SCIENTIFIC AMERICAN

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

Vol. XXXIII.—No. 26. (NEW SERIES.) | NEW YORK, DECEMBER 25, 1875. | $3.20 per Annum. (POSTAGE PREPAID.)

GRAND CENTRAL DEPOT SIGNAL SYSTEM.

Three great railroads have their termini in the Grand Central Depot, located on 42d street, in New York city. An illustration and description of this immense structure have already appeared in these columns. With the exception of the interval between 1:10 and 3:40 in the morning, and of fifty minutes at noon, no period of fifteen minutes elapses in which some train does not depart or arrive *via* the Harlem, the Hudson River, or the New York, Hartford and New Haven road. One hundred and eighteen regular, and from ten to fifteen extra, trains daily pass, in one direction or the other over the tracks on the underground road between 53d street and Harlem bridge, a distance of nearly four and a half miles. Barely two minutes sometimes intervenes between the departure of one train and the incoming of another, and three trains often start at intervals of five minutes apart.

It is obvious that, in order to prevent confusion and accident, the movements of each and every one of these trains, while traveling between the points named, must be governed with absolute certainty. Add to this that crowd after crowd of passengers must be admitted from the reception room to the outgoing cars at exactly the proper time, and the checking of their baggage must be stopped in time to insure its despatch by the proper trains; and the reader will have formed some faint idea of the perfect system which must exist for the management of the machinery of the great depot and its approaches. To indicate the salient points of this system is the object of the present article; and in the accompanying illustrations are represented such devices pertaining thereto as are interesting, both in respect to ingenuity of design and mechanical novelty

GRAND CENTRAL DEPOT—TRAIN DESPATCHER'S OFFICE.

The system as a whole may be divided into three really distinct though closely interwoven parts: first, the means whereby trains are received and despatched, and also the internal operations of the depot controlled; second, the electro-magnetic way signals; and third, the novel interlocking apparatus for switches and crossings. For the sake of clearness, we shall begin with the first, mentioning merely results, and leaving the explanation of the same to consideration in connection with the other two topics.

Located far up on the north wall of the depot, the view from its broad window extending over the intricate network of rails into which the various tracks diverge, is a small cabin, the interior appearance of which the reader has before him in the largest of the engravings herewith given, Fig. 1. On the wall hang signal indicators and bells, time tables, and a huge clock. On the table before the single occupant are a telegraph instrument, a record book, and three rows of ivory buttons, twenty in all. This is the despatcher's office, and here, by pressing the buttons or manipulating the telegraph key, he controls the movement of every train going or coming, the buttons, through simple electric bells, governing everything near and about the depot, the key transmitting instructions to far-off points. By way of illustration, we suppose that one train is to start at 4:30, and that another will arrive at 4:31 o'clock. It is now just 4:10, the passengers are congregated in the waiting room, the cars are in place; and the engine, with steam up, is standing outside, not yet attached. The despatcher touches a button, the sound of a bell is heard, the heavy doors of the waiting room fly open, and the passengers crowd upon the cars. Fifteen minutes elapse: the operator presses another button, a gong strikes in the baggage room, and the checking is stopped. Belated individuals who wish to depart by that train must go *minus* their baggage. Now the operator watches the clock closely; three minutes pass, and then a sharp peal rings out from a bell close beside him. The minute hand points to 4:28, and the incoming train has reached 64th street and is signaling its own approach. The sound continues for half a minute, then stops; the train is at 55th street, and the finger of the despatcher at once presses another button. If we were on the arriving locomotive, we should see a green disk before us, or at night the flash of a green light, meaning that everything is ready for the flying switch just outside the depot, by which the engine is to clear itself from the train, the cars entering the depot by their own momentum. Now it is 4:29; down goes another button; a bell on a post beside the locomotive waiting outside rings for the engineer to back in and couple on. Hardly ten seconds elapse before a sharp "ting" calls the operator's attention to the fact that the pointer arm of the indicator on the wall has swung over from "clear" to "block." The arriving train is on the 53d street crossing. The clock says 4:30; again a button is pressed, the doors of the waiting room are slammed shut, there is a few seconds' delay for the tardy ones on the platforms to board the cars, and then the train moves slowly out of the depot. The indicator pointer still shows "block," and if the outgoing train continues its course a disastrous meeting on the crossing may result. The despatcher remains passive, however, for he knows that the signal between that train and the crossing is normally at "danger," and that the engineer will certainly come to a stop, and wait until the red disk is turned. The delay is but for a second, for the indicator bell almost instantly sounds again, the arm swings over to "clear," and the proper button is immediately touched. A distant cloud of steam can be seen for a moment, and the outgoing train is off again. Pressing another button, the operator restores the danger signal. The arriving train now rushes in, its passengers disembark, and at the sound of the bell from the despatcher, a locomotive kept for the purpose, couples on and drags the empty cars out of the depot.

We have accounted for twenty-one minutes, during which one train has left and one arrived; the reader may imagine the celerity and certainty of the work when we add that, within the fifteen minutes which we recently spent in the despatcher's cabin, three trains on three different roads were started and three received, all at different times and without the slightest confusion.

The electric bells about the depot being of simple and well known construction, and sounded by the establishing of the current when the buttons are pressed, need no elucidation; and therefore the points remaining which require explanation are those relative to the movement of the flying switch and danger signals by the despatcher, and also as regards the indicator which announced the passage of the train over the crossing. This brings us to the second branch of our subject.

The electro-magnetic way signals and their operations are represented in Fig. 3. The signal is a disk made of metal, painted red, and inclosing a circle of red glass. This is supported on a shaft, shown upright (it may be horizontal, or in fact in any position), which, by the gearing and weight shown at A, is rotated through the unwinding of the cord wound about the barrel of the larger gear wheel. The disk may be turned to present its full face or only its edge in any direction, in one case showing its full color and signaling "danger," in the other being almost invisible and allowing the aperture of the frame or box in which it is placed to appear empty, meaning the reverse, or "clear road." It is obvious that, in order to govern the disk so that it must always appear in one of the two positions—that is, full face or on edge—mechanism is required which will allow it to be rotated by the weight exactly one quarter revolution at a time, and no more nor less. This apparatus is found in the simple electro-magnetic device shown. Just below the disk, and rigidly secured to the shaft, are four arms having downward end projections, B. Also fixed on the shaft and further down is a cam, carrying beneath it two short vertical pins. The latter, as the shaft revolves, strike certain leaf springs, which will be seen on the circular stage, C, which is located just above the frame which carries the electro-magnet, D. The armature, E, of the magnet is hinged at one side, and so placed that, when not attracted by the magnet, and consequently held outward by a suitable spring, the projections, B, strike against it as shown in the engraving, so holding the disk stationary. The construction is such, however, that when the circuit is closed by any means, through one of the springs on the circular stage, C, and the pin on the cam of the disk shaft, then the magnet will become active, the armature be drawn in, and the projection freed, when of course the action of the weight will revolve the disk. But as the latter revolves, the pin on the cam will pass clear of the spring on the stage; the current will then be broken, and the armature will fly back in time to intercept the next projection, B, preventing further movement of the disk, which

(*Continued on page* 402.)

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

Club Rates.

Ten copies, one year, each $2 70, postage included $27 00
Over ten copies, same rate each, postage included 2 70

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VOLUME XXXIII., No. 26. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, DECEMBER 25, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

THE END.

With this issue, the time for which a large number of our subscribers have prepaid expires. We hope that all will renew their subscriptions, and bring some of their friends and neighbors with them. The safest way to remit is by Postal Order, Express, Bank Check to order of Munn & Co., or Registered Letter. But little risk is incurred in sending bank bills by mail, although the above-named methods are safest. Beautiful Chromo Name Lists and Special Prospectuses and Circulars sent on application.

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THE ORIGIN OF LIFE.

Whether the line of experimental investigation adopted by Bastian and other students of spontaneous generation will ever lead to a convincing demonstration of the origin of life *de novo* is very doubtful. However fine the apparatus employed, however exacting the precautions against the slipping in of germs from without or their escape from destruction within, the ingenuity of the opponents of the theory will always be able to discover a possible broken link in the chain of evidence.

Like many another point of scientific controversy, this, we suspect, will be flanked rather than carried by direct assault. As in the case of magic and witchcraft—belief in which died a natural death in the minds of intelligent people, superseded by more rational views of man and Nature, but never logically demolished—so, we are inclined to think, the mystery of life's beginning will undergo a natural solution.

Those who hold to the dogma of "no life without antecedent life" are compelled to assume, at some point in the history of the Universe, the occurrence of nothing less than a miracle—that is to say, a phenomenon unknown to Science, and logically unsupposable from a truly scientific point of view.

Life must have begun somewhere, once at least. If it was not a natural product of material conditions, its beginning must have marked a positive breach in that causal connection of events without which Science would be impossible. The weight of all experience is against assumption of such a breach of continuity: in other words, against a miraculous origin of life. On the other hand the weight of experience is equally against the assumption of a material condition absolutely unique in character. If life arose once in consequence of material conditions, Science affords no justification for the assertion that such conditions may not be repeated, possibly in our laboratories.

This is substantially the position taken by Mr. Proctor in the latest expressions of his views, and by Professor Tyndall in his latest discussion of matter and life; and such appears to be the growing conviction of those of the present generation of scientists most pervaded by the spirit of scientific progress. Says Professor Tyndall: "The conclusion of Science which recognizes unbroken casual connection between the past and the present would undoubtedly be that the molten earth contained within it elements of life, which grouped themselves into their present forms as the planet cooled." The context shows that by "elements of life," Professor Tyndall does not mean entities but possibilities of molecular condition by which the phenomena of life were to be evolved in the natural course of events, not by the miraculous addition of a new force but by means of the forces already in play.

"The difficulty and reluctance encountered by this conception," he continues, "arise solely from the fact that the theologic conception obtained a prior footing in the human mind. Did the latter depend upon reasoning alone, it could not hold its ground for an hour against its rival. * * * Were not man's origin implicated, we should accept without a murmur the derivation of animal and vegetable life from what we call inorganic nature. The conclusion of pure intellect points this way and no other."

Admitting the natural origin of life, the question arises: When did life begin?

One branch of the evolution school delights to trace the existing forms of life back to some primodial germ: through changing conditions, the tendency of living things to vary from generation to generation, the survival of the fittest, etc., the one has become many. But there is from this point of view no satisfactory accounting for the persistence of so many primitive forms, or for the present preponderance of undeveloped forms. Nor is there any sufficient reason given for assuming that life began once, and once only, in the distant past.

A more logical position is occupied by those who favor the hypothesis that the material conditions: under which life originates are common conditions; consequently that the low forms of life which swarm in the waters of today are low because of their recentness. If they resemble long past fossil forms, they do so from some natural law of evolution, rather than in consequence of direct descent. From this point of view there may be no closer kinship between humanity and existing brutes than arises from a common relationship to Mother Earth. Man may be cousin to the ape; but that does not necessarily follow from the theory of evolution, as the Science of the future will regard it.

HEAVY LOSS FROM LIGHTNING ROD IGNORANCE.

On the 6th of September last the large woolen mill of Robert Fitton, Esq., at Cavendish, Vt., was struck by lightning and consumed, with a loss of $100,000; 130 persons were thrown out of employment. The mill was 45 feet wide, 106 feet long, 4 stories high. It had a flat, gravel-covered roof, and around the eaves ran a ½ inch iron lightning rod with vertical points every four feet. From the eaves rod six branch rods extended to the ground, five of which terminated at a depth of three feet below the surface, and the other was carried thirty feet underground to the bank of a pond. These particulars have been mostly furnished to us by the proprietor of the mill. The Boston *Commercial Bulletin* states that the insurance underwriters regarded the mill as particularly well protected against lightning, as there was upon it an unusual array of rods, which had been overhauled and put in good order during the year. Yet the mill was struck, the flames flashing instantaneously through the spinning room. The *Bulletin* thinks that the loss of this mill shows what value there is in lightning rods. The insurance companies had to pay $84,000 in settlement.

The principal comment we have to offer is that the burning of the Cavendish mill was a glaring example of the results of lightning rod ignorance. It would be difficult to find a more sagacious or enterprising body of business men than are the presidents, directors, secretaries, inspectors, and agents of our fire insurance companies. It would naturally be supposed that, in a matter which so directly affects their pecuniary interests as fire losses from lightning, they would take great pains to acquire knowledge concerning the means of safety, and promulgate the strictest requirements among insurers. But they appear to be lacking in this respect, although year after year the records of annual losses of millions in property, by fire caused by lightning, are forced upon their attention, and large sums of money in damages are drawn from their coffers. By consulting the naval records they may easily satisfy themselves that, while formerly the losses of ships and lives by lightning were enormous, the losses immediately ceased when rods were introduced upon vessels: and at the present day we seldom or never hear of a serious injury to or loss of life from lightning, upon a properly rodded ship. The same appliance that protects a wooden vessel at sea will protect a wooden building on land, and we will here briefly describe this appliance, though in doing so we only repeat what we have oftentimes published.

In general terms, a ship's lightning rod consists of a rope or rod of copper or iron wire, lashed to the rigging and extended from the sky pole down so as to connect at any suitable place with the copper bottom, which is in contact with the sea. The rod thus has for its terminal a very large surface of conducting material, larger in fact than the deck surface of the vessel, and the lightning passes off harmlessly.

The golden rule of safety for rodded buildings is analogous to the above. *The rod must have for its terminal a very large surface of conducting material,* placed underground in contact with the earth. Without such a terminal, no rod can be considered safe.

How large should be the conducting surface of the terminal, and of what materials made? The area of conducting surface necessary to ensure safety varies with the nature of the soil. If the ground is always moist, a smaller extent of conducting surface for the bottom of the rod will be safer than if the soil is generally dry.

To meet the contingency of a very dry soil at the driest season of the year, the electrician, Mr. David Brooks, of Philadelphia, recommends that the rod have for its terminal a conducting surface, placed underground, equal in area to that of the roof of the building; if this rule errs, it is probably on the side of safety.

Applying the Brooks rule to the Cavendish mill, the rods should have had for their terminals, underground, 4,770 square feet of conducting material, in contact with the earth, instead of which they only had the beggarly amount of less than thirteen square feet. No wonder that the building was struck.

Of what material should the terminals of lightning rods be composed? Iron or copper plates or pipes are the best material. In all cases where there are underground water pipes, the rods should connect with them. If these are of any considerable extent, nothing more is required. In cases where metal terminals cannot be provided, then good charcoal may be used in quantity sufficient to furnish the required extent of conducting surface. This substance ranks next to the metals in conductivity. It may be placed in a trench leading away from the building, with the rod extended along the center. Full particulars concerning lightning rods, the electrical laws concerning them, the electrician's tests for safety, and the best methods for their construction have been given, many times over, in our back numbers; but we propose to continue the subject from time to time so long as may be necessary. We are confident that, if the insurance companies were each to spend seven dollars and place the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT on file in their respective offices during the year 1876, they would derive many most valuable suggestions from our pages, not only concerning the means of safety from lightning, but the prevention of fires of every description: suggestions which, if required to be carried into practice by insurers, would save large sums of money to the companies.

LIGHT IN COAL MINES.

Two or three years ago the SCIENTIFIC AMERICAN suggested a plan of lighting coal mines from without, so as to do away with miners' lamps, and thereby avoid the explosions of fire damp inseparable from their use. The terrible explosion which occurred on December 6 in a Yorkshire colliery, a colliery said to be worked entirely with safety lamps under very rigid discipline, gives fatal emphasis to the demand for a different mode of illuminating such works.

The experiments described in this paper (page 129, volume XXXI.) amply demonstrate the unsafety of safety lamps in places where blasting is practised, the sound wave generated by a blast driving the flame through the wire mesh of the lamp and firing the explosive air without. However perfect the lamp may be, however carefully managed, the protection it affords is only partial; and explosions are liable to occur so long as they are employed. The safety of the miners demands, therefore, the exclusion of all illuminating flames, wherever fire damp is liable to exist, and the lighting of the mines by luminous radiations incapable of exploding fire-damp.

This could be accomplished very easily, we believe, by the generation of the light without the mine (or else at the foot of a ventilating shaft), and its conveyance through tubes to the points requiring illumination. Beams of concentrated light could be sent to any distance through pipes having reflectors suitably placed at bends and angles, or without reflectors, provided the interior of the pipes were smooth and bright. The cost of such lighting would probably be less than the cost of lamps, and the degree of illumination might easily be such as to flood the mine with the brilliancy of daylight.

Another substitute for treacherous safety lamps might be found in electricity, the lanterns being closed so as to make it impossible for explosions to occur. If the insulation of the conducting wires should prove a serious obstacle, it is quite possible that Mr. Edison's "etheric force" would do the work as well without insulation.

THE DISCOVERY OF ANOTHER FORM OF ELECTRICITY.

Several years ago, it was accidentally discovered that, when the contact of an electric current which magnetized a large electro-magnet was broken very near one of the poles of the electro-magnet, the spark was so much increased in intensity as to produce a powerful snap, like that of a small pistol; while the breaking of the contact at a distance from the electro-magnet produced by no means such effect. The next thing observed was the drawing of sparks from the iron electro-magnet, or from its armature; but neither of these phenomena led any investigator to search out their origin, or to try to find what further results of the same class could be obtained.

This appears to have been done at last by Mr. Edison, of Newark, well known among electricians for several valuable inventions relating to electric telegraphy. He investigated the nature of the spark which could be obtained from the iron core of the electro-magnet, which, according to his statement, recently published, does not manifest the ordinary properties of electricity. The galvanometer is unmoved, the delicate gold leaf electrometer exhibits no signs of deflection, a Leyden jar is not charged by it, etc. But we consider the conclusion that this manifestation shows the existence of a new force, to be rather hasty.

It is well known that static electricity, which will produce a shock, will not move the galvanometer, and that the current of a large element of a voltaic battery will neither move a gold leaf electrometer, charge a Leyden jar, nor produce a shock. Therefore to say that the phenomena observed at test new "principles, until now buried in the depths of human ignorance," as some of the reporters of the daily papers have done, is, to say the least, rather premature.

We will here call attention to the fact that at present three principal forms of electricity are known, and they vary so much in their nature that formerly some investigators inclined to consider them as separate forces or fluids. First we have the so-called static electricity, possessing great tension; it is developed on a small scale by friction, and on a large scale by evaporation and induction, as manifested in thunder storms. For this form of electricity, not only all kinds of metals, but water and the human body are good conductors, even the dry skin of the hands forming no obstacle. Secondly, we have the voltaic or galvanic electricity, originated by chemical action, and developed in our galvanic batteries. For this form of electricity, only some metals are good conductors, others poorer, while water and the human body are bad conductors; its effects on the latter cannot be studied without wetting the skin, as the dry skin is a non-conductor of it. This form of electricity is used for telegraphy, while, as is well known, the static electricity (as obtained by friction) is not so useful for this purpose, its great tension causing it to escape too easily. Thirdly, we have the thermo-electricity, discovered in 1820, by Seebeck in Berlin, which differs as much from the galvanic electricity as the latter does from static electricity. For this thermo-electricity, water or the human body is an absolute non-conductor, and a thin metallic wire is but a poor conductor; so that it can scarcely pass through the whole length of the coil of a common galvanometer, and does not act on this instrument, but is powerfully indicated by one made with very thick and short wire, even if the galvanometer consists of one single, heavy, and uninsulated wire, in a coil of one turn or only half a turn.

Now it appears to us that the form of electricity discovered by Mr. Edison, may be:

1. A fourth kind of electricity, requiring as little or less insulation than the thermo-electricity of Seebeck. It is said to pass over the ordinary gas pipe, and can equally well be drawn from several of the chandeliers in a house, or even in other houses, if one of them is connected with the source of the new electricity.

2. It may consist of a continually reversing current of inductive electricity of a form in quality between the static and galvanic kinds. This appears the more probable as its source is said to be a vibrating armature, in which of course there are continuous interruptions, the induced currents formed by the interruptions running in an opposite direction from those formed at the making of the contacts, as is well known by all electricians. Such continually reversing currents of course cannot act on the galvanometer, gold leaf electroscope, or Leyden jar, as their rapid reversion neutralizes all possible charge, the only manifestation being the sparks, of which, however, the rapidity of the succession causes an abundance, little affected by imperfection or even absence of insulation.

At the same time, this would explain why one end of a long wire, bent over the other end connected with the electric generator, will produce a spark. Electricity is present in such abundance that branch currents are easily supplied; while at the same time the two polarities are continually and so perfectly balanced as to exactly counteract one another, so as to be unable to charge any conductor, or to manifest the results of such charge, as in an electroscope, or to establish a polar current and manifest its results, as with a galvanometer. It is undoubtedly a manifestation of electricity; and being neither positive nor negative, as is the case with all the forms of electricity thus far known, it might be called neutral electricity.

The sparks investigated by Dr. Reiss, the well known German electrician, and called by him weak sparks, have polarity, being either positive or negative; and although they have certain resemblances to the electricity obtained by the method of Mr. Edison, they appear to be of a different nature, having a very different origin.

The most remarkable feature of this new form of electricity, which proves its perfect neutrality, is that it has no apparent effect on the human body, and none on even that most delicate of all electric tests, the properly prepared frog's leg, unless an exceedingly strong galvanic current is used around the magnet.

Two New Street Engines.

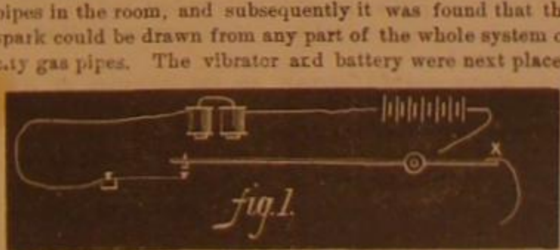
A new traction engine for street usage has recently been tested in Brussels, Belgium, with satisfactory results. Exteriorly it resembles an ordinary street car, with the exception of the chimney which projects through the roof. The body is placed quite low, and the wheels, which run on rails, are concealed to within a short distance from the ground. The boiler is tubular and inexplosible, and is heated by coke. The engine is one of the Brotherhood three-cylinder pattern. The exhaust is condensed in a tubular condenser, and the boiler is fed by a separate steam pump. The machine traveled without smoke or escape of steam, made no more noise than an ordinary horse omnibus, and turned sharp curves very easily. Another engine has been introduced in Paris; but instead of running on a tramway like the above, it is a kind of omnibus or steam carriage. It accommodates 12 passengers and weighs about 5 tuns. A vertical engine supplies the motive power and occupies a space in the rear of but 39 inches high by 31 inches broad. A Giffard injector forces in the feed water, which is taken from the gutters or any other convenient source. The machine will travel at the rate of 9 miles per hour. About 3 horse power is utilized, requiring 600 quarts of water, and 110 lbs. of coal per hour.

THE NEW PHASE OF ELECTRIC FORCE.

In our number for last week, we called attention to what we at first supposed to be a similarity between the prior experiments of Professor Reiss and those of Mr. Edison. A further examination of the Reiss reports satisfies us that the results obtained by Mr. Edison are novel, and have little or nothing in common with those of Professor Reiss.

We have had an opportunity of closely examining the apparatus by which Mr. Edison and his assistants obtained the evidences of the supposed new kind of electricity which has lately elicited so much inquiry and speculation, and we present herewith three diagrams of some of the apparatus used by Mr. Edison during his experiments.

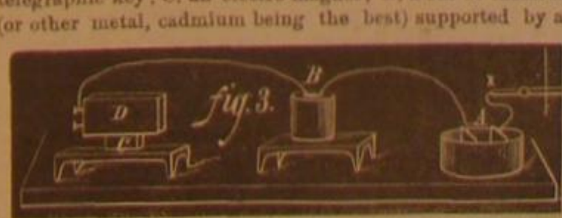
The first recognition of the distinctive character of the spark occurred on the evening of November 22. Mr. Edison and his assistants, as we have already stated, were experimenting with a vibrator magnet, consisting of a bar of Stubb's steel, fastened at one end and made to vibrate by means of a magnet, when they noticed a spark coming from the core of the magnet. They had often noticed the same phenomenon in connection with telegraphic relays, in stock printers when there were iron filings between the armature and the core, and in the new electric pen, and had always supposed it to be due to inductive electricity. On this occasion the spark was so bright that they suspected something more than induction. On testing the apparatus they found that, by touching any portion of the vibrator or magnet with a piece of metal, they got the spark. They then connected a wire to the end of the vibrating rod (the wire leading nowhere), and got a spark by touching the wire with a piece of iron. Still more remarkable, a spark was got on turning the wire back upon itself and touching any part of the wire with its free end. The end of the vibrating rod was then connected by means of the wire to a gas pipe overhead, whereupon a spark could be drawn from any part of the gas pipes in the room, and subsequently it was found that the spark could be drawn from any part of the whole system of city gas pipes. The vibrator and battery were next placed



on insulated stands, and the wire, connected with x, Fig. 1, was carried over to the stove, about 20 feet distant. On rubbing the end of the wire against the stove, splendid sparks were observed. With the wire permanently connected with the stove, sparks could be drawn from any part of the stove with a piece of metal held in the hand. Again, while the vibrator was in action, a block of iron was placed near x, but not touching the bar, nor connected with it in any way except by the wood of the base through the table, and sparks could be drawn from the iron.

These and other experiments which we have had the pleasure of witnessing show conclusively that the new force is not amenable to the laws of voltaic or static electricity.

An experiment made with the apparatus figured in the large engraving (Fig. 2) will satisfy any electrician that the force in action is not induced electricity. All the parts are insulated except the gas fixture. A is the battery; B, a common telegraphic key; C, an electro-magnet; D, a bar of cadmium (or other metal, cadmium being the best) supported by an

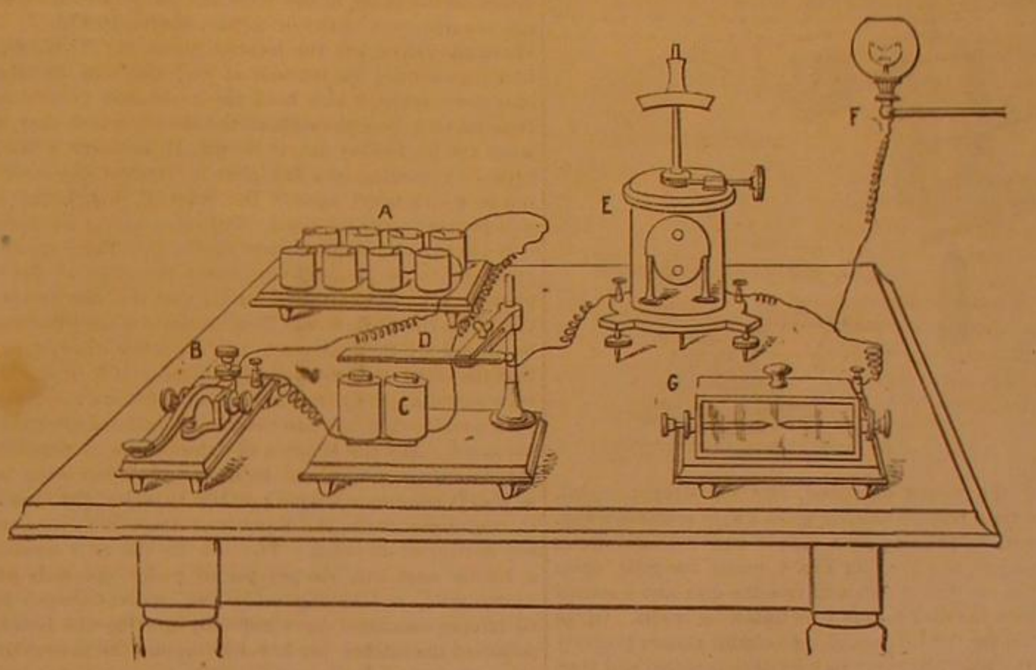


insulated stand; E is a mirror galvanometer; F, the gas pipe; G, a dark box enclosing pencils with graphite points (common lead pencils). The unknown current passes from the bar of cadmium through the galvanometer, without causing the slightest deflection, and—notwithstanding the gas pipe connection, which would drain the wire of induced electricity, if there were any—bright sparks are visible between the graphite points in response to the motion of the telegraphic key.

Standing on an insulated stool, the experimenters draw sparks from the following arrangement (Fig. 3), in which x is the end of the vibrator (which, as well as the battery, is insulated): A, a secondary battery; B, a 200 ohm coil of copper wire; C is a block of iron, and D, a condenser, all well insulated except A, which is of glass, and stands on the table.

In another experiment a glass rod, four feet long, with a piece of carbon fixed to one end, was well rubbed with a silk handkerchief over a hot stove, and the carbon point presented to the apparatus, the other end of the rod being held in the hand with the handkerchief: sparks were drawn, yet the galvanometer chemical paper, the sense of shock in the tongue, and a delicate gold leaf electroscope were not in the least affected by the mysterious current.

Tested in whatever way the experimenters have been able



MR. EDISON'S APPARATUS, EXHIBITING THE NEW PHASE OF ELECTRIC FORCE.—Fig. 2.

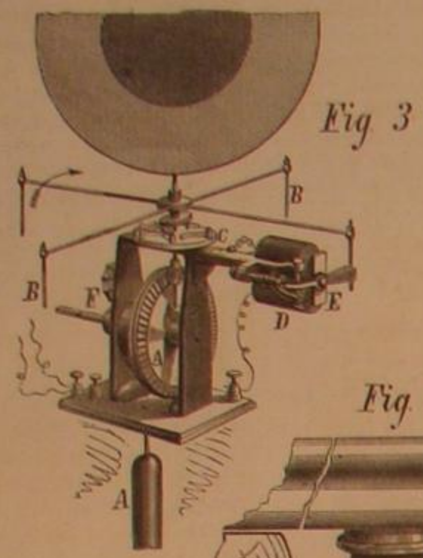
to devise, the new current refuses to obey any of the established laws of electricity further than that it traverses metallic conductors, manifests itself as light, and can be controlled by making and breaking connection. Among its observed peculiarities may be noticed its lack of polarity, indifference to the earth (and consequently its capability of transmission through uninsulated wires), its power of producing action when turned back upon itself, its independence of electric non-conductors, and seeming lack of mechanical and physiological effect.

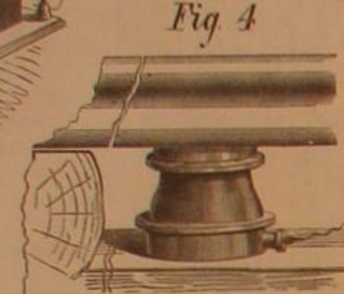
Mr. Edison has proposed the name "etheric force."

Since the above was put in type, Mr. Edison has sent us a variety of additional particulars pertaining to his new and interesting discovery, which we shall give to our readers in our next number.

(Continued from first page.)

will thus have completed exactly one quarter revolution, changing for a given location from an edge view to full face, or *vice versâ*. The reader has doubtless ere this divined that the despatcher, in raising a danger signal to release the outgoing train, or in setting the flying switch signal, simply pressed a button which established an electric current, and thus charged the disks as was necessary. From the foregoing also it will be obvious how this signal is worked on the block plan from two different points. As soon, for example, as a train passes a given location, an operator there





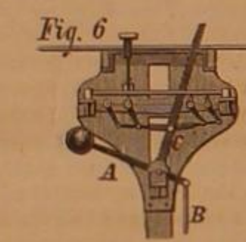
posted, by the means described, sets the danger signal. When the train reaches another point a safe distance away, it may itself, by pressing on a simple and delicate circuit closer, arranged, as shown in Fig. 4, under the rails, again establish the current, which will free the disk arm a second time and turn the disk to safety for following trains. Or, as it is easy to see, by the use of two circuit closers properly disposed, the train might set its own danger signal and then reverse it when a suitable distance has been traversed.

But it is not enough that the signals should be set. The people in charge of them must also be infallibly informed of that fact, as well as of any failure in the working. For this purpose the tell-tale shown in Fig. 2 is used. This is the machine which announced that the incoming train, in one example, was coming over the 53d street crossing; or more properly, it first showed that a block signal had there been set and afterwards reversed; for through that signal it was operated, as we now proceed to show.

By examining the circular stage, C, in Fig. 3, a pair of springs at the left hand side, placed so as to overlap, will be noticed. There are two pairs of these springs, arranged diametrically opposite to each other on the circle, and hence between the two similarly disposed single springs, through which the circuit, as before explained, is established. The members of each pair of springs overlap without touching, but are brought in contact by one of the pins on the cam on

the disk shaft, during the revolution of the latter. Without entering into further detail, we may state that this contact must necessarily be caused with one or the other pair of springs whenever the disk changes position, and the effect of such contact is to send a current to the electro-magnet in the indicator, Fig. 2. The armature of this magnet is connected with the index clapper, and the general construction is such that, whenever the magnet is excited, the clapper will be thrown over to a position opposite to that in which it happens to be. The relation between indicator and signal is so adjusted that whenever the signal shows "danger," the clapper, which has a weighted extremity to aid its motion and to strike a gong at each end of its course, and so to give warning, swings over to "block;" when the signal is reversed the arm swings back to "clear." During its travel it strikes a suspended ball, and this, vibrating, shows to ano perator, who may have several indicators before him, which one has just become reversed. By this arrangement, it will be evident that when the signal moves the indicator must show it, and *vice versâ*; so that the operator always has accurate knowledge of the state of the sections of line under his charge, no matter how far distant from him, or how widely separated the same may be. There are many ingenious points about the system, which lack of space forbids our describing. We may mention, however, the device partially shown at F, in Fig. 3, which consists of the winding stem for the signal weight, and also other mechanism, which compels the turning of the stem and the consequent winding of the cord, before the door of the case in which the signal is contained can be unlocked to admit of the insertion of the lamp at night. Another ingenious device is that used for drawbridges, which consists of a lock on the crank, which withdraws the locking pin of the bridge. It is impossible to do this until a button is pressed, which sets a danger signal for approaching trains, nor can that signal be reversed or tampered with until the bridge is again securely locked in place.

One of the most important localities where that system is necessary is at the crossing of several tracks, similar to that at 53d street; and here also is used the new switch apparatus, which forms the third and last portion of our subject. Fig. 5 shows the interior of the switch house with the working levers. Each lever is connected to a weighted arm, A, Fig. 6, and also, by suitable interposing connections, through the rod, B, to the locks, the signals, or switches. Attached to the shank of the lever, at C, are jointed rods, which are secured to a series of square shafts, D, Fig. 7. Just above the shafts are the locking plates, E. These are flat iron plates hung in journals at each end. In the edge of each are notches, which hold the levers and prevent them from moving from the ends of the slots in which they work when the latches lay flat, as shown. If, however, a latch be tipped by pressing on a foot piece in front of the lever, the rod of which bears against the point, F, Fig. 7, the lever will be freed from the notch. The interlocking arrangement is found in cams on the square shafts, D. These are so disposed as to be immediately under the edge of the latch plates. When a shaft is so turned that the cam presses on the plate from below up, then, obviously, the plate cannot be tipped by the foot piece, nor the lever disengaged; so that the latter is thus securely locked. It is impossible to set a signal at safety if the switch points are not properly placed and locked, nor can the latter be altered after the signal is set. Any combination of interlocking is possible: in other words, any lever can be made to lock any other lever, so that it becomes a simple problem to adjust the apparatus in conformity with the number of track requirements at any particular situation. The lock for the rails consists of a hollow cast iron sleeper placed under the ends of the switch rails, and having other two crescent-shaped pivoted latches connected by a rod. By moving the latter, the points of the latches are lowered beyond the bottom of the



rails, so that the same can be moved sideways, or raised so as to prevent any similar motion. The construction is such that, unless the rails are properly placed, it is impossible to raise the latch, which thus offers an additional means of safety. Taken as a whole, the ingenuity, simplicity, and utility of this perfect system of communication, and the contrivances invented to accomplish it, are truly wonderful. The mechanical appliances are the joint inventions of Mr. J. M. Toucey, the General Superintendent, and Mr. William Buchanan, Superintendent of Machinery, of the Hudson River Railroad.

The electro-magnetic signals are the invention of Mr. Daniel Rousseau of this city, and are the subjects of several very recent patents. The depot arrangements are the results of the combined skill of Superintendent Toucey and Depot Master Franklin. To all the above named gentlemen we are indebted for much courtesy in facilitating our obtaining the interesting facts here presented.

ACIDEMETRY APPLIED TO THE TESTING OF VINEGAR.

In order to determine the value of a vinegar, it is necessary to discover in what proportion acetic acid is present and to assure oneself that no foreign mineral acids are contained. The chemist executes these various operations with acidimetric liquors, reagents, and apparatus; but there has been for some time needed a simple and practical process available to those who may not have at their command the resources of a laboratory. MM. Reveil and Salleron have recently devised an acidimeter, the use of which is illustrated in the annexed engravings (taken from *La Nature*), and which can be readily understood and the directions for its manufacture and employment followed.

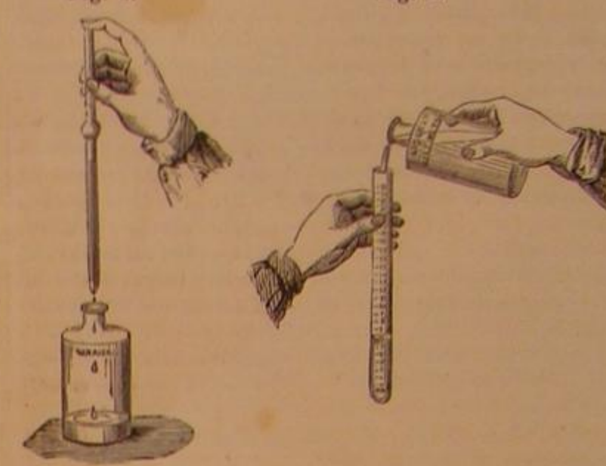
The necessary apparatus consists, first, in a tube of glass closed at one end as shown in Fig. 1; near said extremity, at the zero mark, the word "vinegar" is inscribed to indicate the amount of vinegar to be employed. Above the zero, the tube is divided off, and the divisions are marked 1, 2, 3, etc., so as to show the richness in acid, as will be described below. Second, there is a small sponge attached to a whalebone to be used to clean the tube after each experiment. Third, a pipette (Fig. 2), is marked to show a quantity of 0·25 cubic inch of liquid, so that the amount of vinegar for each test can be accurately measured. Lastly a flask of liquor, used as a standard acidimetric reagent, is added.

One fourth of an inch of vinegar is taken into the pipette and retained therein by the finger, as shown in Fig. 2. This is allowed to flow into the graduated tube and the acidimetric liquid, colored blue, is slowly poured in. The fluid soon becomes red when the tube is agitated by being turned over, the thumb stopping the opening. More of the test liquid is added, the mixture a second time shaken, and so on until the fluid in the tube becomes of the color of the red outer skin of an onion. The graduation on the tube, corresponding to the level of the liquid, is then read off, and this shows the centesimal proportion of acetic acid contained in the vinegar.

The reaction can easily be followed. The acidimetric liquor, prepared in advance, is a solution of borax and caustic soda. The proportion of these ingredients is calculated to correspond to a certain quantity of crystalizable acetic acid. The liquor is colored blue by litmus, and indicates by its change to violet red the moment when the saturation of the acid by the base is effected.

Vinegars are sometimes adulterated with sulphuric and other mineral acids, which may be detected as follows: The vinegar to be tested is boiled with a few fragments of starch.

Fig. 2. Fig. 1.



It is then cooled, diluted, and a few drops of iodine tincture dropped in. With pure vinegar, the blue color of iodide of starch should show itself; if no coloration ensues, a foreign mineral acid is present. Wine vinegars are frequently falsified with wood vinegars (pyroligneous acid): this last product almost invariably contains small quantities of sulphate of soda, the presence of which may be detected by the addition of chloride of barium, which yields a white precipitate, sulphate of baryta.

KING'S IMPROVED SUPPORT FOR PRINTERS' GALLEYS.

The annexed engraving represents a simple little device designed to support a printer's galley when the same rests upon the case, during the process of making corrections in the type or during the transfer thereinto of type from the stick. Ordinarily the galley is rested against the ledge of the case or else placed diagonally across the latter, thus covering several letter boxes and necessitating its being moved whenever the types contained in such receptacles are required. The present device sustains the galley in such a position that none of the boxes are wholly closed, so that access into any one of them may easily be had.

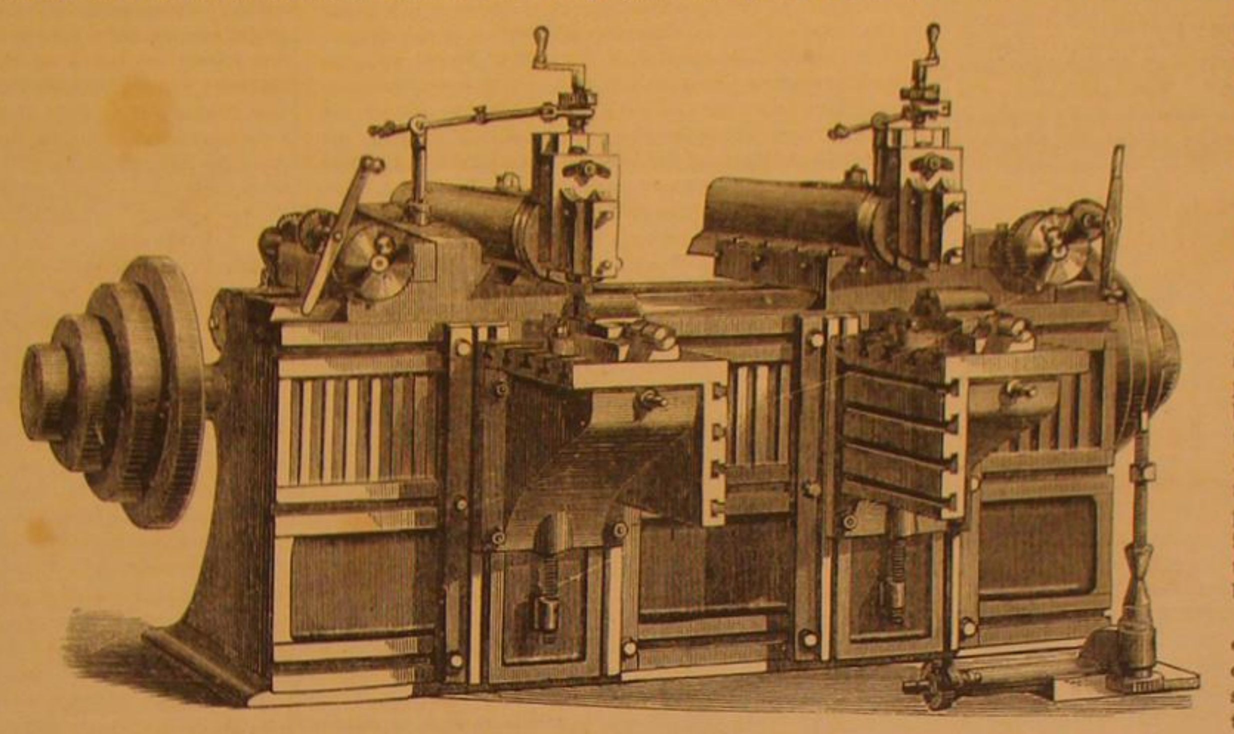
As shown in the engraving, it consists simply of a meta casting, forming a straight grooved piece between two pa rallel pieces, disposed at the ends and at right angles thereto. The groove in the central portion and notches in the cross pieces fit over the transverse partitions of the case, and the galley rests against one crosspiece while the other presses against the longitudinal partition or edge. The invention is a handy convenience for compositors.

Patent now pending through the Scientific American Patent Agency. For further particulars address Messrs. Johnson & King, 100 11th street, Brooklyn (E. D.), N. Y.

THE hydraulic ram is especially useful where there is a small stream of water and only a slight fall. A fall of two feet, and a flow of 1¼ cubic feet of water—92¾ lbs.—per minute, will deliver 0·010 of a cubic foot of water per minute at a hight of 38 feet.

NEW DOUBLE SHAPING MACHINE.

Messrs. R. Fernau & Co., of Vienna, Austria, have recently put in market a double-acting shaping machine, of which the specialty consists in the arrangement of the feed motion, which will be understood by reference to the perspective sketch and the detail. The boss of the driving pinion is extended, and has a curved slot formed in it, which imparts an oscillating motion to a lever; this motion is transferred to a horizontal shaft, through which it is conveyed to the tool holder. On the front end of this shaft is a cast iron cap, which serves as a lever and also as a cover. In a slot in the cover (see Fig. 2) is placed a bolt, which can be moved up or down at will, the end of the bolt projecting, as shown in Figs. 1 and 2, into a triangular opening in the piece within the cap, so that the oscillating movement of the cap gives greater or less motion to the piece above mentioned, which carries at the upper end a pawl and ratchet driving a toothed wheel, that in its turn conveys motion to a worm and wheel. The spindle of the latter carries a horizontal pinion gearing into a rack, and gives motion to the wheel.



DOUBLE SHAPING MACHINE.

Skilled Labor.

The richest mines of wealth of a nation are its workshops, its factories, and its farms, filled with men of highly trained and skilled labor, it being a universal law that the world's great prizes go to the best. This is not simply an abstract question, but one affecting us all in our prosperity and success every day and every hour of the day, and every day in the year. France, Switzerland, Prussia, and Germany have laid us, and are laying us, every year under contributions of millions of dollars for very superior workmanship, taste, and skill. Their silks, their laces, their cloths, their china and porcelain, their bronzes, their fabrics in metal and wood, and their objects of *vertu* and art could be largely produced in this country if we had developed and educated our artisans and mechanics up to the same perfection in workmanship that they have in those countries.

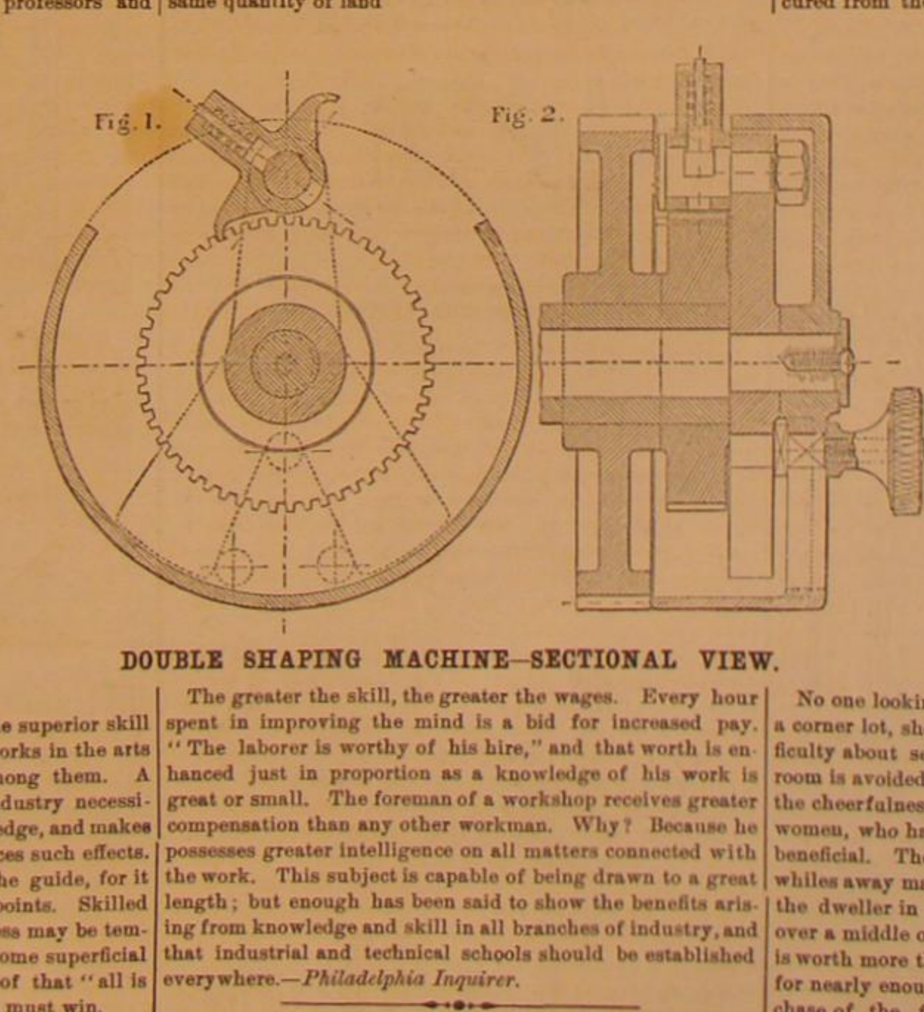
Their mode of thorough instruction in their workshops and manufacturing establishments produces men of the highest order of training, ability, and skill. If we take, as an example, the small State of Wurtemburg, in Germany, with a population of 1,778,000, we find that they have forty-nine industrial and technical schools for the training of boys and educating them in all the industrial arts. In these schools there is a mercantile and commercial course, and one for the application of chemistry to the chemical arts and manufactures, where there are fifty-one professors and teachers of chemical and physical mineralogy, modeling rooms, mechanical workshops, rooms for drawing, botanical garden, and astronomical observatory. There are other schools for building instruction and tradesmen, where builders are trained for masters and constructors of public works, etc., and plasterers, carpenters, grainers, painters, smiths, etc., are educated for fore men and masters; and the schools are crowded with those for whom they were intended, while the graduates are eagerly sought everywhere on the Continent for their superior excellence.

There are also schools for education in all agricultural pursuits, in which practice is combined with theory, they having under their care four hundred square miles of territory. These schools are largely attended, for in one year 12,040 persons, in 523 places, were getting a thorough, complete, and practical agricultural education. Connected with these schools are institutions for practical training in anatomy, physiology, and diseases of animals; and a smithy is attached, in which 4,000 animals were shod per year.

The result of this discipline is shown in the superior skill of the workmen, the excellence of all their works in the arts and sciences, and the harmony existing among them. A thorough acquaintance with a particular industry necessitates a wide range through the field of knowledge, and makes a familiarity with all the causes which produces such effects. The brain is the motive power as well as the guide, for it points the way, and all things move as it points. Skilled labor is its own protection. While its progress may be temporarily impeded by the glittering tinsel of some superficial work, yet its final success is conclusive proof that "all is not gold that glitters," for merit in all things must win.

Carelessness and ignorance are the most fruitful sources of loss of life and property. Proportionately, as the mind becomes trained and disciplined, carelessness ceases; greater care is manifested in the management of all the affairs of life and the products of our workshops. The great hurry, which has characterized our people, to reach results and to accumulate riches causes that neglect and superficial workmanship which is so prevalent. Scarcely a paper is published that does not contain in its columns some startling accident, accompanied by great loss of life, occasioned by defective machinery or ignorance in its management. Railroad collisions nearly all result from these causes. The disastrous errors which frequently occur in many cities among chemists and druggists arise from an ignorance which never would or could exist if a compulsory and skillful training in schools established for the purpose, under practical as well as theoretical masters of the particular industry sought to be acquired, had been gone through. We often read of the falling of a floor filled with people. This shows an ignorance of building and of the strength of different materials, a knowledge of which is so indispensable in this important branch of industry. Schools established for a thorough training in mining would not only save life and property, but cause a more profitable development of our mineral resources.

"Knowledge is power." It is the limiting director of the productiveness of all labor. As a knowledge of all the arts, a thorough acquaintance with the laws of nature exists, so will be the progress in improvement in all the affairs of life. Its application to all the industries causes a greater productiveness from the same labor. It has decreased the labor of farming, and increased its producing power. The superseding of the scythe and the cradle by the mowing and reaping machines has enabled a much greater number of acres to be tilled; at the same time a larger value is realized from the same quantity of land



DOUBLE SHAPING MACHINE—SECTIONAL VIEW.

The greater the skill, the greater the wages. Every hour spent in improving the mind is a bid for increased pay. "The laborer is worthy of his hire," and that worth is enhanced just in proportion as a knowledge of his work is great or small. The foreman of a workshop receives greater compensation than any other workman. Why? Because he possesses greater intelligence on all matters connected with the work. This subject is capable of being drawn to a great length; but enough has been said to show the benefits arising from knowledge and skill in all branches of industry, and that industrial and technical schools should be established everywhere.—*Philadelphia Inquirer.*

THE volume of a confined mass of gas is inversely proportional to the pressure to which it is exposed; the smaller the pressure the larger the volume, and the greater the pressure the less the volume.

Sir Isaac Newton's Experiments.

When Sir Isaac Newton changed his residence, and went to live in Leicester Place, his next door neighbor was a widow lady, who was much puzzled by the little she had observed of the philosopher. One of the Fellows of the Royal Society of London called upon her one day, when, among other domestic news, she mentioned that some one had come to reside in the adjoining house, who, she felt certain, was a poor crazy gentleman, "because," she continued, "he diverts himself in the oddest ways imaginable. Every morning, when the sun shines so brightly that we are obliged to draw the window blinds, he takes his seat in front of a tub of soapsuds, and occupies himself for hours blowing soap bubbles through a common clay pipe, and intently watches them till they burst. He is doubtless now at his favorite amusement," she added; "do come and look at him." The gentleman smiled, and then went up stairs, when, after looking through the window into the adjoining yard, he turned round and said: "My dear madam, the person whom you suppose to be a poor lunatic is no other than the great Sir Isaac Newton, studying the refraction of light upon thin plates, a phenomenon which is beautifully exhibited upon the surface of a common soap bubble."

This anecdote serves as an excellent moral not to ridicule what we do not understand, but gently and industriously to gather wisdom from every circumstance around us.—*Druggist's Circular.*

Corner Lots.

To persons about to build a residence in the city, the following article from the *Land Owner*, on the most desirable corner to locate on, will be read with interest:

When a lot is on the northwest corner of two streets, it is best, in a sanitary point of view, for its frontage to be on the west side of the street and the depth on the north side. The house thus gets the sun in the front bed rooms in the morning, and on the side of the house, looking south, nearly all day. When a lot is on the northeast corner, it is best that its frontage should be on the east side and its depth on the north side of the street. The east side of the street looks west, from which quarter our prevailing cold summer winds come. All rooms looking west are very cold at night, especially at the time of year when sudden changes of temperature are common. If the front bed room windows face the east side of the street, they can be kept closed at night and air secured from the sheltered side windows on the north side of the street, on which the sun shines nearly all day. If a lot is on the southwest corner, it is better that the frontage be on the south side, and its depth on the west side of the street. The rays of the sun do not strike the south side of the street, while they do strike the west side in the early half of the day—thus getting the sunshine and heat in the front bed rooms at the most desirable hours. When a lot is on the southeast corner, it is best that it should have its frontage on the south side and its depth on the east side, for the reason, before stated, that the sun does not strike the south side of the street, while its rays are poured on the east side from about noon till 5 p.m. The cold winds of night can be kept from the best (the front) bedroom by having the windows closed on the east side and by opening them on the south side. These are important facts to be remembered by those who are sub-dividing large lots for sale, or by those who are erecting houses on large corner lots, where they are in a position to front them either way.

No one looking for a residence site, who can afford to buy a corner lot, should fail to do so. By having a corner all difficulty about securing abundant sunshine and air in each room is avoided. Of almost equal value with sun and air is the cheerfulness of rooms in a corner house. The effect upon women, who have little exercise or change, is exceedingly beneficial. There is, from a corner house, an outlook that whiles away many an hour which would otherwise be dull to the dweller in the house. The average cost of a corner lot over a middle one in a residence location is 40 per cent, and it is worth more than this difference. A corner house will rent for nearly enough more than a middle one to justify the purchase of the former from an investment point of view alone. Those who wish a sunny, well aired, and really cheerful dwelling should strain every point to secure a corner. Better a corner and poorer house than a fine house hemmed in between other dwellings.

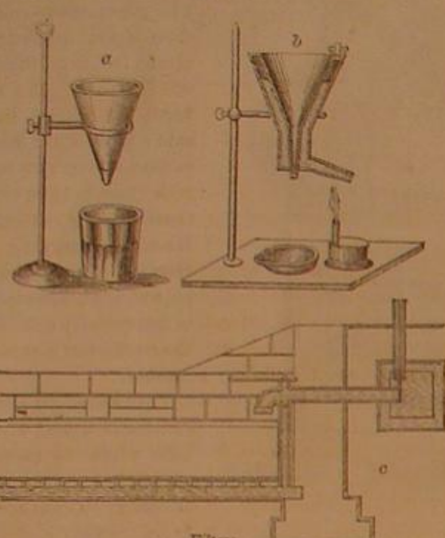
FILTERS AND LIQUID METERS.

In many localities, where the water supply is drawn from rivers adjacent to cities or from sources liable to be contaminated by decaying organic substances, filtration of the fluid, before using it for drinking or cooking, is an important sanitary precaution. To this end various devices have been invented, all so constructed that the water passes through certain substances which, while arresting the passage of matter mechanically suspended, are sometimes of such a nature as to absorb deleterious gases and effete substances. In the annexed engravings, from Knight's "Mechanical Dictionary"*, will be found representations of several different inventions in the filter line.

LABORATORY FILTERS,

used by chemists, are of the simplest construction, and are represented at *a* and *b*, in Fig. 1. The first is made of a circle of bibulous paper, folded and opened into a quadrant and inserted into a funnel of glass or paper. For filtering matters which become viscid on cooling, such as gelatin, tallow,

Fig. 1.



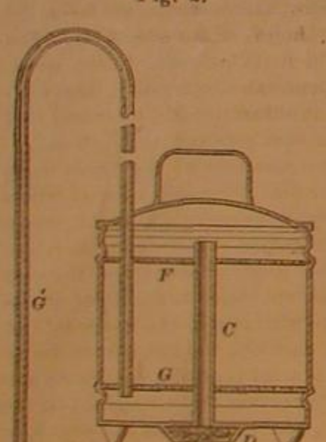
Filters.

wax, etc., the apparatus shown at *b* is used, in which the filter is placed within a water bath which has a leg heated by an alcohol lamp.

DOMESTIC FILTERS

are frequently made in the form of a submerged jar or box composed of porous stone, through which the water passes and is withdrawn by an exterior faucet, as represented at *c*, Fig. 1. In another form the filter is placed within a barrel, and the water passes through a coarse filter, D, Fig. 2, and up a central tube, C, to an upper chamber and thence through filtering material placed between two perforated diaphragms, F G. The water is drawn from the lower annular chamber by a siphon, G', having a stop cock at its lower end. A good domestic filter is easily constructed of a deep wooden tub divided by a tight vertical partition through the middle, the partition being perforated near the bottom. The tub should be nearly filled on both sides of the partition with granulated charcoal, made from sugar maple and screened through a mesh of one sixteenth of an inch, the fine dust being separated by bolting. The foul water enters the tub on one side, passes down and through the holes in the partition, and rises up on the other side, leaving all its impurities in the charcoal. Fig. 3 is a

Fig. 2.

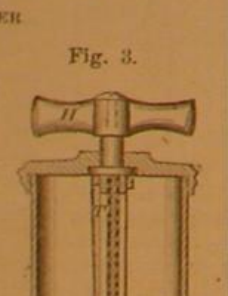


Siphon-Filter.

REVERSIBLE FILTER

interposed in a length of pipe. The water flowing from A to the filtering surface, T, has its impurities detained, while the strained water runs off at B. When the filter surface, T, has become foul, the handle, H, is turned, throwing the dirt to the delivery side, where it carried off by the current of passing water. A

Fig. 3.

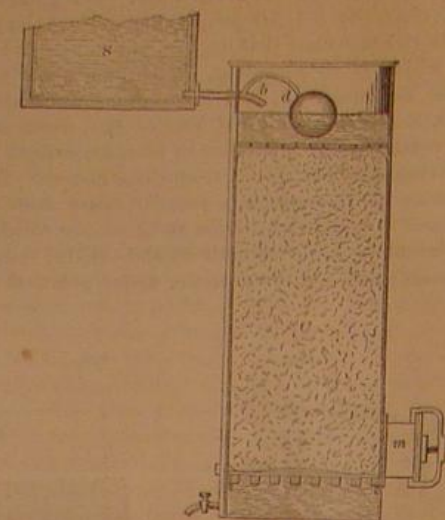


Reversible Filter.

CHARCOAL FILTER

is shown in Fig. 4, which is used for sugar refining. Upon the bottom of a high cylindrical vessel, which is charged with animal charcoal, C, a filter cloth is spread, and upon this the lower charcoal layer is tightly packed, while the remainder of the filling is left loose. Another cloth and a perforated plate complete the column. The sirup to be filtered is let in from the cistern, S, the supply being regulated by the ball cock, *b d*. *t* is a tube by which air is allowed to escape, and *m* a manhole for giving access to the interior for cleansing, etc. An arrangement of a filter in connection with a cistern is represented in Fig. 5. The water passes down through the

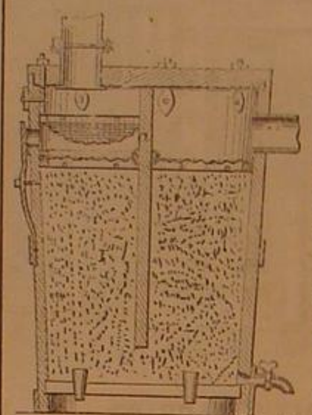
Fig. 4.



Charcoal-Filter.

charcoal or other filtering material in a permanent chamber, on one side of an axial division, and, after passing beneath the latter, rises up and is drawn off from the other side.

Fig. 5.



Filtering-Cistern.

In order to ascertain the quantity of a liquid discharged or received through an orifice,

MECHANICAL LIQUID METERS

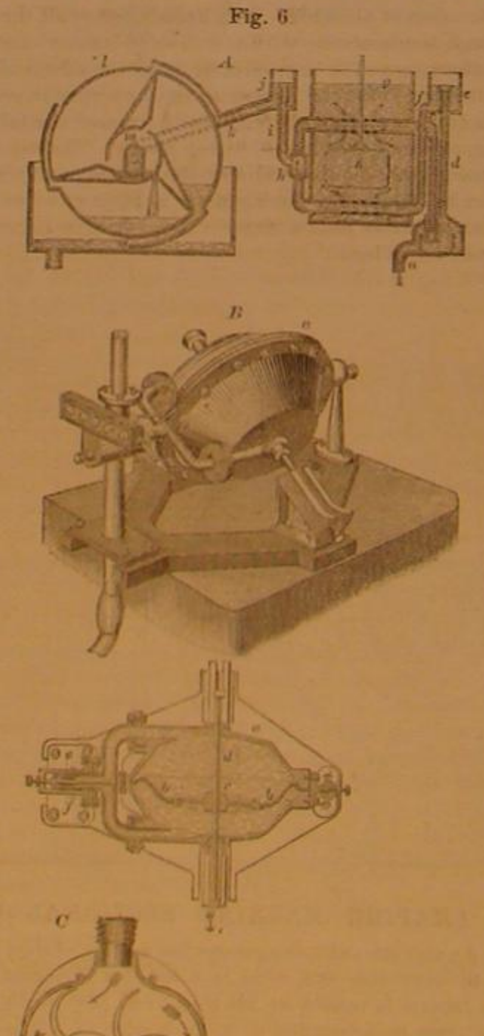
of various forms are employed, the principal being known as the diaphragm, the balanced(in which compressed air is used), the piston, the propeller, and the flexible tube and roller.

In Fig. 6, at A, is shown

THE SIEMENS AND HALSKE SPIRIT METER,

which registers the quantity of spirit discharged and also the amount of absolute alcohol contained therein. The liquid entering at *a* passes through the pipes, *c d*, one of which terminates in a chamber, *e*, whence it is carried by the pipe, *f*, through the vessel, *g*. The other conducts it directly to the upper part of *g*. The parts of the pipes passing through *g* are perforated so as to make currents in the vessel in order thoroughly to mingle the spirit, and the two pipes meet at *h*, whence the liquid is led by *i* into a chamber, *j*, and thence to the volumeter,

Fig. 6



Liquid-Meters.

which is a hollow drum, *l*, having a concentric cylinder, *m*, the space between the two being divided into three compartments. Three slits in the central cylinder permit the liquid to flow successively into each compartment, as it in turn occupies the lowest position, and the apparatus remains stationary until the lower chamber is full. The discharge of this then begins, while the aperture through which it received its supply is carried, by the rotation, above the liquid in the central chamber. The registering dials are actuated in the usual manner. The amount of pure spirit is determined by a hydrometer, *n*, in the tank, *q*, the instrument being filled with alcohol, and rising and falling according to the density of the spirit. Its motions actuate suitable registering devices which give an indication each time the volumeter is emptied, and to an extent showing the quantity of pure spirit contained therein.

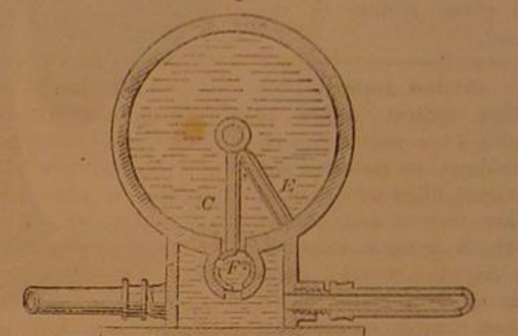
DUBOY'S WATER METER

is represented at B. A diaphragm, *b*, in a casing, *a*, carries a closely fitting metallic disk, *c*, held in position by the rod, *d*. Water enters through either duct, *e* or *f*, raises the diaphragm, and forces out the water on the opposite side until the vessel is full, when the diaphragm fits against that side. When the weight rises to the top, that side is given a preponderance, causing the vessel to turn on its pivots until the relative places of the sides are changed. At the same time, the supply opening is closed and that for discharge opened. Payton's meter, C, same figure, contains two S-shaped arms, whose extremities are during rotation in close contact with each other and with the sides of the box. The arrows indicate the direction of the current.

ATWILL'S PULSATING PISTON METER,

Fig. 7, has a piston, E, which turns on an axle shaft com

Fig. 7.



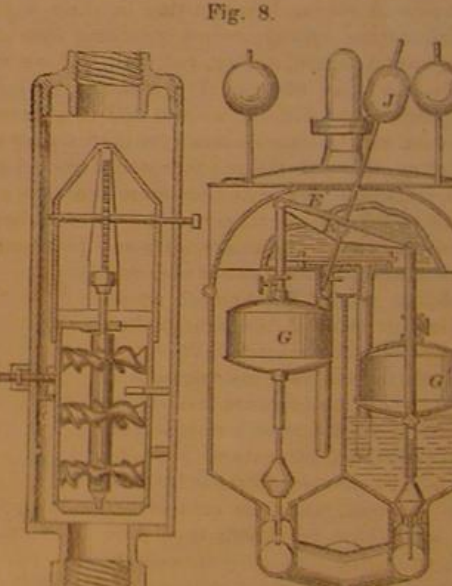
Pulsating-Piston Meter.

municating motion to the register and carrying an arm which, at the end of each stroke, changes a cylindrical valve, F^2, so as to cause the water alternately to enter and discharge from the measuring chamber at opposite sides of the internal partition, C. The spiral vane meter, shown in Fig. 8, is simply a water wheel within a pipe connected to a register to indicate the flow of water. The flow is regulated by a sliding valve. In

YOUNG'S SPIRIT METER,

same figure, a float, G, in the measuring chamber, is at-

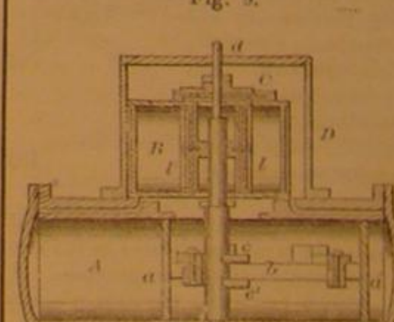
Fig. 8.



Spiral-Vane Meter. Young's Spirit-Meter.

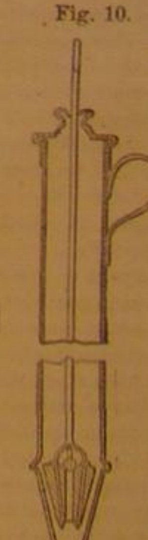
tached to each end of a pivoted beam. The alternate downward motion of the floats, as the chambers are discharged, directs the induction flow from one to the other. The valve stems have a limited sliding motion in the floats, so that each

Fig. 9.



Sickles's Liquid Meter.

Fig. 10.



Liquor-Thief.

*Published in numbers by Messrs. Hurd & Houghton, New York city.

of the latter will rise to a sufficient hight without raising the valve to permit of emptying the chamber. At the point of discharge, the weighted rod, J, is thrown past the vertical and, closing the valve to one chamber, opens the induction pipe to the other, depressing that float sufficiently to close the escape valve. In

SICKLES' METER,

Fig. 9, the liquid flowing into the chamber, D, is, by means of the valve, C, admitted alternately to each end of the hollow valve, B, which is divided into compartments by the partitions, *l l'*. From these the fluid flows alternately through appropriate ports behind the pistons, *a a'*, on the rod, *b*, which has tappets that strike the pins, *c c'*, on the upright shaft, *d*, causing its partial rotation and operating the slide valve, C, which admits the fluid into the compartments of the valve, B.

We add, in Fig. 10, one more device used in connection with liquids, to which the name of

LIQUOR THIEF

has been applied. It is simply a tube which is let down through the bung hole of a cask and then closed, so as to withdraw liquid therefrom. It is closed at the bottom by a plug, actuated by a rod passing through the top, as shown.

PRACTICAL MECHANISM.

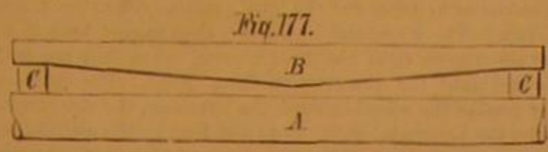
BY JOSHUA ROSE.

NUMBER XXXVIII.

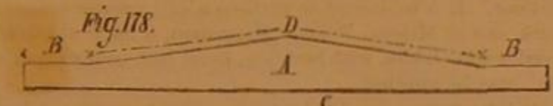
MARKING OUT ENGINE GUIDE OR MOTION BARS.

If an engine guide bar is to be made parallel in its breadth and thickness, it may be marked off from the directions already given for marking a scale. Such bars, however, should always be made thicker in the middle than at the ends (as they are always made in English locomotives) for the following reasons: If the strain upon the bars is equal at all parts of the stroke, the middle of the bar will be subject to deflection because of its distance from the blocks or supports at the ends. Again, towards and at the end of the stroke, the connecting rod stands nearly parallel with the center line of the bore of the cylinder, and then the strain upon the guide bars is very slight; but as the stroke proceeds, the angle of the connecting rod increases until (near the center of the stroke) it becomes the greatest, and therefore places the most pressure upon the guide bars. If, then, the latter deflect in consequence of this pressure, the gland and packing ring in the cylinder cover act as a fulcrum, and the piston rod as a lever, forcing the piston against the top and bottom of the bore of the cylinder, tending to wear it oval and also to wear it to a larger bore in the middle than at the ends, because the deflection of the bar is inappreciable at the ends, whatever it may be in the middle. That the deflection of such bars is sufficient to be of practical importance will be perceived from the following:

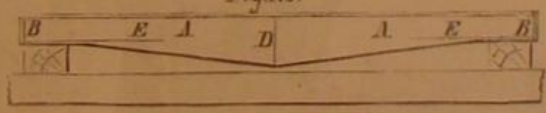
During the years 1864, 1865, and 1866, I fitted up under contract nearly one thousand guide bars (for locomotives) their average size being about 30 inches long, 3½ inches broad, and 1⅛ inches thick or deep at the ends, and 3 inches thick in the middle of their length. They were filed up in the vise, and made practically true to a surface plate. When the first few sets were delivered to an inspector for examination, they were rejected on the ground of being hollow in their length, to a degree plainly perceptible in the surface plate marks, which showed very plainly at the ends of the bar, and graduated away until, in the middle of each bar, they were barely perceptible. This difference was obviously in the wrong direction, since the middle of the bar should, if there be any difference, mark the plainest, because it sustains the most abrasion. I was sent for by the inspector, who had a bar placed upon the bench, supported by a block of wood under each end; and by request, I applied the surface plate, and found, to my astonishment, the marks to be as above stated. As a consequence, the whole of the set of eight bars were returned to me to be refitted. Upon replacing them in the vise and applying the surface plate, I found each bar to mark as true and even as could be desired, and hence returned them untouched, perceiving that the bars, stout as they were, deflected from their own weight, the amount of the deflection being doubled by supporting them, in the one case in the middle and in the other by the ends. The inspector claimed that, by testing the bars while supported at their ends, he had tested them in the position in which, and supported them as they would be, when in their working places: but since no provision had been made for holding them (while being filed up) in that position, and since the top bars stand upside down when upon the engine, it was plainly impracticable to file them up in such a position. The bars were passed, the controversy having served to demonstrate their appreciable deflection, and also that the bottom bars should be filed up a little rounding and the top ones level in their respective lengths. To mark off such a bar as is here described, one face must either be first trued up, or the marking-off must be performed at two separate operations. The better plan is for the marker-off to examine the bar as to size, and have one face planed off. If either face appears defective, it should be the first planed. If the bar appears sound all over, the outside edge face of the bar should be the one to be planed off preparatory to marking off; and in setting it to surface it, care should be taken to set it true with the top and bottom faces, if they are parallel to each other; and if not, to divide whatever difference there may be between them. The bar may then be placed upon the marking-off table in the position shown in Fig. 177, A being the marking-off plate, B the guide bar, C C pieces of wood to lift the bar off the plate. By means of small thin wedges, the planed face, B, of the bar is set at a true right angle to the surface of the plate, and tested by a square. The next operation is to mark off the top or uppermost face, and the question here arises: Shall it be so marked that there will be an equal amount of metal taken off the top and bottom faces, or otherwise? First, then, since the quality



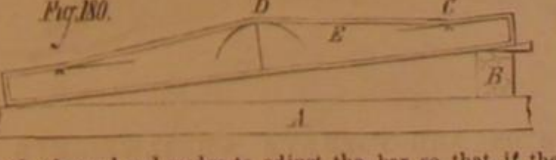
of the metal is the best towards the surface, it is a consideration to take off as little as possible, so as to leave a hard wearing surface; this may appear a small matter, but it is always right to gain every superiority attainable without cost. Therefore, all other things being equal, we should prefer to take as little metal off the top face as would be sufficient to make it true, and should therefore mark it out with that view. Here, however, another consideration arises, which is that the outline of the bottom face is not straight, and cannot therefore be planed lengthways from the center of the bar to the ends; and if such bottom face is to be shaped across its breadth, instead of lengthways, it is a comparatively slow operation, and much time will be saved by so marking off the bar that the bottom will only just true up, so that all the surplus metal will be cut off the top face, which, being done in a larger machine, and lengthways, is a much more rapid operation. There is, however, a method of obtaining both the advantage of taking as little as possible off the top face, and planing the bottom face for the most part lengthways. It is shown in Fig. 178, A being the bar;



the two faces, B B, may be first planed parallel (as required) with the face, C; the back of the bar may then be planed in two operations from the point, D, to the junction with B at each end. Were the method of procedure employed, it would pay to leave the most metal to come off the back of the bar; but there are yet other considerations, which are the facilities in the shop. If the shaping machines are not kept fully occupied, while the planing machines are always in demand, it will pay (if there are not many bars to be planed) to leave as little as needs be to be taken off the bottom of the bar and the remainder off the top. If, however, many bars are to be planed, the most economical of all methods will be to plane the backs by placing, say, 8 of them at a time across the table of the planer, cutting off the ends at the same chucking. Supposing this plan to be adopted, we set the scriber of the marking block just below the lowest part of the surface of the bar, and draw a line along its planed surface, and then another line along each end, to denote the thickness of the parallel parts at each end, making this line longer than is necessary, as a guide in setting the bar in the shaper (in case the ends are shaped and not planed). We next mark off the length of the bar at the ends, using a square and allowing about an equal amount to be taken off each end; and then, still using the square, we mark a line equidistant between the end lines, to denote the center of the length of the bar, which will then present the appearance shown in Fig. 179, the inside line, A A, being for the top

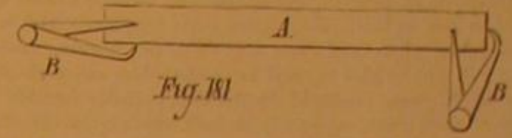


face, the lines, E, for the parallel ends, the lines, B B, for the ends, and the line, D, denoting the middle of the length of the bar. We now turn the bar so that its planed face is uppermost; and setting a pair of compasses to the required thickness of the middle of the bar, we set one point at the junction of the lines, A and D, mark off with the other point a half circle, and then (turning the bar over) adjust it upon the table, as shown in Fig. 180, A being the table, and B a

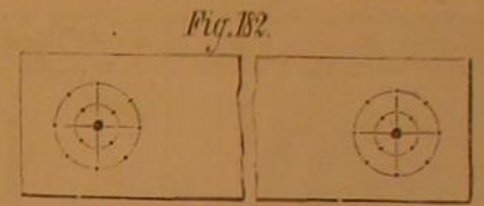


block of wood and wedge to adjust the bar so that, if the scribing block be applied along the table, the needle or scriber point will mark just fair with the top of the circle at D and the mark, C, at the end of the taper part of the bar, A (the mark, C, showing the required distance from the end of the bar). Having made the adjustment, we draw the line, E, thus completing the marking of that half of the bar. We next remove the block of wood and wedge to the other end of the bar, and repeat the last operation, when the marking of the bar will be, so far as its outline is concerned, complete. It will be observed that we have drawn the lines in each case on the one planed surface of the bar only, and not all around the work. The reason for this is that the planed face is a guide, whereby to chuck the work and ensure its being set true. In the absence of one true face, it would be necessary, in marking off the first face, to mark the lines all around the work, which, when planed up, would serve as a guide whereby to set the work during the successive chuckings.

After the faces and ends are planed up, the holes in the ends may be marked by the compass callipers and compasses, as shown in Fig. 181, A being the bar, and B B the compass



callipers set to the required distance. At the junction of the marks thus made, we make a light centerpunch mark, and mark off the circles for the holes, first marking a circle of the requisite size and defining its outline by other light centerpunch marks. We next draw from the same center a circle smaller in diameter, and define its outline also by small centerpunch marks; after which we take a large centerpunch, and make a deep indentation in the center of the circle, which will appear as shown in Fig. 182. The philosophy of



marking the holes in this manner is as follows: If the outside circle alone is marked, there is nothing to guide the eye during the operation of drilling the holes (in determining whether the drill is cutting the holes true to the marks or not) until the drill has cut a recess nearly approaching the size of the circle marked; if the drill is not cutting true to the marks, and the drawing chisel is employed, it will often happen that, after the first operation of drawing, the drill may not yet cut quite true to the marks; and it having entered the metal to its full diameter, there is no longer any guide to determine if the hole is being made true to the circle or not. By introducing the inside circle, however, we are enabled to use the drawing chisel, and therefore to adjust the position of the hole during the earlier part of the operation; so that the hole being cut is made nearly if not quite true before the cutting approaches the outer circle, which shows the full size of the hole. If, on nearly attaining its full diameter, the outer circle shows it to be a little out of truth, the correction is easily made. It is furthermore much more easy to draw the drill when it has only entered the metal to, say, half its diameter than when it has entered to nearly its full diameter.

The object of making a large centerpunch mark in the center is to guide the center of the drill, and to enable the operator to readily perceive if the work is so set that the point of the drill stands directly over the centerpunch mark. This is of great importance in holes of any size whatever, but more especially in those of small diameter, say, for instance, ¼ inch, because it is impracticable to describe circles of so small a diameter whereby to adjust the drilling; and in these cases, if the drill runs out at all, there is but little practical remedy. The centerpunch marks for such holes should therefore be made quite deep, so that the point of the drill will be well guided and steadied from the moment it comes into contact with the metal, in which case it is not likely to run to one side at all. If a motion or guide bar requires to have one corner rounded off, as it should have to prevent its leaving a square corner on the guide block, which would weaken the flange of the latter, the corner cannot be marked off, but a gage should be made as shown in Fig. 183, A in the left hand

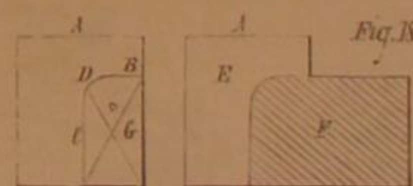
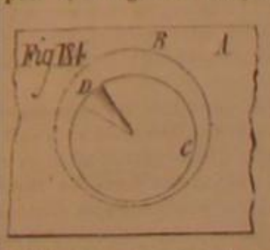


figure being a piece of sheet iron, say $\frac{1}{16}$ inch thick, with the lines, B and C, and the quarter circle, D, marked upon its surface. The metal, G, is then cut away, and the edges carefully filed to the lines, thus forming the gage, A, which is shown upon the bar, F, in the position in which it is applied when in use. It is obvious that such a gage will scarcely suffice to get up a very true round corner; this, however, is accomplished by leaving the corner of the work a little full to the gage and then filing it up to the piece of work fitting against it.

Reference having been made to drawing the position of the recess formed by a drill before it has entered the metal to its full diameter, we may as well explain that process. Suppose A, in Fig. 184, to represent a piece of metal requiring to have a hole of the size of the circle, D, drilled in it, and that the recess cut by the drill is out of true, as shown by the circle, C. A round-nosed chisel is then employed to cut, at D, the groove there shown, running from the outside to the center of the recess, and which will have the effect, when the drill is again introduced, to draw the recess toward that side, thus causing the recess to be true with the marks.



The largest flouring mill in America, it is said, is owned by Hon. C. C. Washburn, of Minneapolis, Minn. It is seven stories high, and crowded with machinery from top to bottom. Its cost was $300,000, has 40 run of burrs, and turns out 1,000 barrels of flour per day.

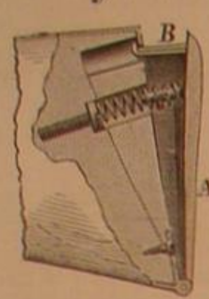
MILLER'S RECOIL CHECK FOR GUNS.

We illustrate a novel invention which is quite sure to be appreciated by soldiers, sportsmen, and all who handle firearms to any extent. Regulation rifles frequently kick with tremendous vigor, and there are few of our hunting readers who will not be able to recal lame shoulders and perhaps a few bad bruises, produced by the unexpectedly forcible recoils of their guns, especially in duck and pigeon shooting. The present device is intended to check this backward blow by neutralizing the same through the medium of a spring, and thus to admit of the use of much heavier charges in the piece and to insure steadiness of aim.

The exterior of the invention is shown in Fig. 1. From the section, Fig. 2, it will be seen that the hinged check plate, A, is applied to the lower part of the stationary butt

Fig. 1

Fig. 2



plate, and is guided by the portion, B, entering a suitable recess in the stock. Its outward movement is regulated by the flanged edge of said portion, B, which catches on the butt plate, as shown. C is a center pin on the check plate, which is surrounded by a coiled spring. The latter holds the device out from the butt, and also yields before the shock, thus breaking the force of the same, and rendering its effect upon the shoulder a mere push instead of a sharp blow. By means of the screw which holds the spring, the tension of the same may be regulated at will.

The invention is readily constructed, and may be applied to any gun. Patented through the Scientific American Patent Agency, November 2, 1875. For further information address the inventor, Mr. W. D. Miller, care of J. H. Johnston, Great Western Gunworks, Pittsburgh, Pa. A working model is on exhibition at the gun store at 943 Broadway, New York city.

IMPROVED UNIVERSAL WHEELWRIGHT'S MACHINE.

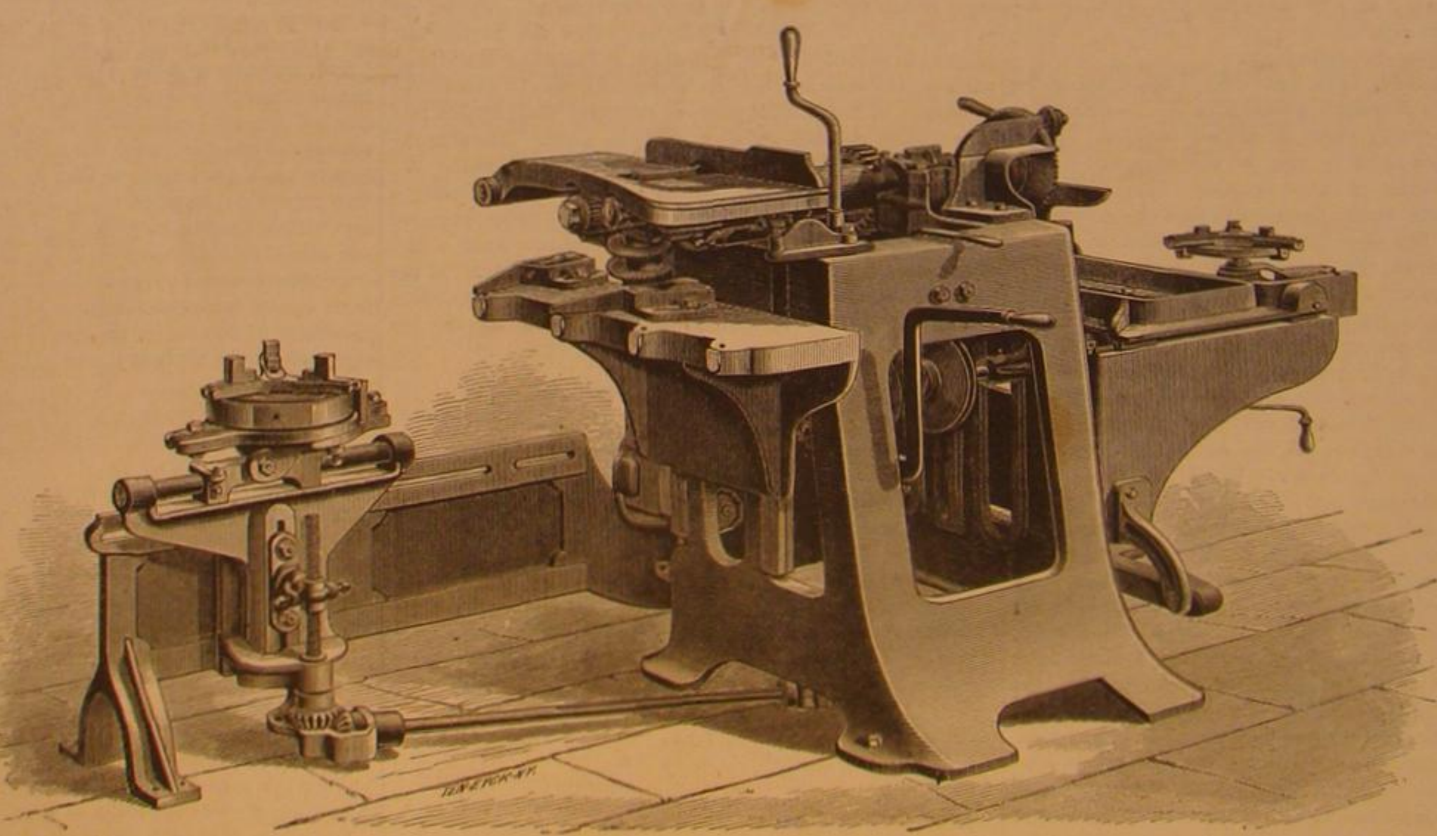
We illustrate herewith a new universal wheelwright's machine, which is designed for planing the rims of vehicle wheels on three sides after said rims are driven on the spokes. When the rim consists of short sections, it is necessary that each section shall conform to a circle greater than the circle of the wheel, so as to give a rise at the joints, which the tire will bind down, thus strongly arching and bridging these weak points. In order to produce this rise, the fellies are generally shaped out to the desired circle before they are driven on the spokes. They always, however, need redressing by hand, as the aforesaid work cannot be performed with sufficient accuracy to insure the meeting of the joints either on the periphery, the face, or the rear sides. It is also necessary to form the rim, when finished, thicker where it rests upon the spokes than under the tire. This labor, in common with the foregoing, has also heretofore been accomplished by hand. With the present machine the whole is quickly done in a single operation.

In construction the apparatus resembles a "two-sided sticker," having a horizontal and vertical mandrel with self-feeding arrangements. It has also a buzz planer table over the horizontal cutter head. Extending out from the front side of the machine is an arm, upon which suitable devices are mounted for carrying a self-centering chuck, in which the wheel is held by the point of the hub during the planing of the rim. To this chuck, a cam-shaped disk is attached, which has as many faces as there are joints or sections in the wheel rim. The wheel is fastened in the chuck, so that the joints in the rim correspond with the high points of the cam. The wheel now being elevated to the proper hight by means of a screw, friction gears, and lever, it is moved toward the machine, the chuck, to this end, being mounted on a collar, loosely fitted on a sleeve and having about ten inches to-and-fro play. The face of the wheel rim then resting over the horizontal cutter, the buzz planer table is lowered to give the required depth of cut, and the wheel is rotated and planed to a true face. The table is raised so as to taper out the cut gradually, leaving a true surface. The wheel and chuck are then moved back to allow the rim to clear the buzz planer, when they are both lowered until the rim rests on three stops. The operator now pushes the wheel toward the machine, the rim sliding under the horizontal cutter head and feed roller, and the periphery coming in contact with the vertical cutter, which is composed of bevel saws. The nut on which the chuck is mounted rests against a stop, preventing the movement of the wheel toward the machine. The feed roll then rotates the wheel, the horizontal cutter planes the rim to thickness and the required bevel, and the vertical head dresses the periphery.

The cam-shaped disk resting against a stop gives the wheel a vibrating motion to and from the vertical cutter head, by which the rise at the joints is produced. The wheel is so placed in relation to the line of the feed roll shaft that the latter is inclined to draw the wheel toward the machine, always keeping the cam against the stop, causing a uniform vibration. Bent rims are dressed to a true circle by removing the stop, so that no vibration whatever is imparted.

It is stated that with this machine the wheels are made with certain uniformity, that all ordinary material can be planed straight out of wind and square on the buzz planer table, and to thickness on the sticker table. A saw board or table, can be substituted for the buzz planer table, and a saw for the cutter head, when all kinds of straight sawing can be done. If it be desired to perform a still greater range of work, one of Messrs. Bentel, Margedant, & Co.'s universal wood-worker tables, with back top, bevel rest, gaining frame, etc., may be attached.

On the reverse side of the machine, a spoke-sawing wheel and a tenoning and boring apparatus is arranged, the whole of simple construction. The hollow auger is secured to the mandrel and carries a dished saw which, at one rotation of the wheel, saws off the spokes and bores the tenons. Wheels from 30 inches to 6 feet in hight may, we are informed, thus be tenoned as desired. The change from a wheel tenoner to a boring or routing machine may be quickly made without the use of a wrench, and all kinds of boring may then be done. Two men may operate, on opposite sides of the machine, on different work at the same time. A horizontal shaper may be made of the rim planer which will shape, round, and corner all ordinary work. The capacity of the rim planer is 35 to 50 sets of wheels in ten hours; that of the wheel tenoner is much greater. The wheel tenoner is, if desired, made separate, and with or without the boring attachment. The varied capabilities of the machine apparently fully justify its title of universal. In point of economizing room and in combining the functions of several usually distinct machines, the invention will prove one of much utility to wheelwrights and wood workers generally. Manufactured by Messrs. Bentel, Margedant, & Co., Hamilton, Ohio. For further information, address the patentees, Messrs. Buffington & Forney, Burlington, Iowa.



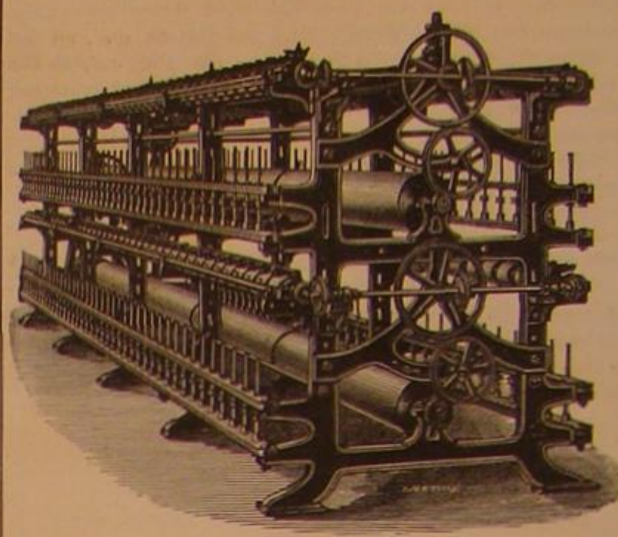
BUFFINGTON AND FORNEY'S WHEELWRIGHT'S MACHINE.

AN article called fish flour has been brought forward in the last few years. The flour is prepared from dried fish, thoroughly desiccated, and then ground in a mill.

VON BULOW, the pianist, says beer drinking is the great fault of his countrymen. They do not get drunk, but drink till their blood becomes sluggish and their brains stupid.

AMERICAN SILK-SPINNING MACHINERY.

It is estimated that 6,000 persons are employed and over $10,000,000 capital invested in the extensive silk factories of Paterson, N. J. The process of silk making begins with the assortment of the skeins of raw silk, which are imported from Japan, Italy, China, and France; then follows washing in soap and water to get rid of the gummy material left by the worm, and then drying in an ingenious apparatus which throws out the water by centrifugal force. Winding next follows, when the silk is wound off from the skeins upon



bobbins, after which the bobbins are taken to the doubling rooms, and there the silk from two, three, or four spools is wound together upon one. Finally the silk is spun, and this is done upon spinning frames of two or three stories and containing hundreds of spindles which revolve at a very high velocity.

The manufacture of these frames has recently been begun by the Danforth Locomotive and Machine Company, of Paterson, N. J., and numerous improvements have been added. We give herewith an engraving oft he two story frame, which is adapted to either tram or organzine, and is made of any desired length and to contain any required number of spindles. The latter are adjusted with nicety, and are capable we are informed, of running at a speed of from 7,000 to 8,000 revolutions per minute without perceptible wear. The machine also has a longer drag than is usual, which gives the thread a better opportunity to become properly twisted, and thus free from the kinks or curls so annoying to silk manufacturers.

Silk making in Paterson, in Hartford, Conn., and in some localities in this city is an industry of which the growth has been more rapid than is generally realized throughout the country.

The exhibition of silk machinery of American production, which, it is promised, will be made at the Centennial, will, we believe, attract the attention of manufacturers the world over, and perhaps serve to emphasize the fact that already excellent silks of American make are found on the counters of the dry goods warehouses, in close and in some cases successful competition with those from celebrated foreign looms. It is very much to be regretted that a recent conflagration in Paterson has destroyed a large amount of very fine silk machinery, including two large looms especially constructed for exhibition at the Centennial.

New Mode of Illumination for Lighthouses.

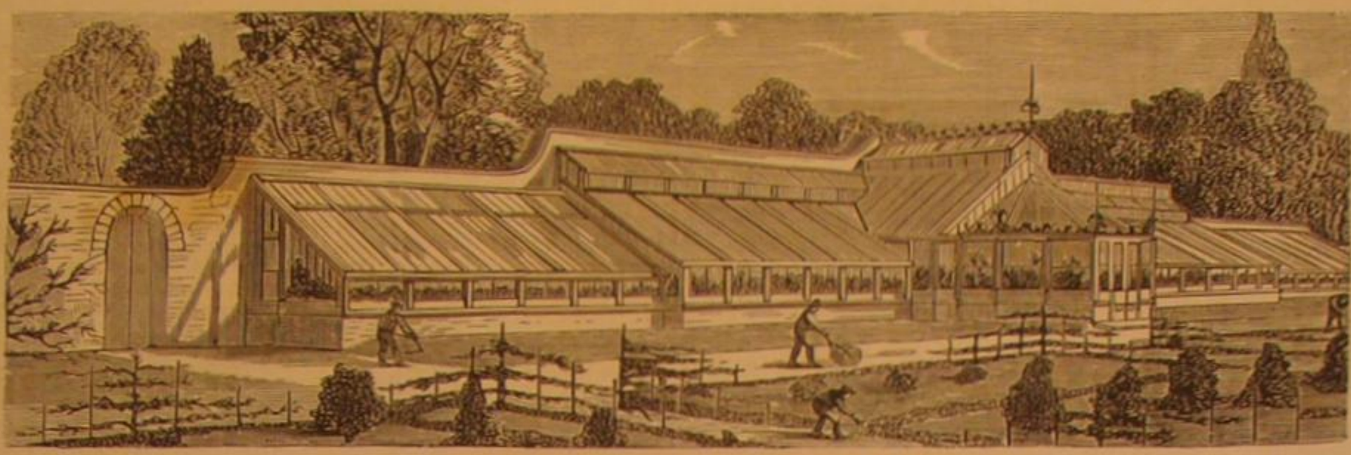
Professor Batestrieri, of Naples, proposes for this purpose an apparatus composed of several disks of polished silver or copper, so arranged as to transmit successively the light received, so that all the rays falling upon the disks are concentrated into one powerful beam. The invention resembles the system of Fresnel, but the latter utilizes only about one third the light received, while M. Balestrieri's device, it is said, utilizes the greater portion. With an oil lamp having a burner 2·7 inches in diameter, at a test of the above described apparatus, a beam of light was transmitted which enabled a newspaper printed in ordinary type to be read at the distance of 0·6 of a mile.

GREENHOUSES AND HOTHOUSES.

The long winter of our Northern and Middle States tries the patience of our gardeners, and renders doubly acceptable any hints and directions for the construction of greenhouses, wherein plants can be nurtured till the advent of spring; and where propagation can be carried on, so that a large supply of plants, both for flowers and fruit, may be ready for planting out as soon as the frost leaves the ground.

Where the horticultural operations are extensive, the plan shown in our Fig. 1 is perhaps the best that could be adopted. The buildings can be constructed of any required size, and the heat is well confined to the back of the house by the brick wall. Flues are built in the wall with furnaces at the ends; or steam or hot water pipes are used for heating. Grape vines are usually trained under the sloping roof, and thus enjoy the maximum of light and sunshine. The wall is very handy in a fruit garden, even when not covered with glass. Fruit on trees trained against a brick wall (as shown on the left of Fig. 1) ripens much earlier; indeed, in England peaches and nectarines will hardly ripen at all in ordinary seasons unless the trees enjoy the reflected heat from a wall, which, by the way, should be painted black.

Fig. 1



RECENTLY CONSTRUCTED HOTHOUSES.

Gardeners who devote much time to the cultivation of the grape will find the glass frames, shown in our Fig. 2, economical and efficient. The timber used in making them is small in quantity, and the glass is well placed to ripen the fruit. Air is readily admitted to the vines by raising the glass frames, the hight of which can be adjusted by the attachment shown in the engraving, which displays the construction so clearly that no further explanation is necessary.

Fig. 2

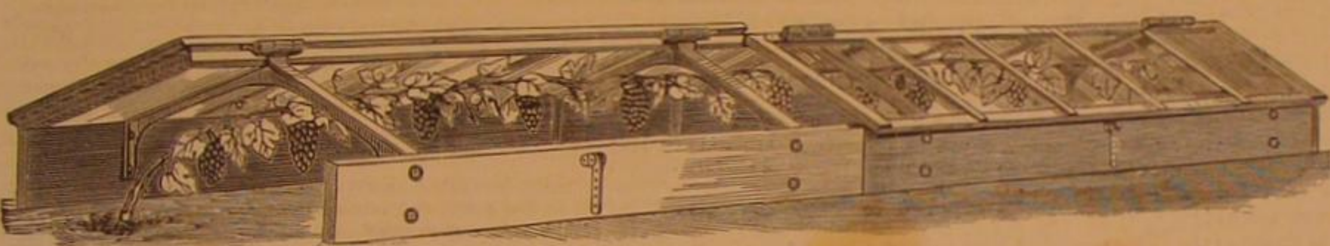


Fig. 3.

GRAPE VINE AND HOTBED FRAMES.

Another convenient form of glass frame is shown in Fig. 3; it is especially suitable for use on hotbeds. Being of little depth, the sun's heat is concentrated by the glass on the rich earth of the well manured bed; and the frames, which are well suited to cucumbers, melons, and early tomatoes, are so constructed as to slide open for purposes of ventilation.

Winter is the time when people are most apt to feel the need of a greenhouse; and if they do not construct one then, they usually get their plans perfected, and begin building in the early spring. We have published illustrations of more elaborate and expensive greenhouses than the one represented herewith; but we have seen none in which the arrangement is better, and the cost of construction less, than the one shown in Fig. 1. While Fig. 2 and 3 present no special novelty, they are each well adapted for the different purposes for which they are intended, and can be built cheaply.

PLANT VASES FOR INDOOR DECORATION

The votaries of floriculture are now turning their attention indoors, and inquiries as to proper and tasteful modes of parlor and dinner table decoration are beginning to reach us. The usual way of keeping plants in houses is to place them in vases or tazzas, of wood or pottery, although some are now made in bronze or iron, of very handsome designs; terra cotta is also employed, and, although cheaper than metal, is capable of equally effective ornamentation. Filled with a light earth, and covered with the moss called sphagnum, hardy and half hardy plants will thrive well in these vases; care must, however, be taken not to water them too profusely, as (there being no way of escape through the bottom of the vase for superfluous water) too much moisture will rot the roots.

The accompanying illustration represents a bronze tazza, ornamented with well known decorative plants. The margin is fringed with *isolepis gracilis*, used expressly to tone down the harshness of the metal work. Two or three plants of the palm-like curculigo, says a correspondent of the English *Garden*, from the pages of which we select the engraving, are placed in the center; and these, by furnishing bold and graceful foliage, contrast well with the horizontal lines of the tazza below, while their cool and deep-toned greenness forms a pleasing contrast to the character of the stand itself. Heaths and similar hard wooded plants are added, and with good effect.

ORNAMENTAL PLANT STAND.

Take the Poles out of the Streets.

Complaints are frequently made against the objectionable practice of the telegraph companies in placing their poles in the streets of cities; and the popular belief is that the wires ought to be put underground. It is true that the main streets of New York are sadly disfigured by the clumsy wooden poles, and probably no improvement can be expected until we have a better city government. But the idea that it would be easily practicable to work the wires underground is a mistake. They could, however, be taken out of the streets and placed above the buildings, as in some cities, and we hope the time is not far distant when this desirable change will be made. As to underground wires, they cannot be easily worked, even when carefully insulated, on account of the interference of static induction. All telegraph wires, without regard to their position, are thus affected, but wires placed underground or in water are affected 50 times as much as those which pass through the air, the amount of the static charge in aerial wires being inversely proportional to the distance of the wires from the earth. The amount of the static charge in all telegraph wires, whether they are stretched through the air or buried under the ground, is proportional, also, to the length of the wire; and consequently an underground wire of half a mile to a mile in length may be worked without any inconvenience from the presence of the static charge, while one of greater length may give rise to the most serious trouble.

In London, all the railroads have stations centrally situated, most of the roads coming into the heart of the city. The South-Eastern Railway, for instance, has a station at Cannon street, which is only one third of a mile from the General Post Office, where the headquarters of the English telegraph lines are situated. Now, these telegraph wires are placed on poles and follow the lines of the railroads into the stations, where they first pass under ground, running as subterranean lines only from the railroad termini to the central telegraph station. Hence, the quantity of underground wire in London is comparatively small. In addition, it may be stated that in all parts of the city there are certain large distributing telegraph offices which are connected by wires with all the sub-stations in the city—of which there are 400 to 500—and every wire from each of these distributing offices to the several hundred sub stations is carried over the house tops; where there are several wires running to the same station, they are insulated on poles which are fastened to the tops of houses. In addition to those that have been mentioned, there are in London 800 private lines, running to all parts of the city. They use what are known as the Wheatstone dial instruments. There is not a single rod of wire working all these instruments that is under ground, the wires all being carried over the house tops. Frequently 40 to 50 insulated wires are made into a single cable, which is suspended on fixtures attached to the roofs of houses.

In 1854 a telegraph company was organized in England which constructed an underground line between London and Liverpool, 210 miles, the cable containing 10 wires. But in less than two years after the line was built, its insulation became so much impaired that the company was obliged to take up and replace a considerable portion of the cable. One wire after another still continued to fail, until there were only five of the ten that would work at all. After this, as others failed, sections of the underground line were abandoned, and wires placed on poles were substituted, until, finally, so much of the underground system had failed that the company decided to place the whole line on poles. The copper and gutta percha which constituted the valuable portion of the underground cable were taken up and sold for enough to replace the whole system with a good overland line. All similar lines that were ever constructed in England have been abandoned, except one of thirty miles, constructed by the government nearly three years ago as an experiment, which is the only line outside of the cities.

In like manner, says Mr. G. B. Prescott, 20,000 miles of underground lines in En-gland, France, and Germany have been abandoned. In the city of New York there are over 5,000 miles of telegraph wires in operation, four fifths of which are used for local communications, stock-reporting instruments, and private lines.

If a law should be passed compelling the companies to place their wires underground, the whole system of communication would have to be changed. But, even were it practicable to work our system upon the underground lines, it would be impossible to place all the wires in the city of New York lone underground in less than four or five years.

The Manora Breakwater.

At a recent meeting of the Institution of Civil Engineers, the paper read was on "The Manora Breakwater, Kurrachee" (the design for which was illustrated on page 99 of volume XXVII. of the SCIENTIFIC AMERICAN), by Mr. William Henry Price.

It was stated that the Manora Breakwater was the most important feature of the Kurrachee Harbor Works, which were commenced in 1860, from the design of the late Mr. James Walker, assisted by Mr. William Parkes. Besides the breakwater the chief works were: In the lower harbor, a stone groyne 8,900 feet long, dredging and removal of rock; and in the upper harbor, an increase of one fourth to the area of the backwater, involving a new tidal channel 2¼ miles long, crossed by a screw pile bridge 1,200 feet long, and an embankment 2,780 feet long, to close the old channel, also of a jetty 1,400 feet long, with quays. All these works were now nearly completed, and had already produced great benefit, the entrance having been made direct instead of circuitous, deepened 6 feet and sheltered, the anchorage space enlarged, and the internal accommodation improved. The trade of the port was $17,500,000 per annum, and railway communication with the Punjaub would further develope it. About $2,250,000 had been expended on the whole of the harbor improvements.

The Breakwater projected from Manora Point for a length of 1,503 feet, into a depth of 5 fathoms of water, in order to shelter the entrance from the southwest monsoon seas, and to prevent their tearing up sand from the bottom and depositing it as a bar. The characteristics of the sea, wind, and tides, as bearing on the design, were alluded to, and it was stated that the bottom was irregular near the shore. The structure consisted of a base of rubble stone, leveled off generally to 15 feet under low water; and on this concrete blocks, each weighing 27 tuns, were set on edge, leaning back at a slope of 3 inches to 1 foot, and without bond, two blocks forming the width and three the hight, and together making a square of 24 feet in cross sections, the top being about the level of high water. The rubble base was deposited from native boats, and was leveled for the superstructure by helmet divers. Two European mason divers were employed, and six native divers trained on the work, the latter chiefly for shifting the rubble. No accident occurred, and the party generally did not suffer in health. After mentioning circumstances which determined the use of concrete blocks and of Portland cement, particulars were given of the composition of a 37-tun block, the materials being cement, river sand, shingle, and quarry lumps, with salt water. The ratio of the bulk of the cement to that of the finished block was nearly $\frac{1}{11}$. About 3,500 tuns of cement were used. The mixing station, block ground, and molding of the nineteen hundred and seventy-two blocks, including three hundred and twenty-five of special smaller sizes, were then described; and it was remarked that the Messent mixers had been found very efficient. The blocks were sometimes used one month after being made, and once, as an experiment, a 27-tun block was safely lifted in seven days. When the work was fairly established, the blocks cost for current expenses $3.75 per cubic yard, though the average total rate was raised beyond this by extra expenses in the earlier stages.

The blocks were lifted on to the trucks by a steam hydraulic traveling crane of 50 feet span; each truck carried one block, and was taken separately by a tank locomotive to the breakwater. The blocks were set by a steam traveling crane, called the Titan, which ran on rails laid on the finished work, and overhung the end, so as to carry the blocks of three tiers in advance to their places, thus dispensing with staging. The framing of this crane supported a traveler and crab, worked by an 8-horse power engine on the top, which also drove the traveling gear of the entire machine. The cost of the Titan, delivered and erected at Kurrachee, was $14,395. The rate of setting was limited by the progress of the foundation and by the supply of blocks, but during the last season ten 27-tun blocks were set daily on an average, while on one occasion six blocks were laid in one hour and forty minutes without special pressure.

The base was commenced on the 17th of March, 1869; and later in that year the shore end stump, 45 feet long, to make a starting place for the Titan, with other preparatory works, was completed, after some unavoidable delays, and the first block was set on the 1st of November, 1870. The delays of the foundation were merely felt in the first season's work, but a length of 225 feet was built in four months, taking the breakwater out to 270 feet from the shore. During the second season, 1871-72, after a few days spent in repair of monsoon damages, a length of 523 feet was built in about four months, making a total of 793 feet. During the third season, after the repair of monsoon damages, a length of 710 feet was built, completing the breakwater on the 22nd of February, 1873, to its full length of 1,503 feet, which had thus been barely twelve months in actual building.

The action and effect of the monsoon sea, and the repair of damages, were then detailed. In 1871 the center joint opened here and there, and one block was over from the top course on the harbor side. Slight damage also occurred to the shore end in the sea angle. The nature of the settlement was described, also a curious rocking action, and the closing up of the cross joints under the action of the sea. The repairs of the damage, in the first season, cost $925. During the second monsoon, 1872, twenty-five blocks were washed out from the top course on the harbor side, eighteen of these block being, in one length, 86 feet. The damage was again traceable to inequality of settlement. The sea side did not suffer, nor did the shore end, though both showed evidence of the force of the sea. The damage was repaired in a few days at a cost of $2,560. The monsoon of 1873, the first after the completion of the breakwater, did trifling damage, and was confined to the shore half length, still pointing clearly to weakness of foundation. The repairs cost $995. In the monsoon of 1874, the outer end and scar, which had not then been in any way specially secured, lost five blocks during unusual weather, though no other part of the outer half length suffered, but the shoreward half opened here and there. The repairs of this season cost $2,090, and included tho re-erection of an iron beacon on the outer end. The nature and extent of the subsidence (which in some parts amounted to 3 feet, but without dislocation), were then noticed, also the action of a mollusk, the pholas, on the concrete blocks, and the effect of the sea on the rubble base, which did not, however, affect the stability of the superstructure.

The cost of the breakwater had been $467,825, or $311.25 per lineal foot, but this amount included preliminary charges, the current expenses during the last season being only $170 per foot. This sum included the repair of damages during the progress of the work, and during the two monsoons since its completion, but not the expense of engineering and office establishment. The work had been carried on in the Bombay Public Works Department by the author and his assistants, advised by Mr. William Parkes, as consulting engineer, and without employment of any general contractor. The completion of the work was favorably noticed by all the government authorities concerned.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED HORSE-HITCHING DEVICE.

John Schoonmaker, New York city.—This consists in attaching to the reins rings which are caught upon hooks on the forward part of the wagon body, so that, should the horse attempt to run away, the whole weight of the wagon will come upon his mouth and hold him back.

IMPROVED STILL.

Henry Deymann and Edward Melchers, Toledo, Ohio.—This inventor proposes an improved column for refining stills, in place of the so-called French column, so that a finer spirit, with less steam pressure, is produced by means of simpler construction, which prevents leakage, decreases the trouble and expense connected with the repairs of the French column, and which may be put in the space of one story, with a considerable saving in copper plate. The essential features consist in arranging the chambers of the columns, on opposite sides thereof, with alternating horizontal and vertical partition plates and connecting overflow pipes and draining stop cocks. The intercommunicating arrangement of the chambers virtually produces two columns in one, so as to require about half the hight and material only, and offers the advantage of having all the overflow pipes at the outside.

IMPROVED INKSTAND.

Herman Schirmer, Wheeling, W. Va.—This is an ink vessel with an inverted conical tube extending nearly to the bottom of the vessel, and having an orifice at the lower end in connection with an air regulating device by which the hight of the ink in the tube is regulated.

IMPROVED PHOTOGRAPHIC PLATE HOLDER.

Frank A. Howson and William S. Howson, Brooklyn, N. Y.—This is an improved combination holder for the ground glass and plate for photographic cameras, by which, in every case, the exact image that was focused on the ground glass is obtained with perfect certainty on the sensitized plate. By its use the ground glass door of the camera may be dispensed with. The device is provided with lower grooved glass holders, glass buttons or studs at the top, and a side support, on which the ground glass and plate are insulated, and securely fastened by a spring top plate.

IMPROVED MONUMENT.

John N. Wallis, Fleming, and Theodore Wallis, Scipio, assignors to themselves and James A. Moore, Auburn, N. Y.—This inventor proposes gravestones of a more tasteful form than those commonly used. He suggests making the monuments of stone and glass, having inclosed chambers for the preservation of flowers and other objects.

NEW HOUSEHOLD ARTICLES.

IMPROVED CURTAIN FIXTURE.

William H. Maine, Abington, Mass.—This is a spring curtain roller provided with a device for preventing the unwinding of the spring when the roller is removed from the brackets. A spiral roller spring acts on a spindle, revolves the same, and throws a pin instantly out of its seat against a cam of a sleeve, so as to retain the spindle and prevent the unwinding of the spring. The roller thus remains in locked position as long as it is out of the brackets, and is instantly available for use when replaced in the brackets.

IMPROVED COMPOSITION FOR SOAP.

William F. Darnoby, Nashville, Tenn., assignor to himself and Edward B. Stahlman, of same place.—This compound, the inventor states, is an excellent article both for laundry and toilet, and is very cheap. It is made of Kirk's double extract, Colgate's soda soap, sal soda, water, spirits of ammonia, ether, and oil of sassafras.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CHECK-ROW ATTACHMENT FOR CORN PLANTERS.

George C. Flagg, Columbus, Ill.—This includes several new and ingenious devices, so constructed that wheels mark the rows in one direction and marker arms mark it in the other direction. The machine is so guided that the ends of the inner markers may meet, or nearly meet, the ends of the marks made by the outer markers upon the previous crossing, so that the ground is marked in accurate check row by the machine crossing the field in one direction.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CAR COUPLING.

Oscar E. Ford, Meridian, Miss., assignor to himself and Minor B. Clinton, Dallas, Tex.—This coupling consists of drawheads with forward-projecting parts, which are recessed at their inner sides, and provided with laterally sliding spring-acting jaws that interlock by the entering of the projecting parts of the drawheads into the space formed by the shorter part. The drawheads are thus firmly connected without chance of getting detached, while the jaws have play in vertical direction by the widening of the recesses at the rear part, which allows the coupling of cars of different hights.

IMPROVED CRANK STOP.

William H. Phillips, Bridgeton, N. J.—The cranks of windlass and other shafts have been heretofore disconnected by the backward rotation of said shafts, but the shafts required to rotate several times in order to effect such result. This inventor effects the disconnection at the first backward rotation of the shaft, and to this end provides a pivoted catch, which engages a sliding piece that locks the crank to the shaft.

IMPROVED SPARK CONVEYER.

Charles K. Cullers, Bunceton, Mo.—This device is principally a kind of ball-and-socket joint for connecting the sections of pipe for conducting the smoke for the locomotive back along the top of the train to the rear end, the said joint being free to oscillate to any required extent, and allowing the necessary contraction and extension of the pipe, and at the same time keeping tight.

IMPROVED SADIRON SHOE.

Victor C. Thebaud, Buffalo, N. Y.—A large number of inventions are in existence for getting rid of the unnecessary weight of metal in flat irons, most of which accomplish their object by abolishing the fixed handle and substituting an adjustable one which will serve for several bodies. The present inventor suggests a very different plan, and proposes a shoe for the iron, which is easily attached and replaced at will, so that an effective ironing surface is always obtainable. The device is made with external flange, having curved side extensions at the front and a fastening screw at the rear part to be readily applied to the iron.

IMPROVED TREADLE FOR MACHINERY.

Andrew N. Hagerty, West Alexander, Pa.—This is an auxiliary treadle and connecting rod, in combination with the main treadle and connecting rod, to work a pawl for starting the machine by a ratchet wheel. The object is to insure the turning of the machine in the right direction, and to avoid the necessity of starting the balance wheel by hand, thus leaving both hands free for managing the work.

IMPROVED RAIL JOINT.

George A. Mead, Salem Center, N. Y.—In this device, the tongue or tenon of one rail enters a slot in the other. The slotted part is bolted together by a couple of bolts, arranged the same as in fishplate joints. The object is to make an endless joint, and to dispense with the fishplates commonly used.

IMPROVED WATER REGULATOR AND INDICATOR FOR STEAM BOILERS.

Dexter Cook, Elmira, Ohio.—This is a cylindrical tank traveling in vertical guides and supported by a spring. It is connected at top and bottom with the steam and water spaces of the boiler. When the water in the boiler falls below a certain level, the tank, becoming lighter, is raised by the spring, and the fact is indicated by a graduated scale and pointer and by a whistle allowed to sound by mechanism connected with the tank. The latter is also connected with a feed valve, so as to open the same, and thus allow water to enter the boiler when a deficiency is indicated, and closes the valve when the level is reached.

IMPROVED FEATHERING PADDLE WHEEL.

Peter Gregerson, Wauzeka, Wis., assignor to himself and Phillip Miller, same place.—The paddles are hung by pivots above their centers, and are held to their work by stops. The latter are controlled by sliding rods which, acted upon by a cam on the wheel shaft, push said stops beyond the outer edge of the paddles, and then retract them by springs. There are other devices which allow the cam to shift right or left, as the wheel is turned in either direction, and an ingenious mechanism is provided for purposes of adjustment.

IMPROVED GATE.

Robert Samuel Rinker, Mount Jackson, Va.—The object of this invention is to provide an improved automatic or self-opening gate; and it consists in an arrangement of elbow levers and catch hooks, controlled by a cord or wire, with a weighted lever, upon one end of which lever the wheels of the vehicle pass to raise the weight and set the gate, so that it can be readily opened from either side by the person in the vehicle by pulling a tripping cord, arranged upon both sides of the gate, within convenient reach, upon a post, each vehicle serving to raise the weight and set the gate for the next succeeding one.

IMPROVED BRICK KILN.

Holland B. Evans and Earnest G. Kemper, St. Charles, Mo.—The invention relates to a new construction and arrangement of the several compartments of the kiln and their flues, which cannot be made plain without the aid of drawings. In general the flues are so made that their heat can easily be controlled, and by using the invention it appears that as many more bricks as are contained in the compartments can be burned with the same or less amount of fuel than with a kiln of the same dimensions constructed in the old way

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED RECORDING AND SIGNAL FARE BOX.

Edward Henry Schnell, South Norwalk, Conn.—Another machine for enforcing honesty in car conductors is a recording and alarm fare box, in which the record is made by punctures or slits formed in a piece of paper at the same time that the signal is sounded. There is also a separate compartment in the case of the instrument for depositing tickets as they are collected by the conductor, with a door which only opens when the signal and recording devices are actuated. So that in order that the tickets shall agree with the record the conductor is obliged to collect and deposit all the tickets.

IMPROVED BARREL.

Leslie E. Sunderland, Williamsburg, Va.—The object of this invention is to provide a barrel for the shipment of produce, which shall be capable of transformation after the said produce is delivered, so as to occupy a comparatively small space, and be returned to the sender at the rates of solid freight and at a comparatively trifling cost. It consists in a series of staves, connected by hoops which have peculiar fastenings, which adapt the staves to be disposed flat for return transportation, or rolled up and fastened to form a barrel. The sides of the barrel are straight, and the heads are held in place by lugs alternating, when the barrel is set up upon opposite sides of the head. The heads are thus of less diameter than the inside of the barrel, so that the barrel, when returned, may be packed full of heads, and the rest of the barrel sides packed flatly together.

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The Baxter Engine—A 48 Page Pamphlet, containing detail drawings of all parts and full particulars, now ready, and will be mailed gratis. W. D. Russell, 18 Park Place, New York.

Notes & Queries

H. M. D. will find directions for making a fireproof artificial stone on p. 113, vol. 24.—M. H. can fasten emery to wood by the method for emery and iron, described on p. 363, vol. 31.—H. J. will find directions for making nitro-glycerin, dualin, dynamite, etc., on p. 212, vol. 33.—H. F. S. can brown his gun barrels by using the recipe given on p. 11, vol. 32.—F. F. will find a recipe for stove blacking on p. 57, vol. 25.—T. should French polish his pianoforte work. See p. 11, vol. 22.—M. H. K. will find a recipe for white fusible metal on p. 374, vol. 32. The process of repairing desilvered mirrors is described on p. 346, vol. 25.—S. N. will find directions for staining glass on p. 390, vol. 30; for etching glass, on p. 379, vol. 33.—H. A. S. will find directions for making clarified cider on p. 204, vol. 33; for preserving cider, on p. 139, vol. 33.—S. & B. will find on p. 139, vol. 32, directions for making paste that will probably answer their purpose. As to State laws regulating the sale of patents, see p. 187, vol. 33.—S. T. S. can mold rubber by following the directions on p. 283, vol. 29.—W. T. can clean shells by the method described on p. 122, vol. 27.—H. D. M. will find a recipe for Babbitt metal on p. 26, vol. 33.—C. B. will find directions for silvering glass on p. 346, vol. 33. Full directions for nickel plating have frequently been published in these columns. See pp. 155, 235, vol. 33. This also answers E. J. C.—R. R. M. can make a mold, for use on type, of plaster of Paris. The metal that is lightest in water is the lightest out of water.—B. H. C. will find full directions for putting a white enamel on iron on p. 362, vol. 32. This also answers A. F.—C. S. F. will find an account of the oleomargarin process on p. 23, vol. 32.—P. D. R. can fasten rubber to iron by the method given on p. 42, vol. 26, for leather. A good recipe for paste that will keep is published on p. 219, vol. 30.—D. G. F. will find a description of the phosphorus lamp on p. 10, vol. 27.—V. can read the inscriptions on coins by following the directions on p. 246, vol. 26.—H. G. W. will find directions for making spongy platinum on p. 330, vol. 25.—H. N. M. can cement glass to brass by the method described on p. 1, vol. 33.

(1) N. S. asks: How can I unite the mercury in a thermometer which has become separated by agitation? A. Fasten a string 3 or 4 feet long to the instrument, and swing it round your head. The centrifugal force will cause the mercury to unite.

(2) R. F. L. asks: How can I stick leather on the face of iron and wood pulleys? A. Glue the leather to the wooden pulley. Paint the iron pulley with a good coat of white lead in oil, and let it dry; then glue the leather on.

(3) L. B. asks: What is black rosin, and is it known by any other name? A. Black rosin is also called colophony, and is the residue left after the distillation of turpentine.

(4) H. L. M. asks: How can I get a white metal that will flow perfectly into an iron or brass mold, and which, when turned out, will stay bright? A. Melt together 4¼ lbs. of tin, ½ lb. bismuth, ½ lb. antimony, and ⅛ lb. lead. This alloy fuses at a low temperature and does not tarnish.

Can the color be taken out of horsehair, so as to make it white? A. Wash in weak lye, and fumigate with the vapor of burning sulphur (sulphurous acid).

(5) G. G. B. asks: What do pattern makers use to blacken their patterns with? A. Lamp black mixed with copal varnish and alcohol.

(6) J. N. J. asks: Why do iron and steel weld with less heat with than without borax? A. The use of borax is as a flux, to make the steel heat evenly, and to prevent the corners or edges from burning before the rest of the metal is of the proper heat.

(7) M. D. F. asks: How can chilled iron be drilled? A. By hardening the drill in mercury instead of water.

(8) C. R. asks: What pressure per square inch is required to crush pieces of ice together so as to form one clear homogeneous mass? A. Consult Professor Tyndall on "Forms of Water."

(9) J. H. asks: In what quantity, and at what intervals, should quinine be taken as a remedy for chills and fever? A. In many cases two grain doses are recommended to be taken before each meal, whenever an attack of chills is anticipated.

(10) E. C. & Co. ask: Would it be beneficial to soft maple lumber, for building a large friction pulley, to boil it in olive oil? A. Yes. 2. Would it harden the timber, and make it less liable to split? A. Yes. 3. Would the gear slip more after such treatment? A. Yes.

(11) H. A. S. asks: How is bromide of camphor made? A. Triturate the camphor first with a drop or two of dilute spirits of wine, and then digest with bromine water. The bromine unites with the camphor to form an unstable bromide of camphor, which is crystalline, and is decomposed by heat, by contact with air, and by action of ammonia.

(12) D. C. G. asks: Is there any preparation of phosphorus, either fluid or dry, that is luminous in the dark when hermetically sealed? A. A full description of the phosphorus lamp will be found on p. 299, vol. 33. It consists of a strong solution of phosphorus in olive oil. The solution is kept in a small, glass, stoppered bottle, and when required for use the cork is removed and the solution agitated.

(13) W. J. H. asks: What would be the difference between suspending a weight (that works such machinery as clockwork) direct, and hanging the same weight around a pulley attached to weight? Would there be any difference in effect upon the train of wheels, providing the amount of pressure on drum (not the weights) were same in both cases? A. Neglecting friction and rigidity of cordage, if the weight required in the second arrangement were 100 lbs., that in the first need only be 50 lbs.

(14) T. D. W. If two persons are in a top wagon, about 500 lbs. weight rests upon the two axles, which are as stiff as they are usually made. Now if the axles can be made 2¼ times as stiff, how many lbs. will the change take away from the load drawn by the horse? A. The question is rather indefinite, but we do not imagine that there would be much difference in the two cases.

(15) C. P. asks: How many lbs. strain will there be on a rope which has a horse at each end, pulling in opposite directions, supposing each horse to be pulling 1,000 lbs.? A. One thousand lbs. This question is anything but new. See p. 186, vol. 24.

(16) M. R. asks: Is centrifugal force of a wheel in motion a radial or a tangential one? A. Radial, as we understand your question, that is, in the direction of a radius.

(17) J. G. says, in answer to N. K. B.'s query as to the area of a polygon: If A be the area of the circle and P the perimeter of the regular polygon, the area of the latter is

$$\frac{P}{2}\sqrt{\frac{A}{3\cdot1416}-\frac{P^2}{4n^2}}$$

n being the number of sides which must be given. If these be given, A and P, as before, and B, the area of the regular polygon, the

$$\text{number of sides} = \frac{P}{2\sqrt{\frac{A}{3\cdot1416}-\frac{4B^2}{P^2}}}$$

(18) S. says, in reply to W. J. E., who is troubled with dreams: If you abstain from sleeping on your back you will not dream. It is very rare that a person who is not laying on his back dreams.

(19) L. C. Jr. says, in reply to H. J. E., who asked how to apply wax to stove patterns: As the stove plates of to-day are more or less ornamented with designs, having well defined depressions or elevations, the casting must be heated till it is hot enough to melt the beeswax and not burn it. Then apply the wax by rubbing it here and there over the surface of the plate; a small quantity only is required. After which, and while the wax is in a liquid form, give the casting a thorough brushing with a new shoe brush; this will spread the wax uniformly over the entire surface and at the same time remove all the surplus wax. Then allow the casting to cool, and, with a second shoe brush, give it a thorough brushing, and you will have a surface to your pattern that will give you a mold with as sharp corners as your pattern.

(20) W. J. R. says, in answer to T. D.'s inquiries as to compound gears: I judge from T. D.'s list of gears and pitch of lead screw that he has got a Pratt & Whitney lathe, which, unlike most other lathes, has, on the inside gear on the stud, double the number of teeth that the cone gear has. Therefore, with gears on stud and screws having the same number, the revolutions of cone and screw will be as 2 to 1, and the pitch of lead screw is made practically 16 instead of 8. The SCIENTIFIC AMERICAN'S rule will work by counting the screw as 16. The following index is useful for T. D.'s lathe:

Thread.	Stud.	Screw.	Thread.	Stud.	Screw.
2, 3	Cannot be cut with the list of gears.		4	112	28
			5	"	35
			6	"	42
			7	"	49
8	"	56	9	"	63
10	"	70	11	"	77
12	"	84	13	"	91
14	"	98	15	"	105
16	"	112	18	56	68
20	56	70	22	56	84
24	56	77	28	56	98
32	56	112	36	28	63
40	28	70	44	28	77
48	28	84	52	28	91
56	28	98	60	28	105
64	28	112			

COMMUNICATIONS RECEIVED.

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

On Screw Cutting Gears. By R. H. B.
On the New Force. By H. M. P.
On Solar Heat. By W. L. S.
On the Contraction Policy. By F. A. L.
On Reissues of Patents. By G. E. B.
On the Hydro-Pneumatic Puzzle. By M. P., by C. M., and by N. B. J.
On Spiritualism. By E. P. M., and by F. G. F.
On the Orbit of the Sun. By J. S.
On Making Rifles. By B.
On Poisons. By H. S. W.
On Carbonic Acid Gas. By C. W. S.
On Oceanic Currents. By T. L.
On Electric Whistles. By L. S. W.
On Chemical Action. By E. V.
On a Dioptric Light. By C. G., and by W. C. G.

Also inquiries and answers from the following:
I.—G. W. P., Jr.—T. B.—J. M.—A. J. B.—A. C.—G. E. C. S.—S. H.—S. R. H.—C. S. D.—S. E. H.—F. S. B.—A. R.—H. A.—J. G. S.—C. A. F.—C. L.—A. C. R.—J. A. W.—F. E. E.—R. B.—J. Q. R. B.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells alligator leather? Who makes an engine run by burning crude oil in the cylinder? Who makes the best gas meter? Whose is the best process for preserving shingles? Who sells *papier mache* cornices and centerpieces for ceilings? Who makes reflecting drawing boards and other drawing apparatus? Who sells phosphor-bronze? Who sells haircloth for pressing cider?" 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 November 16, 1875.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Alarm, door, Spoor & Searle	170,408
Alarm etc., low water, T. Hass	170,261
Amalgamator, Bancroft & Walker	170,329
Ashes, sifting coal, J. Waldron	170,317
Auger handle, J. Swan	170,413
Bagasse, saturator for, A. W. J. Mason	170,180
Bale band stretcher, J. Z. Stocker	170,411
Barrel, Flye & Watson	170,162
Bed stone, oscillating, E. Armitage	170,325
Bedstead, sofa, W. R. Hamilton	170,258
Bedstead, sofa, J. Schoen	170,403
Bee hive, O. Colvin	170,227
Billet loop, K. W. Holmes	170,264
Billiard table, A. Hand	170,169
Binder, temporary, C. D. Lindsey	170,282
Binder, temporary, H. B. Stephenson	170,302
Boiler steam, R. Dempster	170,348
Boiler injector, W. Randall	170,299
Boiler superheater, T. Vernon	170,316
Bolts, etc., making, J. R. Blakeslee	170,151
Boot, T. R. Evans	170,359
Boot tip, Merrill & Holtt (r)	6,762
Boot, wooden soled, M. J. S. Falcon	170,161
Boot burnisher, etc., A. C. & T. T. Esworthy	170,358
Box lid fastening, J. L. Stevens	170,410
Brush handles, forming, W. Wendell	170,329
Buffer stem, P. W. Pratt	170,190
Building block, B. A. Berryman	170,331
Burner, gas, A. M. Silber	170,407
Butcher's saw, W. Millspaugh	170,181
Butter package, A. J. Dibble	170,242
Cable etc., electric, G. W. F. Hoogeveen	170,266
Camera obscura, T. A. Kellett	170,271
Car axle box, L. Brauer	170,338
Car brake, P. Klunzinger	170,379
Car brake shoe, H. Stenz	170,409
Car coupling, Brinkerhoff, Bennett, & Selder	170,226
Car coupling, A. Brown	170,227
Car coupling, D. Harper	170,259
Car heater, safety, C. A. West	170,321
Car lifter, railroad, J. D. Imboden	170,374
Car platform, E. Tilp	170,415
Car seats, lock for, E. S. Scofield	170,195
Car starter, A. Dahler	170,347
Car starter, G. S. Knapp	170,175
Cars, wind wheel, A. W. Woodward	170,215
Cars, ventilating, E. E. Hargreaves	170,364
Carboy, A. H. Fatzinger	170,246
Carbureter, feed, etc., J. Austin	6,734
Card, playing, R. R. Landis	170,281
Carpet rag looper, W. H. H. Wyckoff	170,323
Carriage curtain, H. C. Moody	170,291
Carriage top, shifting, Gillespie & True	170,361
Caster, furniture, L. F. Cerf	170,156
Chair, reclining rocking, J. R. Newman	170,293
Chairs, bellows for rocking, E. E. Sells	170,308
Chandelier, F. S. Shirley	170,194
Cheese preservers, J. Q. Black	170,222, 170,223
Chisel, submarine rock, A. J. Whitney	170,425
Chronometer, solar, M. Wheeler	170,423
Cigar mold, J. Charter (r)	6,758
Clamp for stamp stems, tappet, N. J. Colman	170,236
Clock, geographical, S. J. Wallace	170,212
Clothes clamps, etc., slotting, M. Pratt	170,394
Clothes dryer, F. M. Clark	170,235
Clothes dryer, G. W. Green	170,253
Coffee huller, D. Lombard	170,283
Composition for beverage, W. A. Martin	170,286
Cooker, steam, G. H. Scribner	170,404
Cooking apparatus, H. M. Smith	170,199
Corn marker, J. McGregor	170,287
Corpses, head rest for, C. D. Blachford	170,224
Cow milker, W. H. Pearson	170,187
Cracker machine, C. S. Fowler	170,250
Cradle, W. V. & N. W. Van Dervort	170,418
Crane, H. B. Robison	170,301
Crosshead, J. W. Hill	170,370
Cultivator, Price & Hunt	170,395
Curd cutter, A. & E. H. Sedgwick	170,404
Curry comb, C. E. L. Holmes	170,265
Curtain fixture, E. B. Lake	170,277
Curtain fixture, G. W. Peirce	170,298
Curtain roller, Taylor & Donahue	170,205
Dental engine attachment, Buckingham *et al.*	170,342
Dental polishing tool, L. F. Locke	170,178

Detergent, J. W. Munger 170,183
Digger, potato, W. P. Martyn.......... 170,387
Door pull, sliding, H. H. Elwell.......... 170,357
Drill, coal shelling, P. G. Donohue.......... 170,350
Drill, mining, J. S. Fleming.......... 170,249
Dyeing fabrics, A. Schultz.......... 170,307
Earthenware, bailed, B. F. Roberts.......... 170,192
Elevator, B. T. Babbitt.......... 170,327
Engine frame, steam, W. S. Finney.......... 170,248
Engine, rotary, W. Haven.......... 170,365
Engine bucket, rotary, B. T. Babbitt.......... 170,128
Engines, valve box for, H. W. Adams.......... 170,149
Envelope opener, La Blanc & St. Pierre.......... 170,276
Equalizer, draft, H. Cartwright.......... 170,232
Eraser, etc., protector, L. L. Tower (r)......6,766 6,767
Fabrics for skirts, etc., A. Komp 170,380
Fare register, Watson & Knowlton.......... 170,318
Fence, J D & F Hyberger 170,269
Fence, iron, R. Rogers.......... 170,302
Fences putting barbs on wire, W. Dulin 170,354
Fiber and steel, testing, J. Garland 170,166
Filter and funnel, druggist's, A. E. Garrison.......... 170,167
Fire escape, T. Jingras 170,270
Fire escape, J. E. Lindlau.......... 170,281
Fire kindler, C. F. Cushing.......... 170,158
Fire lighter, G. Elberg.......... 170,356
Fishing rod case, C. Perry.......... 170,188
Flower stand, portable, D. M. Reynolds.......... 170,399
Fruit jar, E. S. Hunt 170,172
Furnace door, puddling, J. Boyland.......... 170,225
Furnace, hydrocarbon, H. M. Smith 170,198
Furnaces, feeding air to, W. C. Ford. 170,165
Furnaces, superheating air for, W. C. Ford.......... 170,163
Furnaces, retort for, H. M. Smith.......... 170,197
Furnaces, heated air to, W. C. Ford.......... 170,164
Furniture caster, L. F. Cerf.......... 170,156
Game board, J. G. Thurber, Jr.......... 170,429
Gas conduits, naphthaline from, J. C. Tiffany.......... 170,414
Gas lighter electric, O. A. A. Boillion 170,303
Gas lighting, electric, E. E. Bean.......... 170,221
Generator, steam, H. M. Smith.......... 170,196
Glass, annealing, J. M. Brookfield.......... 170,339
Glassware, making, T. B. Atterbury.......... 170,218
Grain drill, J. C. Daman 170,241
Grate, J. Schroeffel, Jr.......... 170,306
Halter fastening, J. Thornton 170,207
Hame, G. J. Letchworth.......... 170,177
Hames, J. Thornton 170,208, 170,209
Hame top, E. G. Latta.......... 170,176
Harness tug, B. S. Leonard.......... 170,382
Harvesters, J. O. Brown.......... 170,228, 170,229
Harvester, L. J. McCormick.......... 170,388
Harvester, corn, Townsend and Parr 170,315
Harvester carriage attachment, J. O. Brown.......... 170,230
Harvesting machine, J. O. Brown.......... 170,231
Hay loader, Perry and Manley.......... 170,189
Heating drum, T. B. Field.......... 170,247
Hinge, F. Toedt 170,314
Hogshead and barrel horse, J. N. Parker 170,186
Horse detacher, D. E. Owen.......... 170,389
Horse power, G. W. Gordon.......... 170,252
Horse power, A. D. Manley.......... 170,386
Horseshoe, A. Dunbar.......... 170,245
Horseshoe-calking vise, W. Weaver.......... 170,319
Hose coupling, W. A. Caswell.......... 170,155
Hose, lining hydraulic, J. U. Braman.......... 170,153
Hose pipe nozzle, S. Reid 170,397
Hydrant, J. O. Connor.......... 170,238
Indicator, speed, M. A. Wier.......... 170,213
Iron into steel, cast, C. L. Jeffords.......... 170,173
Iron, refining cast, A. Warner.......... 170,420
Jack, hydraulic, M. J. Walsh.......... 170,419
Kiln, brick, H. W. Adams, Jr 170,148
Kiln, brick, W. N. Weidner.......... 170,421
Kitchen utensil, T. S. Page.......... 170,295
Lamp chimneys, finishing, J. Lowery.......... 170,283
Lamps, manufacture of, T. B. Atterbury.......... 170,219
Lamps, wick raiser for, A. Albertson.......... 170,428
Latch, locking, J. Drucklieb.......... 170,358
Latch, reversible, H. S. Pomeroy.......... 170,393
Leather, vat for tanning, O. W. Bean.......... 170,330
Lightning rod, I. Johnson.......... 170,377
Limb receiver, H. R. Allen.......... 170,217
Loom shuttle, etc., J. Wolfenden.......... 170,214
Loom weft stop, Isherwood and Nuttall (r) 6,761
Lounges, attaching frames to, W. Seng.......... 170,406
Lubricators, C. H. Parshall 170,296, 170,297
Macaroons, preserve for, Heide and Wirtz.......... 170,368
Mail bag fastening, H. M. Smith.......... 170,195
Mattress, wire, A. Z. Boda.......... 170,334
Mattresses, frame for wire, W. J. Boda.......... 170,333
Measure, graduated, Young and Davis.......... 170,216
Meat mangle, C. C. Kerr.......... 170,378
Mechanical movement, E. Leslie.......... 170,280
Mill, I. A. Hedges.......... 170,367
Mill and press, cider, H. Krumsick.......... 170,275
Mills, concentrating tailings from, F. E. Mills. 170,289
Millstones bearing for, C. Custer.......... 170,346
Mitten, A. P. Smith (r).......... 6,764
Motion, converting, M. Crossman.......... 170,427
Motor, volute spring, W. S. Shoemaker.......... 170,310
Music sheet, electric, W. F. and H. Schmoel, Jr. 170,402
Needle threader, P. E. Lambert.......... 170,278
Ore, classifying, R. M. Wengler.......... 170,422
Paper collar, E. F. Bradford.......... 170,336
Paper fastener, Pack and Vanhorn.......... 170,294
Paper, perforating, W. Braidwood.......... 170,337
Paper weight, E. Dressler.......... 170,243
Parchment, vegetable, A. G. Fell 170,260
Peat cutter, Newton and Zollner.......... 170,184
Photographic background, Taber and Boyd 170,204
Photometer, P. Munzinger.......... 170,292
Picture frame clamp, etc., C. P. Poinier.......... 170,392
Pills, coating, A. F. W. and W. F. A. Neynaber. 170,185
Pipe, blow, C. Ramsey.......... 170,304
Pipe joint, J. Hyde.......... 170,373
Pipe trap, waste, T. Hudson.......... 170,368
Pipe, water, W. H. Sampson 170,305
Planing machine, hand, Doane and Passel.......... 170,349
Planter, corn, J. B. Abbott.......... 170,147
Planter, corn and seed, H. P. Sullivan.......... 170,412
Planter, corn, G. W. Brown (r) ...6,755, 6,756, 6,757
Plow, gang, F. A. Hill 170,262
Plows, furrow gage for, B. B. Hawes.......... 170,256
Press, power, B. G. Martin 170,179
Printing press, J. L. Firm (r).......... 6,760
Prison doors, operating, B. Richter.......... 170,400
Pump, etc., beer, D. S. Whitman.......... 170,426
Pump bucket, chain, Van Duzer *et al.* .... 170,2·1
Pump, rotary force, A. Carlin.......... 170,343
Punch, conductor's alarm, Hill & Ruger.......... 170,170
Purifier, middlings, J. F. Gandolfo.......... 170,251
Railroad rail chair, J. Gogerty.......... 170,168
Railroad rail joint, R. Long.......... 170,384
Register, T. B. Doolittle.......... 170,351
Register, G. F. Spencer.......... 170,200
Ruler, parallel, J. D. Hall.......... 170,257
Sash balance, H. Cutting.......... 170,240
Saw, butcher's, W. Millspaugh.......... 170,181
Scaffold, D. C. Place.......... 170,391
Scales, weighing, W. W. Reynolds.......... 170,191
Scoop, sifting, W. S. Boon.......... 170,152
Screw cutting machine, G. Emig.......... 170,160
Screw tap, E. Reynolds.......... 170,398
Seaming machine, W. C. Sharp.......... 170,309
Separating substances, A. B. Stanberrie.......... 170,312
Separator, grain, W. W. Johnston.......... 170,376
Sewing machine, F. Chase.......... 170,345
Sewing machine, J. W. & R. H. Lufkin.......... 170,284
Sewing machine, overstitch, W. A. Polmateer.......... 170,390
Sewing machine table, H. R. Tracy.......... 170,416
Sewing machine tuck marker, A. Johnston.......... 170,375
Ship's births, swinging, E. P. S. Andrews.......... 170,324
Shirt front, W. J. & M. A. Duke.......... 170,244
Shoe and stocking, rubber, J. M. Bibbins.......... 170,332
Shutter fastener, S. C. Tuckerman.......... 170,210
Shutter worker, H. A. House.......... 170,171
Sizing composition, S. B. Dorian.......... 170,352
Skate, E. Murray (r).......... 6,763
Slate-cleaning block, A. H. Bryant.......... 170,340
Sofa and table, convertible, C. C. Harris 170,260
Solvents, etc., recovery of vaporized, Whiting *et al.* 170,424
Spike machine, W. Haddock 170,255
Spikes, machine for making split, A. Whittemore. 170,322
Spinning, adjusting spindles, F. A. Sterry (r).......... 6,765
Spirits, P. Griffin.......... 170,254
Stage plank and carrier, W. S. Booth.......... 170,335
Steam whistle, King & McKiernan 170,274
Steel, manufacturing, F. Berchtold.......... 170,150
Stove, cooking, R. Thomas.......... 170,206
Syringe, W. Molesworth 170,182
Table, extension, G. Heyl.......... 170,369
Table, ironing, J. S. Hays.......... 170,366
Tailor's coat measure, J. S. Church 170,157
Telegraph, facsimile, J. C. Ludwig.......... 170,385
Tenoning machine, E. H. Rees.......... 170,396
Tide and current wheel, J. J. Hell.......... 170,263
Tires, clip for broken, J. W. Hoddinott 170,371
Toilet case and towel roller, D. Miller.......... 170,288
Trap, fly, H. B. Earing.......... 170,355
Truss, H. A. Kimball.......... 170,273
Tubes, bending metallic, J. M. Reid.......... 170,300
Tuck marker, R. G. Buss.......... 170,154
Tweer, H. J. Chandler.......... 170,234
Tweer, P. H. Standish.......... 170,313
Type-setting machine, J. Hooker.......... 170,372
Type-writing machine, W. H. Case.......... 170,233
Type-writing machine, L. S. Crandall.......... 170,239
Valve seats, refitting, C. F. Hall.......... 170,363
Ventilating churches, etc., W. Kingham.......... 170,174
Vise, E. Caswell 170,344
Wagon body, C. A. Dewolf.......... 170,159
Wagon brake, A. L. Bartlett.......... 170,220
Washing machine, F. Gittere 170,362
Washing machine, J. D. Lawlor.......... 170,279
Washing machine, J. I. Shotwell.......... 170,311
Watch case spring, A. S. Buckelew 170,341
Water ejector, H. Coll (r).......... 6,759
Water meters, register dial for, J. C. Kelley.......... 170,272
Water wheel, S. C. Lyons 170,285
Well curb, C. M. Minor 170,290
Whistle, steam, King & McKiernan.......... 170,274
Wind power, J. M. Armour.......... 170,326
Windlass, friction, A. D. Stout.......... 170,203
Window sash bead fastener, J. W. Tripp.......... 170,417
Window shade roller, A. Roelofs.......... 170,401
Wood-boring gage, G. S. Hudson.......... 170,267
Wrench pipe, D. P. Stanton.......... 170,201

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INDEX.

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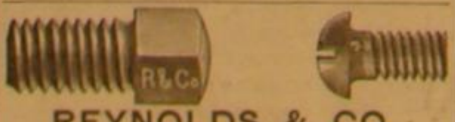

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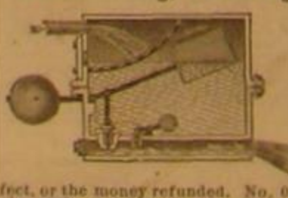

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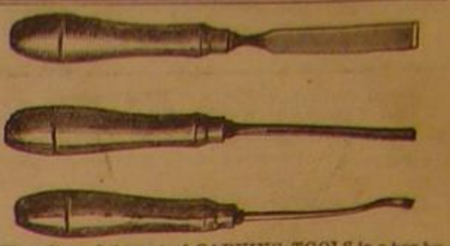

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