manner that the latter is turned automatically when the lever or handle is relieved of (hand) pressure, thus allowing the valve to close tightly on its seat. There is also a short rigid tube to deliver the water into the hollow valve, and to act as a support or guide for the same when open, and a new arrangement of combined stop and packing disk on the lever shaft.

IMPROVED REIN HOLDER.

George W. Miller, Constitution, Pa.—This is an improved rein rest for attachment to the dashboard of vehicles, so constructed as to prevent the horse from throwing his tail over the reins, and to prevent the reins from falling to the ground should they be accidentally dropped. It may be turned down out of the way when not required for use.

IMPROVED HARNESS SADDLE.

John W. Schwaner, New York city.—This relates to an improved construction of wrought iron harness saddles. The new features are a wrought iron bed plate, cut out into proper shape, struck up into proper form, and provided with holes, strengthening corrugations, and recesses for the back band loops; a wrought iron seat plate cut out into proper shape, struck up into proper form, and provided with the strengthening rib and other arrangements, in combination with the bed plate; and salient angles formed upon the side edges of the seat plate, to be bent down over the side edges of the wooden seat block.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CORN UNCOVERER.

Hugh H. Gilchrist, Swan Creek, assignor of one half his right to John J. Worden, Youngstown, Ill.—This consists of a plate which is to be attached to the sole of the plowman's shoe, and which carries a bar having several prongs or fingers. This arrangement enables the plowman to uncover the corn that has been covered or partly covered by the soil thrown by the plow or cultivator, and straighten it up, freeing its leaves from the soil.

IMPROVED GANG PLOW.

Timothy M. Shaw, Lebanon, Tenn.—In this device are the following new features: First, a frame composed of two curved beams, each provided with a shovel or plow, and adjustably connected at their front ends, so that one shovel or plow may be set in rear of the other. Second, said frame is provided with handles, which are adjustable correspondingly with themselves. Third, the beams and handles are connected by two sets of transverse parallel bars, made separately adjustable as to length, and connected to said beams and handles by means of universal joints or couplings. The result of this combination and arrangement of parts is that the handles may be adjusted so as to remain opposite each other, and the plow beams will at the same time be held rigidly connected whatever be the adjustment of the plows, whether in gang or one or both inclined from a vertical, to take more or less into the side of ridges, while cultivating between the rows of growing crops.

IMPROVED RICE MORTAR.

Nathaniel O. Tilton, Savannah, Ga.—This rice-cleaning machine has a reciprocating pestle, and is used for separating the thin skin or film which remains on the grain after the hull or rough outside shell has been removed. The new feature is an open centrally located ring, which gives increased friction, and causes the rice to clean in less time.

IMPROVED CHURN DASHER.

John R. Underwood, Nelsonville, Ohio.—On the dasher shaft are two sets of bars, arrayed radially to the axis of the shaft and placed one above the other. The lower sides of the bars are concave, so that when the dasher is forced down the bars enter the milk with the recesses filled with air, and the air and milk are forced out through holes in the sides of the bars toward the sides of the churn, throwing the milk into violent agitation, and bringing the butter in a very short time.

Business and Personal.

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

"Wrinkles and Recipes" is the best practical Handbook for Mechanics and Engineers. Hundreds of valuable trade suggestions, prepared expressly by celebrated experts and by correspondents of the "Scientific American." 250 pages. Elegantly bound and illustrated. A splendid Christmas gift for workmen and apprentices. Mailed, post paid, for \$1.50. Address H. N. Munn, Publisher, P. O. Box 771, New York City.

Re-cutting Files. Send for Price Lists. Passaic File Works, Paterson, N. J.

Wanted—Partner with Capital. Must be a good Salesman to forward the introduction of an indispensable article. Plenty of money in it to the right party. Address W. M. T., Box 225, Carlisle, Pa.

Pattern Maker's or Wood Turner's Lathes, new design. Address The Goulds Mfg. Co., Seneca Falls, N. Y.

Tobacco Wafers—Patented. State Rights for Sale. Address D. A. Alden, Malden, Mass.

The Richards Mfg. Co., 91 Washington St., Chicago, possess best facilities for manufacture and sale of Novelties and Toys. Correspondence with inventors solicited.

Manufacturers! Send for Illustrated catalogue of Best Belt Pulleys made. A. B. Cook & Co., Erie, Pa.

There are very few firms in this country which "push" things more persistently than that of Geo. P. Rowell & Co., New York. And they are eminently fair in all their business transactions, which, doubtless, is the secret of the great success which has rewarded their efforts. They are constantly doing something which is to the benefit of the publishers and to that also of advertisers.—[Republican, West Meriden, Conn., Feb. 28.]

Manufacturers of Improved Door, Sash, and Blind Machinery. Send circulars and prices to Nelson Bro's, Walkerton, Ontario.

For Sale—114 in. x 36 in. heavy hor. Engine, cut-off, Wheel & Governor, \$400; 5 in. x 12 in. Cook & Rhymer's Holster, \$300; Lincoln Miller, \$300; 25 in. x 12 ft. Lathe, \$300; 45 in. Chucking Lathe, \$185. Shearman & Hines, 45 Cortlandt St., New York.

Agents Wanted—For Stephens' Combination Rule. See Advertisement elsewhere.

Fine Castings and Machinery, 96 John St., N. Y.

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Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

L. & S. H. P. Engines. Geo. F. Shedd, Waltham, Ms.

Solid Emery Vulcanite Wheels—The Original Solid Emery Wheel—other kinds imitations and inferior. Caution—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 39 Park Row, New York.

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Water, Gas and Steam Goods—Send eight stamps or Catalogue, containing over 400 illustrations, to Bailey, Farrell & Co., Pittsburgh, Pa.

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

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

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

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

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

American Metaline Co., 61 Warren St., N. Y. City.

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

Magic Lanterns and Stereoscopes of all sizes and prices. Views illustrating every subject for Parlor Amusement and Public Exhibitions. Pays well on small investments. 72 Page Catalogue free. McAllister 49 Nassau St., New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 420 Grand Street, New York.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven, Conn.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Temples and Officines. Draper, Hopedale, Mass.

Notes & Queries

X. is informed that no one is entitled to make, for his own use, an article that is patented. The right to sell patented articles in a certain territory depends on the agreement which the agent has made with the patentee.—J. F. W. will find a recipe for lemon sugar on p. 378, vol. 30.—R. B. will find good directions for making an aquarium on p. 81, vol. 31.—N. F. will find a recipe for gutta serena varnish on p. 379, vol. 31.—J. N. will find a description of the physiological and pathological properties of alcohol on p. 91, vol. 31.—W. H. K. will find an illustrated description of the gyroscope on p. 91, vol. 31.—W. M. will find good directions for building a cistern on p. 91, vol. 31.—F. W. can straighten his gun barrel by the process described on p. 197, vol. 31.—N. S. B. & Co. will find, on p. 43, vol. 31, a good recipe for aquarium cement.—R. K. will find a good recipe for preserving timber on p. 265, vol. 31.—G. G. H. will find a good recipe for blacking for patterns on p. 409, vol. 31.—J. C. L. is informed that his queries as to currency are not in our line. Many saws are made entirely in this country; same very large ones are made from steel plates made and forged in England.—A. D. will find directions for preserving eggs on p. 219, vol. 31.—E. T. A. will

find directions for producing verde bronze on brass on p. 283, vol. 31, and for an Etruscan color on jewelry on p. 303, vol. 31.—C. W. E. will find a prescription for boils on p. 379, vol. 24.—S. Z. R. will find a description of a method of wire transportation on p. 370, vol. 31.—L. D. will find directions for black enamel on iron on p. 208, vol. 26.—A. R. S. will find directions for melting brass in small quantities on p. 263, vol. 31. An average brass melts at 1750° Fah.—S. S. B. will find directions for staining common wood in imitation of black walnut on p. 337, vol. 31.

(1) A. B. H. asks: What will cause aniline colors to penetrate furs, felt, etc.? A. The great affinity that woolen materials have for all the aniline colors, we should think, would render the dyeing of even very fine felt a not difficult matter, if properly managed. Where a delicate shade is required, the fibers are sometimes dyed before matting. In any case the material should first be properly cleansed.

(2) W. S. W. says: I have read of drowned persons being found by putting mercury in pieces of bread and letting them float on the water in which the bodies were supposed to be. The bread floated till it came over the bodies and then sank, it being supposed that the mercury was attracted by articles of gold jewelry on the bodies. Is this so? A. The statement is not true. The most delicate instruments have failed to determine the existence of any attraction between the two metals, save the force of chemical affinity which acts between the molecules at extremely minute distances. This also answers several other correspondents.

(3) T. Y. asks: What liquids (besides acids) will absorb or dissolve sal ammoniac in crystals? A. Water.

(4) G. W. D. says: In the manufacture of raisins by artificial processes, the grapes are dipped in a strong, hot solution of concentrated lye, which opens the pores, or cuts the skin, so that the moisture can pass off freely in the evaporating chamber. Such preparatory treatment, however, leaves on the raisins an alkaline taste, which is objectionable. Can you suggest some other method by which the skin of the grape can be opened or softened for the purposes named, without injury to the flavor? A. In the preparation of raisins for the market, this and similar processes seem to be employed almost universally. In cases such as you mention, where the taste of the raisin has been impaired by such treatment, we should recommend the trial of some method that will tend to neutralize or destroy the objectionable flavor, such as dipping for a few moments into a solution of citric or tartaric acid in water, washing in clean water, and finally re-drying.

How can I remove the oil from salmon, preparatory to drying same, so as to overcome the tendency to rancidity? A. We do not know of any method by which the oil may be removed and the fish remain intact. The tendency to rancidity might be overcome by steeping the fish for a short time in a solution of some harmless disinfectant, such as salicylic acid or iodate of calcium.

(5) C. P. says: I poured some clean water in a tumbler, and then some kerosene oil, when the water remained on the bottom. On adding common whitewash and stirring the whole mixture, the lime sunk to the bottom, then came a layer of water, then a layer of spawn-like matter, then clear kerosene. What was the spawn-like matter? A. Probably a mixture of water and oil, in which case, if allowed to remain quiet for a short time, it would separate, and a distinct line would mark the surface of contact between the two liquids. You should have stated what, besides lime and water, the whitewash contained, if anything.

(6) F. X. M. says: 1. It is said that muddy water will freeze into clear ice. If that is the case, at what point does the clarification commence? It is evident that water may be very cold, and yet remain muddy, so that it must be at the freezing point: it is certainly not after the ice has formed. A. Water, on freezing, does purify itself from all foreign matter provided the latter be not in too great excess, in which case the rejected impurities may become entangled between the fast forming crystals. This self-purification probably takes place at the moment of crystallization. 2. In building an ice house, what cheap substance is best for filling between the walls? A. Use good charcoal, finely crushed. 3. What advantage is it to a cooking stove to feed the fire with air heated to 300° instead of supplying it directly from the apartment, at 50° to 70°? A. A slight saving in fuel.

(7) J. W. S. says: Please give me a good recipe for making green paint for window blinds. A. An excellent pigment for this purpose consists of chrome green (hydrated oxide of chromium) ground in oil and tempered with white lead and sometimes barytes (sulphate of baryta).

(8) E. R. says: I am making a pulse tester. I have a very light glass tube, with a ball at one end. It is half filled with alcohol; and in order to expel the air, I boiled the alcohol, and then closed the tube by the spirit lamp, but it does not work satisfactorily. If I mix a little liquid carbonic acid with the alcohol, would there be any danger of explosion in case the tube should break? A. It requires some care and practice, as well as some previous knowledge of the requirements of the case, in order to satisfactorily construct these little instruments. Carbonic acid is not suitable for the purpose, and there is danger in using it.

(9) H. S. asks: How much would a steam boiler, made of copper $\frac{1}{2}$ inch thick, of a cylindrical form, 18 inches in diameter, and 13 inches deep, stand? A. About 15 lbs. 2. What part of a horse power would such a boiler give, if kept boiling? A. We cannot tell you, as there is no rule for it.

(10) A. E. R. says: In warming a shop with exhaust steam, shall we get more heat by closing the drip pipe cocks so far that nothing but water will come out, thereby letting about half the exhaust steam into the air through the exhaust pipe, or by opening the drip pipe cocks and letting all the exhaust steam through the heating pipes? A. By the latter method, as we understand the question.

(11) W. W. L. says: I wish to build a boat to go up the rivers of Texas. There will be four men, with the necessary baggage for a hunting expedition. We want a small cabin, and the boat should be so constructed as to run about 5 miles an hour. What should be the dimensions and shape? What power of engine will be required? What should be the size and pitch of propeller? Would side wheels do as well as a screw? She should not draw over 1 foot of water. A. You can make a boat 30 feet long, and 5 or 7 feet wide, and use an engine 5x6 inches, and a propeller 32 inches in diameter and of 4 feet pitch.

(12) J. E. H. says: 1. Given a small steam boiler containing naphtha instead of water. If heat is applied, will the hydrocarbon vapor that is formed have the same behavior as steam, and will a steam gauge indicate the pressure in the boiler as if it were steam? A. Yes, unless the naphtha is more volatile than water. 2. If naphtha be used for some time, as in the above case, will there not be a thick deposit in the boiler, which will be required to be cleaned from time to time? A. Generally, yes.

(13) J. B. W. says: I put a lightning rod on my dwelling; area of roof is 2,000 feet. Rod is made of copper about $\frac{1}{4}$ inches in diameter. I led the end of it into a bed of about half a barrel of iron turnings, not spread out into large surface but tumbled into an excavation made for the purpose, and so arranged that the bottom of the mass of turnings was about 3 feet below the surface of the ground, and the top about 1 foot below, the rod running through the mass and some 5 feet into the ground. Now what I want to know is, if this conducting material and the manner of placing it is in accordance with your views of safety? If not, what can I do to remedy it? A. Your method of arrangement of rod within the conducting material at the terminal is correct; but your rod has the common defect, namely, its terminal in the ground is insufficient. You have 10 feet conducting terminal. You should have 2,000 feet. The rule for dry soils is to have for the terminal of the rod, underground, an area of conducting surface equal to the roof area. Your roof area is 2,000 surface feet. You should therefore have a conducting surface of 2,000 feet for your rod terminal. Charcoal is an economical material for the purpose. A trench 400 feet long, 18 inches wide, 5 feet deep, with a layer of charcoal on the bottom 9 inches deep, firmly compacted, and the rod extended along the whole length of the trench, in the center of the charcoal, will give you a reliable terminal. The joints of the rod should be welded, or soldered and firmly bound, so as to make the rod, practically, one continuous piece of metal.

(14) H. F. K. asks: I am desirous of heating my shop by live steam. Can you give a rule by which I can know the boiler capacity requisite for every 100 feet of radiating surface in my pipes? I wish to rate the boiler low enough to secure a fair economy of fuel. A. You do not send sufficient data; but by applying to a reliable boiler maker, and giving him full particulars, you can doubtless ascertain the proper proportions.

(15) A. M. says: My flouring burrs are running on very hard spring wheat; and they sweat badly and gum up everything near them with dough. How can I prevent this? A. We do not know of any remedy except waiting for the wheat to dry, if your stones are properly dressed. If any of our readers can aid you, we would be glad to hear from them.

(16) W. R. C. asks: 1. Can I locate a boiler 100 yards from the building containing the engine, and can I, by laying underground a tube, properly protected, run the engine? Will there be much loss of steam? A. Lay the pipe in a box and pack sawdust or other non-conducting material around it; and put in a good trap to carry off the condensed water.

(17) W. I. Co. say: We have a large vein of magnetic iron ore, but it has an access of top water. By making a cross cut tunnel or adit, 600 feet in length through soft ground (which requires timbering), we can cut the vein at 50 feet under the surface for a water adit, and save the pumping of the water to the surface from that depth. What is the customary adit grade in Cornwall and other parts of Europe, and in America? Of what grade are the railroad tunnels in America and in the Alps, that carry off their top water? A. The grades vary considerably, from 0.67 feet in 1,000, where a very slow current is desired, to 1 in 400.

(18) W. M. D. says: I am building a small engine, 2½ by 5 inches stroke. My boiler is 30 inches long, internal diameter 17 inches, made of boiler plate $\frac{1}{2}$ inch thick. Would cast iron heads do? Of what thickness should they be? Will 6 one inch flues be sufficient? What pressure will it be able to carry? A. It would be better to use wrought iron heads. Get in as many tubes as you can without corroding. If your boiler is well built, it should sustain from 130 to 140 lbs. per square inch with safety.

MINERALS, ETC.—Specimens have been received from the following correspondents, examined, with the results stated:

J. A. B.—A variety of magnetic oxide of iron.—W. H. G.—It is decomposed spar, and consists of siliceous, alumina, and carbonate of lime, which constitute the chief part. It does not necessarily

indicate the presence of metal. There are many localities of tin ore in the United States, but no genuine tin mines. Tin is usually associated with fluor, apatite, topaz, blende, wolfram, etc.—N. W. D.—No. 1 is a rock composed of calcite, chondrodite in grains, and traces of serpentine. There is no reason for rejecting the determinations of the professional assayer. No. 2 consists of hornblende, quartz, feldspar, and muscovite, and the silver may be taken as the assayer has determined.

J. R. A. asks: How can I cure and prevent cracked heels in horses?—J. L. asks: How is oatmeal manufactured?—R. H. B. says: The general impression is that the rainbow is literally a bow. Has any one ever seen the complete circle of a rainbow, which of course can only be seen from a balloon?—B. B. asks: Will it damage flax straw for manufacturing purposes to thrash it with a common spike cylinder thrashing machine?

COMMUNICATIONS RECEIVED.

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

On Chemistry on a Mathematical Basis. By E. V.

On the SCIENTIFIC AMERICAN's Publications. By J. M. R.

On Mr. Edison's Discovery. By N. P.

On a New Form of Chair. By C. M. A.

On the Hydro-Pneumatic Puzzle. By W. H. C.

On the Speed of Pulleys. By J. B.

Also inquiries and answers from the following:

F. B. S.—H. B.—J. T.—S. N.—F. H.—C. E. H. Jr.—P. S.—W. H.—W. S. D.—C. B. L.—R. Y.—J. G.—A. A.—E. R. McG.—A. A.—A. M.—A. J. C.—R. C.—W. L. G.—E. H.—A. J. M.—J. H. H.—W. D.—A. S. C.—B. P.—J. D.—H. B. P.—C. J. T.

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 inquiries analogous to the following are sent: "Who sells the best permanent magnets? Who makes the best traction engines? Whose is the best machine for mitering picture frames?" 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.]

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