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AUTOMATIC STEAM ENGINE.

In the accompanying illustrations we present front (Fig. 1) and back (Fig. 2) views of an automatic steam engine, built at Mount Vernon, Ohio, which may be considered as the result of the first successful effort to construct, in the West, a complete machine of this description, not only combining all the requirements necessary to give the most economical results, together with a positive and sure regulation, but at the same time equalizing, in workmanship, material, and design, the best productions of Eastern shops.

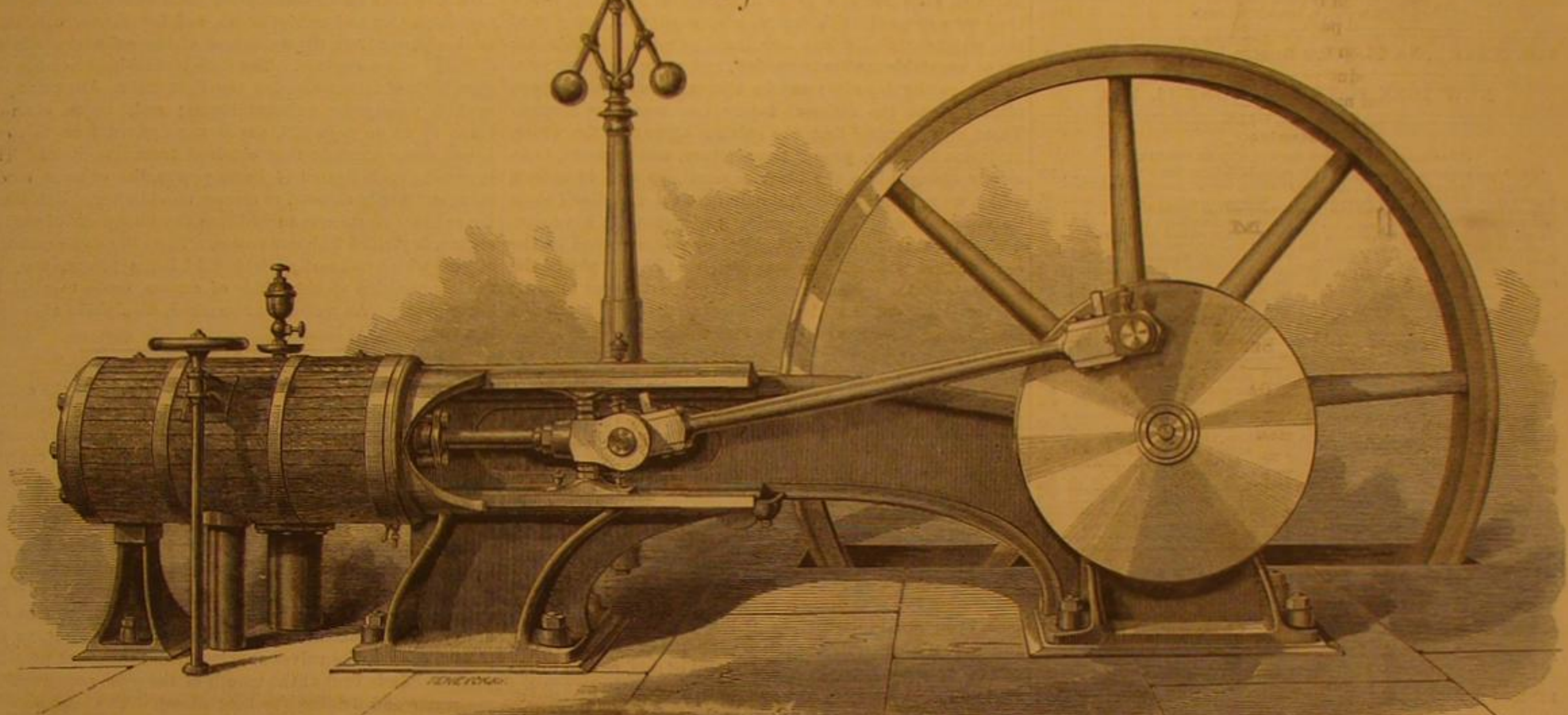
Without entering into the mechanical details, which are clearly shown in our engravings, we have but to call to the notice of our readers the special advantages which the manufacturers claim for this particular form of engine. The desirable points of stability and durability, it is stated, are secured by the use of the Surdo bedplate, wherein are united cylinder head, slides, pillow block, and feet for foundations, by an elliptic arch in one casting of pleasing design; each pound of material being so placed as to produce the best results. To this is securely bolted the casting containing the steam jacketed cylinder and steam chest. This joint is made broad and the surfaces truly scraped to each other, so that when completed it is as though the structure were of one piece. This principle of construction allows for the free expansion of the cylinder when heated by the steam, thereby avoiding all strain on the foundations, while the engine remains as perfectly in line, with the same clearances, lap, and lead, when at work hot as when set cold.

Regulation of the speed is effected by the governor, measuring at each stroke the exact volume of steam at boiler pressure which shall be admitted to the cylinder to do the work for that stroke, and which, at the same time, is demanded by the load upon the engine. Its principle of construction is such that no variation of pressure or change of load can alter the revolutions, and yet the speed can be varied at the will of the engineer at any desired moment.

Economy is claimed to be effected by the use of a steam jacket, by means of which the metal of the cylinder is kept at a higher temperature than the steam doing work inside, thereby preventing condensation. The valves are provided with flat wearing surfaces, which have been proved the best for continual tightness. Instantaneous closing of the cut-off is effected by the direct pressure of the steam upon a piston; and, lastly, a high rate of expansion of the steam takes place in the cylinder, whereby the full amount of heat is developed into work.

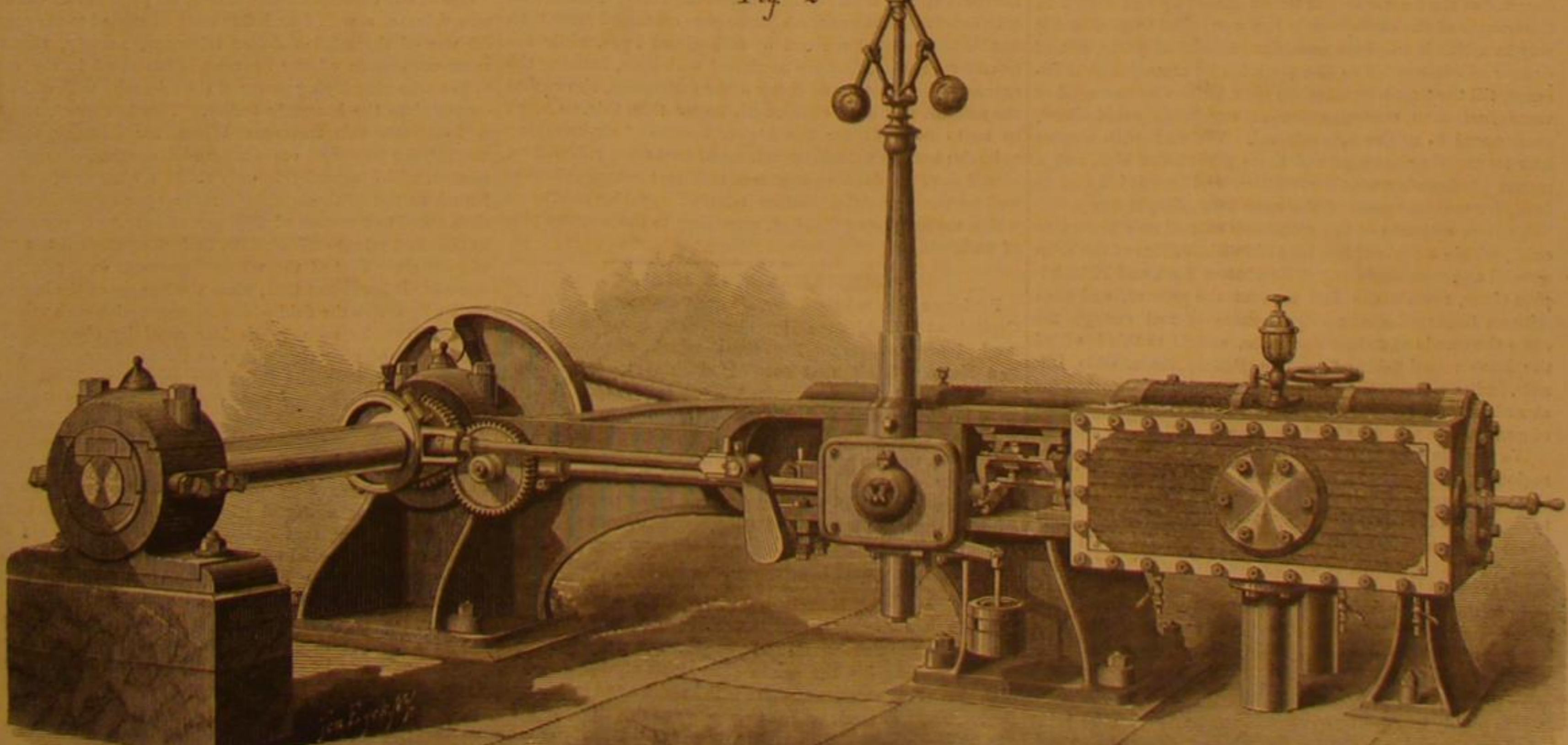
We are informed that actual practice and tests prove these engines capable of giving within ten per cent of the full

Fig 1



COOPER'S AUTOMATIC STEAM ENGINE.

Fig 2



theoretical power of the indicator diagram, and a development of a horse power on $2\frac{1}{13}$ lbs. of coal per hour. They are now being placed in factories under a guarantee of from 3 to 3½ lbs. of soft coal per horse power per hour, and in flour mills on a consumption of 25 lbs. of coal per barrel of flour. These results are produced by steam from the ordinary tubular boilers with good natural draft. For further information address the manufacturers, the John Cooper Engine Manufacturing Co., Mount Vernon, Ohio.

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Contents:

(Illustrated articles are marked with an asterisk.)

OUR COAL DEPOSITS.--THEIR FORMATION AND EXTENT.

Among the manifold, but at the same time most striking, proofs of a providential care during numberless past ages, preparing our planet for the future abode of highly intelligent beings, are the coal deposits. Without these all our modern material progress would be utterly impossible, and the human race would have remained in the stationary condition in which it was, in regard to all industrial pursuits, during the many centuries which preceded the discovery of the inestimable utility of coal.

Let us first consider that the kind of fuel used in former ages is totally inadequate to supply the present enormous wants of all our many steamships, locomotives, stationary steam engines, and domestic warming and cooking arrangements; and secondly that the amounts of coal consumed by these reaches most astounding figures, which are continually increasing. If then we make a visit to a coal region, descend into the mines, gather all the information we can obtain about the subject (which is the result of all kinds of explorations in regard to the vast coal deposits and the manner in which this valuable mineral is distributed), we become dumbfounded at the immense quantities stored up and buried in the bowels of the earth. We are compelled to admire the way in which it was kept safe, for millions of years, out of danger of combustion or deterioration by atmospheric influences, till the time arrived when man, driven by the need of more fuel than contemporaneous vegetation could afford, commenced to utilize this mineral. We find with wonder how its cropping out here and there served as a hint, and a means of drawing man's attention, and how it led him to look, for more material of the same kind, deeper down.

A rough estimate of the quantities of coal now known to exist, within a circle of less than 200 miles radius of the commercial and manufacturing cities of New York and Philadelphia alone, reveals the fact that at the present, and even with an increased consumption, there is coal enough for some thousands of future centuries, and if to this is added the known coal fields of western Pennsylvania, Ohio, Illinois, Indiana, Iowa, the Pacific Coast, etc., our amazement at and admiration of such a providential care, for thousands of generations yet to be born, become boundless.

We read, in some of the older geographies, that the coal regions are confined to the temperate zones, and especially to those parts peopled by the most advanced nations, that is, to Europe and North America. Such an assertion is simply based on the assumption that all the existing coal fields have been discovered, which is totally unwarranted. New coal fields are found almost daily in different parts of the world, even in the tropics; and now China appears to be as rich in coal as the United States east of the Mississippi. From its similarity in geographical position to the eastern plateau of the other great continent, this fact appears, *a priori*, to be very probable.

It is highly interesting to consider, from a geological point of view, the natural agencies by which such masses of carbon have been collected and stored up for future use. It is evident that, at a period of our earth's existence, all the hydrogen burned up and formed steam, which later condensed into water, also that all the carbon burned up and formed carbonic acid. At the temperature of the red heat, indeed, and above it, the affinity of carbon for oxygen surpasses almost all other chemical affinities, and for this reason carbon and a red heat are practically used to reduce oxides, that is, to rob them of their oxygen. The carbonic acid thus formed (unlike the steam, which condensed into water and formed the ocean) remained as a gas in the atmosphere and contained almost all the carbon in existence, as at the present time almost all the hydrogen in existence is contained in the waters.

As carbon is the main ingredient of plants, in fact the basis on which the cellular vegetable structure and growth depend, an atmosphere so rich in carbon as to contain all that there was of it was exceedingly favorable to vegetation; add to this a greater heat of the earth's surface (being partially supplied from below) and a consequent very moist atmosphere, and it is no wonder that vegetation did flourish in a manner so luxurious that it is difficult for us to form a conception of the same except by visiting the tropical forests of the present day. Great changes in the different levels of the earth's surface often swept the piled up remnants of such forest vegetation into lower basins, where they were covered with water, afterward with deposits of this water containing lime and other ingredients; other layers of vegetable matter succeeded, and other layers of mineral or earthy deposits; and in this way many strata were piled up and the different future coal measures formed. These only required first the solving agency of the water, exclusion from air, proper temperature, and pressure, to be slowly changed into the black mineral, so rich in carbon, which we now call coal. Not only does the coal itself show its vegetable origin, but chemical experimenters have succeeded in making coal artificially, by placing wood in the conditions in which it was supposed that Nature placed the remnants of the ancient forests when the coal was formed; the correctness of the above theory of the coal formation was thus practically verified by experiment.

As we are as yet very far removed from a complete knowledge of the number of coal fields and the quantities of carbon they contain, we know nothing of the amount of carbon thus eliminated from the atmosphere by the power of sunbeams on vegetable life. It is thus impossible to estimate what proportion of carbonic acid gas was once possessed by our atmosphere; we know only what has been left, and this is fully sufficient for vegetation. It is by weight a little less than one thousandth part, and as carbonic acid, CO_2, consists of 6 parts carbon to 16 of oxygen, our atmosphere contains in weight nearly one three-thousandth part of carbon. Estimating the atmospheric pressure at 14½ lbs. per square inch, or in round numbers 2,000 lbs. per square foot, every square foot of terrestrial surface supports an amount of carbon equal to one three-thousandth part of this, or two thirds of a pound of carbon. As a square mile contains 27,878,400 square feet, every square mile supports two thirds of this or 18,595,600 lbs. of carbon. Considering the earth as a globe, which is correct enough for our purpose, its surface is, according to the formula $4\ r^2\pi$, equal to $4 \times 4{,}000^2 \times 3{\cdot}1416$, or very nearly 201,000,000 square miles, which gives nearly 4,000,000,000,000,000 lbs. of carbon. Estimating the land as one fourth of the earth's surface, it would be 50,000,000 square miles, which, when covered with 4,000,000,000,000,000 lbs. coal, shows 80,000,000 lbs. to the mile, or very nearly 3 lbs. per square foot. As a cubic foot of coal weighs on an average 150 lbs., 3 lbs. coal are the 50th part of one foot thick, or very nearly one quarter inch. The amount of carbon still in the atmosphere would therefore, if extracted, form a layer of coal over all the lands of the earth of one quarter of an inch thick. We know already so much of the deposits that we are aware that the coal existing would do much more than that; therefore we may conclude that our atmosphere once contained more than double the present amount of carbonic acid gas, while the quantity of this substance combined with lime, forming the extensive lime rocks and many other carbonates, shows that the amount was once even much larger than this, so much so as to be unfit for the higher species of air-breathing animals; and the natural operations of past ages, referred to, served thus the double purpose of making the atmosphere as well as the terrestrial surface adapted for the conditions which are now being fulfilled, according to the evident plan of an intelligent Providential Power.

ELECTRICAL FIRE ARMS.

Professor Samuel Gardiner, Jr., the man who lights the Capitol at Washington by electricity, has invented a method of discharging fire arms which dispenses with gun locks and all that sort of machinery. Within the handle of the pistol or gun he has a galvanic battery, or a Leyden bottle and a rubber to produce electricity. Thence a wire extends to the cartridge, the arrangement being such that on pressing a pin with the finger, a spark of electricity enters the cartridge and fires the powder. Now, if the Professor will only make one more improvement, namely, shoot the ball by electricity without gun or powder, he will distance all competition, and add new laurels to his already distinguished fame as an electrician.

BISULPHIDE OF CARBON.

In the manufacture of illuminating gas, lime is used as a purifier, to arrest the fumes and compounds of sulphur, which become mixed with the gas in the process of distilling the coal. This lime becomes charged with sulphur and other matters. A new method, by Julius Kircher of this city, for producing bisulphide of carbon from the above waste of gas-making establishments known as gas lime, consists in mixing the gas lime with equal parts of clay, loam or sand, subjecting the same to heat in a closed retort, which expels the sulphurous vapor, and conducting such vapor over charcoal heated to a light red. In the passage of the sulphur vapor over the coal the requisite carbon is supplied, one part, by weight, of carbon uniting with two parts of sulphur, forming bisulphide of carbon. This being now hot is in the gaseous state, but assumes the liquid form when cooled by refrigeration with cold water.

Bisulphide of carbon is a very peculiar liquid. It is very clear and brilliant. In respect to light it is highly dispersive and refractive, and excellent prisms may be made by filling triangular shaped bottles with the fluid. It may also be used as a sieve to separate the heat from light. For example, if we dissolve a little iodine in a bottle of bisulphide of carbon, and place it in the path of a sunbeam, the heat rays will pass readily through, but the rays of light will not. The natural odor of bisulphide of carbon is not unpleasant, as may be ascertained by opening a bottle of the liquid and applying the organ of smell. But when a little air mixes with the bisulphide vapor, a most disgusting odor, which might be termed the concentrated essence of rotten eggs, is the result.

Bisulphide of carbon boils at 118·5° Fahr., has never been frozen, is used for thermometers, for dissolving india rubber for making ice and refrigeration, and latterly for obtaining motive power from the waste heat of the exhaust steam of ordinary steam engines. The Ellis bisulphide of carbon engine, heretofore described in the Scientific American, is worked wholly by exhaust steam; and, in an example given by us on page 276, the power derived from this exhaust steam exceeds that obtained from live steam. The steam engine indicated 14 horse power, the exhaust steam being ordinarily allowed to escape up chimney. But when the exhaust steam was turned into the bisulphide of carbon engine, it yielded 22 horse power. Thus the same quantity of coal which ordinarily yielded 14 horse power, was, by the interposition of bisulphide of carbon, made to yield 36 horse power. As we before remarked, bisulphide of carbon is a very peculiar liquid.

A GAS-PROPELLED BOAT.

Mr. William A. Leggo, of Montreal, Canada, is the author of a novel method of propelling vessels, designed especially for canal boats, to overcome the difficulties of horse towage. He discards steam wheels, ropes and other common contrivances. All that Mr. Leggo uses is a large bent pipe which is attached to the stern of the vessel, the mouth of the pipe being placed under water, pointing stern-wise. The pipe rises to the deck, and at the upper end of the pipe is a gas light and valves that open inward for the admission of hydrogen gas and atmospheric air. As soon as enough hydrogen and air have entered, to wit, two parts of hydrogen to one of oxygen, the mixture takes fire from the gas light, an explosion ensues, the valves are closed, and the great pressure produced finds vent at the mouth of the pipe, acting against the water and driving the boat ahead. The valves then open again, the gases flow in, a new explosion takes place, and so on. These explosions follow with as much rapidity as the motions of a steam engine piston, and thus the boat soon acquires a regular velocity. Whether the manufacture, cost, and storage of the gas, and the working of the gaseous motor, will equal the economies and conveniences of steam power and its propelling appurtenances remains for Mr. Leggo to ascertain by trial. But we think he will find that steam is the cheapest and simplest motor, take it all in all. The same amount of fuel that he requires to produce the gas and work the gas engine will yield a greater amount of useful motive power if used in connection with a proper boiler, engine and propeller.

AN OBJECTION TO THE LARGE TELESCOPE ANSWERED.

One of our correspondents makes, on page 341 of our current volume, a well founded remark in regard to the practical use of the million dollar telescope, namely, that the apparent motion of the heavens is increased in the same ratio as the magnifying power of the telescope with which we contemplate the heavenly bodies. This is correct, and we will estimate this increase: When, for instance, using a magnifying power of one thousand diameters, the apparent motion, which actually is only about a quarter of a degree (equal to the sun's or moon's radius) per minute, becomes then equal to a motion of 250° per minute, or 4° per second, or 360° in 1 minute 27 seconds, in fact equivalent to a velocity equaling that of the whole firmament in 1 minute 27 seconds. It is evident that, when the images of the heavenly bodies fly across the field of the telescope with such velocity, nothing can be seen, much less carefully observed. His comparison of observing a flea, on the periphery of a wheel revolving ten thousand times per second, while sitting on another wheel, turning four thousand times in the same short period, is rather exaggerated. The most sanguine expectation is to bring the moon apparently to within 8 miles, which corresponds to a magnifying power of 30,000, and this may be as easily controlled as astronomers now control the present powerful telescopes, by simply mounting them equatorially, that is, attaching them to a main axis which is placed parallel to the axis of the earth, and giving, by means of properly regulated clockwork, to this axis a rotation contrary to that of the earth, but with the same velocity, that is, one revolution in 24 hours. In this way, the two motions neutralize each other, and the telescope stands motionless in space, at least as far as concerns the daily terrestrial rotation. The fixed position of the earth's axis and the great distance of the stars makes the effect of the earth's yearly motion totally imperceptible, when the stars or the further planets are the objects observed.

In regard to the moon's apparent and real motions, our astronomers have also solved the problem of regulating the motion of the telescope, so as to follow the moon perfectly. This was necessary in order to make the admirable lunar photographs, such as those with which Mr. Rutherfurd and Dr. Henry Draper (both of New York city) have enriched the scientific world. The same principle, applied to the million dollar telescope, will keep any mountain crater or other object on the moon's surface exactly in the center of the field of the instrument; the only precaution to be observed will be that everything is to be constructed with the utmost care, as evidently all little defects and aberrations produced by the apparatus will become magnified in proportion to the power of the lenses. As the motion of each planet is perfectly known, having been the subject of the most rigid calculation, the means of keeping each planet in the center of the field of any telescope, however great its power, is a simple mechanical problem, founded on mathematical data and of as easy solution as is the case with the moon's motion; it is, in fact, easier, as the moon shows more of such irregularities than the planets; while at the same time, by her greater proximity, these eccentricities are more perceptible to us than those of other heavenly bodies at greater distances.

THE VIENNA EXPOSITION.

The great show, from all accounts, is still in a chaotic state of confusion, and the reports of the correspondents of European and domestic journals, written from Vienna, indicate that but slow progress is being made toward reducing the contents of the vast building to anything resembling order. Visitors are few, averaging barely 10,000 a day, and these have to pick their way through a wilderness of packing cases and among a Babel of workmen, with no better reward for their labor than a sight of half finished trophies or jumbled mixtures of goods, destitute of arrangement and still covered with their protecting screens. "Judging from the efforts made in some parts of the buildings," says one correspondent, "the exhibits will only be in order a little while before it will be time to restore them to their packing boxes." Another writer clings to the hope that the 1st of July will find everything complete, while a third, taking a more despairing view of matters, doubts if the show will ever be finished, and strongly advises Americans contemplating a trip to Vienna to defer their journey for at least two months.

THE GENERAL OFFICIAL CATALOGUE

has been recently issued by the Austrian government, but the lists are imperfect, and the United States, Spain, Portugal, and a large portion of the German section are entirely omitted. At present Austria has the largest number of exhibitors, 7,290, the majority of whose products relate to textile industries and clothing; Hungary is next, 4,629; then France, 2,508; and Germany, 2,459. England has 784 exhibitors, principally of machinery. Salvador ends the list with but 5, presenting specimens of her productions. Of the various groups, that devoted to substances of food as products of industry is best represented, by 2,653 entries. The fine arts are badly neglected, the exhibitors in the four groups devoted to the subject numbering but 8, and all coming from Russia. The total number of people contributing to the show is summed up as 24,014. This catalogue, though deficient in many respects, is the best information available at present upon the extent of the exhibits, though of course its figures indicate the *personnel* of the participators in the exposition without relating to the number of objects they may display. At some future time it will be corrected; and its statistics, when including those of the nations above mentioned as omitted, together with such additional contributions as may come from China and the Asiatic countries, the West India Islands, and other as yet not fully represented localities, will doubtless be materially altered.

WITHIN THE ROTUNDA

is the scene of the greatest activity. The great central transept is almost entirely in order, and is furnished with rich draperies and cases of textile fabrics. In the center the great fountain is rapidly approaching completion, but its design cannot yet be determined. Most conspicuous are the stearin trophies, which may well be taken for polished marble and which are exquisite in design and workmanship. One consists of a high column with gilded and black polished pedestal, capital, and bands, surmounted by a huge ball of white stearin. Another is a complete temple formed of the same material, which has six columns each ten feet high; within is a figure of the Goddess of Peace. *Engineering's* correspondent, from whose graphic report we draw the main facts herewith given, notes a large number of general exhibits comprising arms, clocks, ivory articles, etc., which in the absence of detailed particulars are of no special interest to the American reader. Lavassiére *et fils*, of Paris, copper workers, display an odd trophy, occupying a space some 30 feet square. The area is enclosed by walls of burnished bars and copper tubes arranged in groups of different lengths so as to present a somewhat castellated appearance. These tubes are cut away in the center of two sides so as to leave entrance ways. Over the front portal is secured a fine piece of copper work—probably part of a vacuum pan—which forms a domed metallic canopy; around are arranged various kinds of copper and brass work, fire box sheets, fittings, etc. Pollak of Vienna displays a huge structure made with great skill and ingenuity entirely of variegated matches. Faber exhibits his world famed pencils, and a rival manufacturer, immense urns of polished plumbago. A portion of the

SUGAR MACHINERY

has been set up in the machinery hall. This class of apparatus may be divided into two sections; that for making sugar from cane, and that relating to the beet root manufacture. There is also in addition a very interesting exhibit of a plant for extracting the saccharine matter from potatoes and other vegetables. In the first division Heckmann of Berlin displays a magnificent vacuum pan 10 feet 3½ inches in diameter, the top of the brass dome of which, as it rests on its platform, is over 27 feet from the floor. It is made entirely of copper and in only five pieces. The upper part is dished out of one sheet of copper; the middle part of the body down to the flanges is built out of another; the lower body, which is nearly cylindrical, is made out of a third, and the two bottoms, each out of a single piece. The pan contains 645 square feet of heating surface and twenty-five complete rings.

F. Aders, of Magdeburg, has the finest apparatus for the manufacture of beet root sugar. The boilers resemble marine boilers standing side by side, and are simple wrought iron cylinders 8 feet 3 inches by 10 feet 8 inches. Each contains 510 seamless 2 inch brass tubes, passing through the end plates and communicating, not with the interior of the boiler, but with separate steam chambers at each end. The low pressure steam is admitted in one of these chambers, is condensed in passing through the tubes, and imparts its heat to the juice in the boiler. The steam given off by the boiling after passing through a safety vessel is used to heat the contents of the second boiler; and, as it is necessarily itself condensed in the process of imparting its heat to the juice in the second boiler, no separate condenser is required for it to insure that the boiling in the first boiler takes place *in vacuo*. The steam from the second boiler is condensed in the usual way. The safety vessel is a special feature, and serves to free the steam from all the sugar which may have become mechanically mixed with it. Each boiler contains 2,850 square feet of heating surface, and they are considered the largest of their class ever constructed. The

MARINE ENGINES

exhibited are few in number, as manufacturers seemed loth to forward their goods to a country in which but little demand for them could exist. Messrs. Burmeister & Wain, of Copenhagen, contribute a pair of compound engines of thirty horse power, nominal, of novel design. There are two high pressure cylinders on the top of the low pressure cylinders, but the latter have trunks so that the total hight of the engines is not more than would be occupied by ordinary direct acting engines without the extra cylinders above. Each low pressure cylinder has one of the side frames cast upon it. There is a horizontal cylindrical surface condenser, the pumps of which are worked by levers connected with the lower ends of the trunks. A forty horse power compound marine screw engine from the *Stabilimento Technico* of Trieste, is noticeable for the manner in which the air and circulating pumps are worked. There is a short throw forged crank in the center of the crank shaft, from which a connecting rod works the feed pumps by a cross head; and the feed pump rods, being prolonged and carried across above the shaft, form the piston rods for the air and circulating pumps. The Austrian and Hungarian Lloyds, in a large pavilion of their own, exhibit a series of models of various vessels, and also the stern post and tube, screw shaft and propeller of a vessel having engines of about 200 horse power. The propeller has four blades with their tips bent back for the sake of getting an extra large leading radius; an arrangement, by the way, which has been proved not to possess sufficient advantage to compensate for the additional risk of having the blades broken. As regards

THE UNITED STATES COMMISSION,

we have little of novelty to add. The report of the official investigation relative to the charges against the suspended commissioners is still delayed, and in its absence no just opinion of the difficulty can be formed. Foreign journals, we notice, applaud the action of the Government in its prompt though severe measures. A deputation of influential citizens from New Jersey, recently waited upon the President in reference to the case of General Van Buren; but, other than the assurance that justice would be done, we note no results of the interview. There has been a brief sensation caused by the statements of a restaurant keeper, regarding approaches made to him by the ex-commissioner general, but the report, as published in a morning contemporary, has since been stated to be incorrect, and it is doubtful whether the facts have any substantial basis. There is little question but that if General Van Buren is innocent of the aspersions cast upon him, as we trust he is, his experience has been a severe one, for which, if exonerated, he deserves ample reparation from the country.

SCIENTIFIC AND PRACTICAL INFORMATION.

MERCHANT STEAMERS.

According to the bureau of statistics at Brussels, the steam merchant marine of the world consisted in 1872 of 4,335 steamers, measuring 3,680,700 tuns. Of these Great Britain has 2,538, aggregating 2,382,145 tuns, and the United States 420, of 282,150 tuns.

SCHIO-LIAO.

The Hansa recommends shippers of sugar, coffee, tea, tobacco, etc., to abandon the use of costly envelopes of sheet lead and zinc to protect their cases, and substitute therefor the Chinese "schio-liao," or varnish made of 4 parts fresh blood, 4 parts of powdered lime and a little alum. It is said that three or four coats of this substance ensures complete impermeability. The composition was described on page 65 of our volume XXIV.

NIGHT SIGNALS.

In England and Germany a method has been proposed of applying the commercial code of signals to night use. Sir W. Mitchell and Captain Nordenholt suggest the use of red white, and green lights to flash a certain number of times according to the letter to be communicated. Thus, the first six consonants of the alphabet are represented by from one to six flashes of a white light; the next six by a red light, and the third six by a green light, used in the same manner. Only two lanterns are needed, one entirely white, and the other having a green and a red side. Experiments made with this system have proved satisfactory.

SPONTANEOUS CHANGE IN THE EXTRACT OR ESSENCE OF VANILLA.

Quite recently there has been considerable comment in scientific journals in reference to the poisonous properties of the vanilla bean. The flavoring is supplied in two forms, the powder of the pod and an alcoholic extract. Dr. Oliver believes that there is no reason to consider that either the pod itself or the extract is deleterious when fresh, but that there is strong reason to fear that the extract at least may undergo a change so as to be capable of producing poisonous symptoms. The alteration probably takes place through oxidation, after exposure for a length of time to the air. Hence it is to be inferred that bottles containing the extract should be kept well corked. Schroff believes that the poison is produced by the use of cashew nut oil to besmear the vanilla pods. The low priced extracts of vanilla in the market are made of the tonka bean, a cheaper article somewhat used for flavoring snuff. There is, however, no reason to suppose that this bean possesses deleterious properties.

FERTILIZER FOR MELONS.

Coffee grounds, which are very rich in nitrogen, are said to form an excellent manure for melons. In order to produce the best effect, they should be mixed with the earth which forms the bed, so that they should be well decayed by the time the roots begin to develope.

RECENT PHOTOGRAPHIC IMPROVEMENTS.

M. A. Martin proposes the following very soluble collodion: Add to two parts of sulphuric acid at 150° F., one part of dry nitrate of potash; when the mixture has cooled to 131°, place therein small tufts of cotton as rapidly as possible. After 7 or 8 minutes of immersion, turn out the whole at once in a large quantity of water and wash quickly, repeating the washing until complete neutrality is obtained. The dried cotton is carded with copper cards in order to eliminate all pulverulent portions. About 123 grains of cotton are to be employed with every 10 ounces of the above mentioned mixture.

M. Jeanrenaud advises photographers to make use of a cold solution of 3 or 4 per cent of carbonate of ammonia, as a powerful solvent of the chromatic products which color carbon proofs after their development. The substance, he says, replaces cyanide of potassium with advantage.

For magic lantern images, G. Willis recommends the following process: On a solution of india rubber in benzole, of the consistency of ordinary collodion, allow to float for half a minute the sheet of paper which is to be applied to the plate of glass. Add, to the white of eggs, about 7 grains of chloride of ammonia for each egg, beat up strongly and filter. Then allow to float upon this liquid the already impregnated paper, taking care to avoid air bubbles. The paper dries very quickly and can be preserved for a long time. The sensitiveness and the printing are the same as ordinarily, but the image on the paper should have very dark colors. It is then washed to remove all trace of silver, and pressed against the plate. When the paper is dry, the surface is lightly rubbed with a wad of cotton dipped in benzole, after which it may be detached, leaving the image on the glass. The picture is fixed by employing a solution of soda, sufficiently weak not to attack the colors. Plates thus prepared are remarkable for their transparency, and as the tints applied are very intense, they can bear to be much magnified. Another advantage in the process consists in that a quantity of paper already treated with the caoutchouc can be held in reserve.

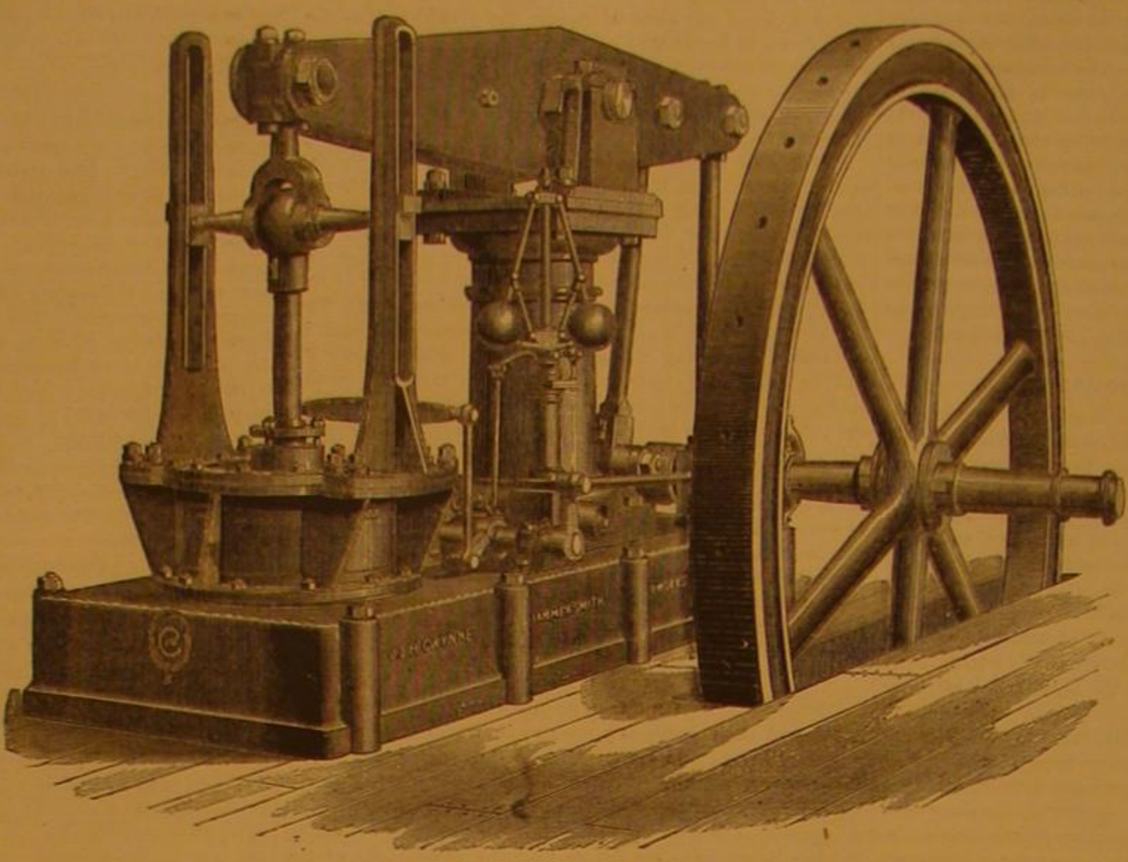
M. Letaile diminishes the intensity of a negative which is too opaque after development by first washing it and then covering it with a solution of 7·5 drams of chloride of gold in a pint of water. The operation is repeated until the negative assumes a suitable color. Next it is placed in a bath of nitric acid which entirely covers it, dissolving the silver and causing the image to nearly disappear. By the aid of sulphate of iron, however, the latter is darkened and caused to reappear with much transparency. Recourse may be had to pyrogallic acid to attain at once the degree of intensity and of transparency desired. The image which remains after the application of the nitric acid, on account of its great transparency, is excellently adapted for enlarging.

A JAPANESE SUSPENSION BRIDGE.

Mr. T. J. Waters, the Surveyor General of the Japanese government, has recently completed the first suspension bridge built in Japan. It is constructed over a ravine filled with water, which separates the Mikado's palace from his pleasure gardens, and is intended solely for his own personal use and that of his immediate attendants. The fabric, says the *Japan Weekly Mail*, is 234 feet long, 17 feet wide, and 60 feet above the water. It is supported by two red brick columns 64 feet high from the foundation, and the cables are of galvanized iron. The hand rails are of thin wire rope, and, with the entire structure, are handsomely ornamented. The anchors are buried 23 feet deep, and the bridge has been tested with a rolling load of 20 tuns. The Mikado, we understand, took great interest in the construction and frequently inspected its progress.

PUMPING ENGINE.

We are indebted to *Engineering* for the accompanying engraving of a small non condensing beam pumping engine, constructed a few months ago by the Messrs. Gwynne, of the Hammersmith Iron Works, Hammersmith, England, for pumping from a well one hundred feet in depth. The engine has a steam cylinder 20 inches in diameter with 2 feet 6 inches stroke, and the piston rod is carried through the bottom of the cylinder and attached to a balance weight (about half a ton) employed to counterbalance the weight of the pump rods, etc. The beam is 8 feet 6 inches long, and is composed of two seven-eighths inch wrought iron plates stayed together at intervals. The connecting rod is 4 feet 2 inches long between centers. The crank has a throw of 8½ inches. The pump, which is carried on a girder 25 feet from the bottom of the well, is of the bucket and plunger class, the barrel being 16 inches in diameter and the plunger, 11½ inches. The stroke of the pump is the same as that of the steam cylinder, namely, 2 feet 6 inches. A large air vessel is placed above the retaining valve of the pump, and the latter delivers the water through a rising main 9 inches in diameter. Altogether the engine is of a very convenient type, which may be advantageously employed in many situations.



BEAM PUMPING ENGINE.

WENHAM'S HEATED AIR ENGINE.

At a recent meeting of the Institution of Mechanical Engineers, in London, England, Mr. C. W. Cooke, in a paper on the subject, gave the following details regarding Wenham's hot air engine, an engraving of which we reproduce from the pages of the *Engineer*. This machine belongs to that class in which the fire is inclosed and fed by air pumped in beneath the grate to maintain the combustion, the larger portion of the air entering above the fire to be heated, the whole, together with the products of combustion, being made to act on the piston.

Our illustration gives a sectional view of an engine of this description of one horse power. A special feature is the furnace shown at A, in which perfect combustion is obtained from ordinary bituminous coal, which is generally preferred for this engine. The space under the grate is separated from the upper part by a moderately air-tight diaphragm, and above the grate is an annulus of segmental fire bricks, as shown, with semi-cylindrical grooves at their joints, so that when placed together the center forms a cylindrical hopper containing a store of fuel sufficient for several hours' work, and the grooves at the joints form a series of vertical flues through the bricks. The column of coal descends as it is consumed on the furnace bars, and, the air coming into contact with nothing but coal in a state of intense ignition, all the products of combustion must pass through the ignited portion. The channels in the fire bricks that serve as flues being also white hot, no unconsumed fire gases can pass through.

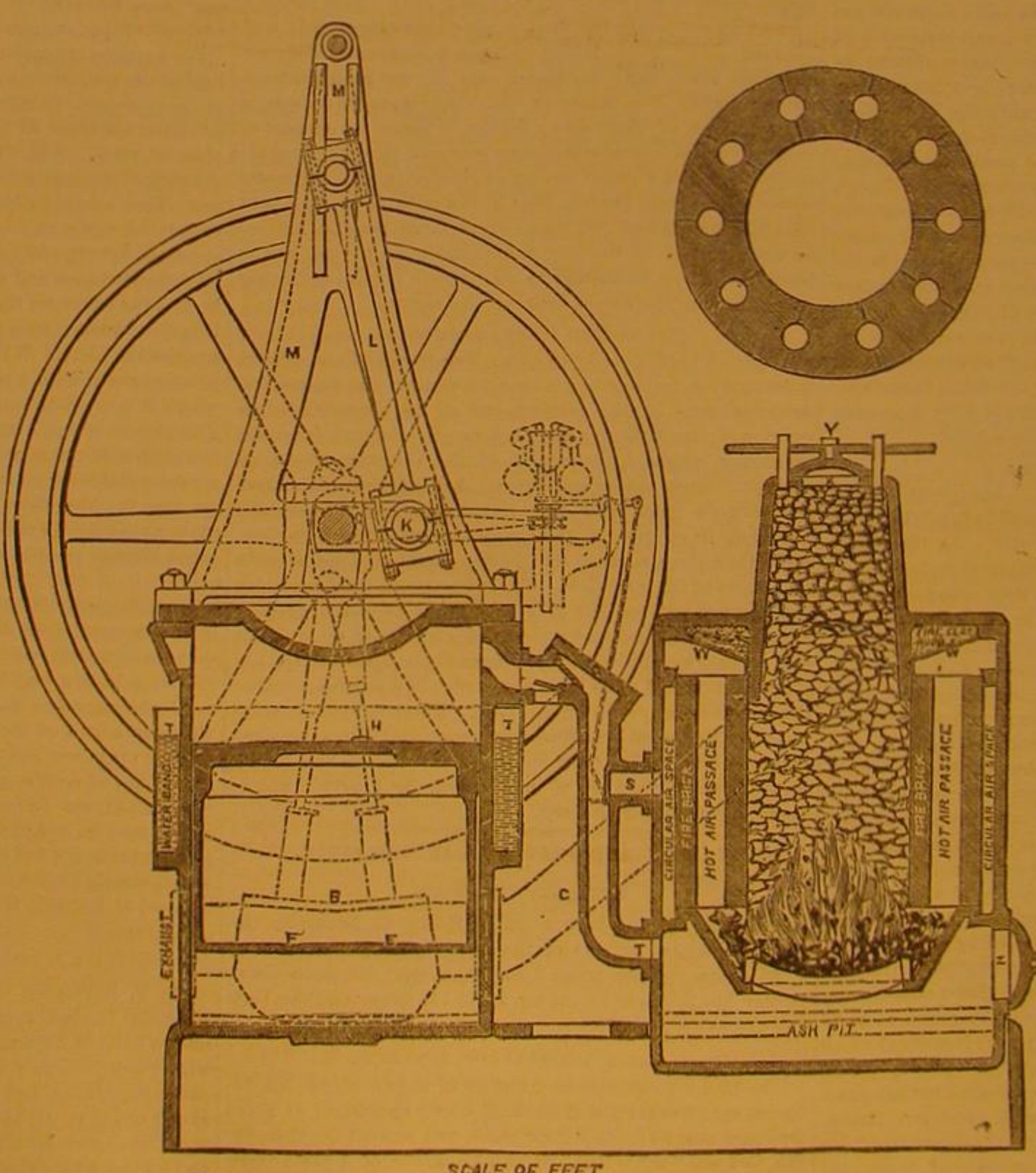
The furnace has a cover, by which it can be hermetically closed in front of the ash pit, shown at Z, and there is a similar cover for filling the coal hopper at Y. The products of combustion, after leaving the channels of the bricks, are met by a [illegible] plate, W, lined with fire clay, which prevents the cover of the furnace from getting unduly hot. The fire bricks are separated from the outside shell of the stove by a ring of powdered brick or ashes. There are two cold air supply inlets to the fire, the one below the fire, at T, and the other above the fire, at S; and there is a swing valve, by which more or less of the air supply is directed below or above the fire. If all the air be directed below the fire the combustion becomes very intense, and the heat, and consequent expansion of the air, correspondingly great, and the engine will gain in power and speed. If, on the other hand, all the air be directed above the fire through the passage, S, a very dull fire will be the result; the air will be comparatively cool with less increase of volume, and there will be a diminution in the power of the engine. This difference of power serves as a very effective means of regulating the speed of the engine, and the governor was consequently attached to the lever of the swing valve at S. No other regulation for speed is required, giving this advantage that the combustion of the coal is exactly proportioned to the amount of work performed. The engine is of the steeple form, having two piston rods placed diagonally, with the main or crank shaft running between them; and in order to make the cylinder as compact as possible, the cover of it is provided with a segmental chase or depression, in which the crank passes. The engine is single acting, the air pressure acting on the under side of the piston only; the air is admitted from the heater by means of a puppet valve, E, moved by a cam, at G, on the main shaft. There is a similar valve, also moved by a cam, which opens from the cylinder to the exhaust. This valve is shown at F.

The chief peculiarity in this engine is the method by which the top of the cylinder serves as the air pump, and is made to convey into the heater for expansion the reduced bulk of air required for the due performance of the engine. The top of the piston does not reach the cylinder cover, but there is a clearance space left between them. The result is that the pressure in the heater should never exceed 15 lbs. on the square inch; the extent of this pressure is obtained entirely by the amount of clearance space above the piston, the action of which may be thus explained: The piston rises until it compresses the air contained in the air pump to half its volume, or to a pressure of 15 lbs. per square inch, and not till then does there exist equilibrum between the air in the air pump and that in the heater. The pump valve, Q, then opens, and during the remainder of the stroke, air is pumped into the furnace. At the end of the stroke the valve, Q, closes, leaving still 15 lbs. pressure in the space above the piston. As there is no further escape for this, it acts upon the piston during part of the down stroke, and equalizes the action of the engine; a small fly wheel only is therefore required.

This is, of course, not any advantage in power, for whatever power is required in order to obtain this pressure of 15 lbs. above the piston must be deducted from the force of the up stroke; it is only transferred from the lower side of the piston to be utilized above by the subsequent expansion of the compressed air. After the expansion has ceased, the inlet air pump valve below Q opens, and admits the quantity of cold air required for the next stroke of the engine.

Mr. Cooke observed that air engines on this principle cannot be worked advantageously at a high pressure. The air is found to enter the working cylinder at 1127° Fah., and to leave it at 466° Fah. About 8 lbs. of coal per horse are found to be consumed per hour.

There can be no doubt that, in many applications requiring a few horses' power, this engine will be found very useful, and the verdict of the discussion tended to this direction. The manufacturers do not, of course, put it forward in competition with the ordinary steam engine, but rather as a fairly economical, non-explosible, small prime motor.

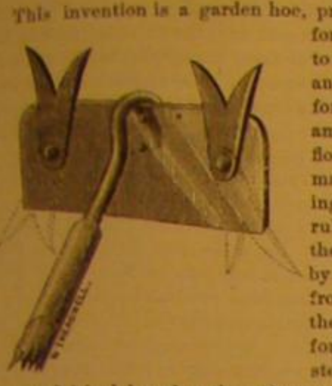


WENHAM'S HEATED AIR ENGINE.

Australian Pearl Fishing.

Pearl fishing on the coast of Western Australia is rapidly assuming importance, one English speculator having had no fewer than 400 Malay divers at work during the season of 1872–73. The fishing grounds lie about two to three miles from the coast. Small schooners anchor near these, and the diving takes place from skiffs, containing each about ten men, who dive in succession, going down two to four fathoms (the Malays are able to reach six fathoms). The season begins in September and ends in March, and the diving is most extensively done one or two hours before and after the lowest neap tide. One of these skiffs will earn $150 in a week, in mother-of-pearl, exclusive of pearls. The natives receive no regular wages, only good food and some articles of clothing, with occasional small presents. The Malay divers receive about four dollars monthly, besides board, and passage money to and fro. The fishing is done in a very rude and primitive fashion at present, but improved appliances are being called in, and a rich harvest is expected.

IMPROVED GARDEN HOE.



This invention is a garden hoe, provided with swinging forks, one being attached to each edge on the right and left of the hoe blade, for loosening the earth among tender vegetables, flowers, etc. The device may also be used for raking out weeds or other rubbish from between the rows, which is done by turning the forks up from the cutting edge of the hoe, as shown. The forks are made of thin steel, about 1½ inches long and ½ inch broad at the points, and are fastened to the hoe by means of rivets. Patented Oct. 29, 1872, by Mr. Reuben P. Buttles, of Mansfield, Pa.

Never Turn Around in the Street with a Ladder on your Shoulder.

Old Mr. Watson on Nelson street has got a nice little bill to pay. He sent a man down town for a pot of paint and a ladder. The man got the paint, and then went to a lumber yard after a ladder. Then he tied the paint pot on the end of the ladder, and put the ladder on his shoulder. This was a very smart arrangement, and the man himself admired it very much. He started for home this way, and didn't find any trouble in getting along the first block, because people had an impression that a long ladder with a pot of yellow paint dangling on the end of it wasn't exactly the thing to trifle with, so they balanced along on the curbstone or rubbed up against the buildings. Pretty soon the man saw somebody in a store he knew, and he turned round to speak to him, and drove one end of the ladder into a millinery case and knocked the crown out of an $18 bonnet. Then he backed off in affright, and knocked down two sewing machine agents with the other end. Then he started to turn round, and an old gentleman who was desperately endeavoring to pull his wife out of danger saw the peril and shouted out: "Hi there!" But it was too late. The pot struck against an awning post, tipped to one side, and the entire contents went over the aged couple. This so startled the man that he whirled completely around, smashing in an entire store front, frightening a milkman's team, and knocking over some thirteen persons who were actively dodging about to get out of the way. Then he dropped the ladder, and fled into the country, shouting "murder" and "fire" at every jump. A regularly ordained painter is now engaged on Mr. Watson's house.—*Danbury News.*

FIREPROOF FLOOR.

In this invention, Mr. Nathaniel Cheney, of the Architectural Iron Works, New York city, the inventor, proposes to do away with lath and other combustible building material, and apply the plaster, for ceiling rooms, directly to iron wire, which is interwoven with the tie rods of floor or roof arches.

In our engraving the arch, A, is formed of metal plates bolted together at the edges by angle bars, and resting at the ends on metal skew back beams, B, which are tied together by wire rods, C, to prevent end pressure or strain on the walls, and hold the arch up stiff and firm. On the lower floor the arch is made of brick, and is similarly secured, supporting a layer of concrete above.

The connecting or tie wires, C, are arranged close together, as shown in the section, Fig. 2, and small wire is woven in at suitable distances. The fabric is suspended by the

Fig. 1.

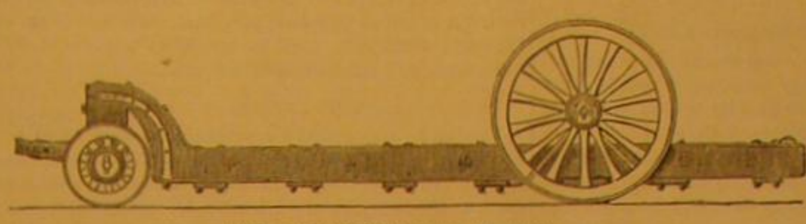
Fig. 2.

short rods, D, from above, and upon it the plaster is applied in the ordinary manner. The device is necessarily fireproof, and is said to form firm floors, incapable of transmitting sound to any considerable extent. Patented through the Scientific American Patent Agency, April 1, 1873.

REMEDY FOR HEADACHE.—Pains in the head arise from such a variety of causes that no one remedy will answer in every case. But the following is said to be an excellent preparation, and from the simple nature of the ingredients we think it is worth trying: Put a handful of salt into a quart of water, and one ounce of spirits of hartshorn and half an ounce of spirits of camphor. Put them quickly into a bottle, and cork tightly to prevent the escape of the spirits. Soak a piece of cloth with the mixture, and apply it to the head; wet the cloth afresh as soon as it gets heated.

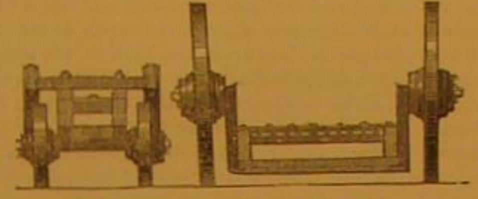
THE BELGIAN DRAY.

A tun is considered a good load for a one horse cart or dray in New York city, while two tuns are sometimes carried, two horses being employed. Heavy loads are carried much more easily when the size of the wheels on which the load is supported is increased. In Belgium advantage is taken of this fact in the construction of drays, which are thus described by a correspondent of the *English Mechanic:*



THE BELGIAN DRAY—(Side Elevation).

Its load capacity of dead weight is 10 tuns. For bulky loads, there are sockets on the sides for fixing stanchions. The wheels are very strongly made, with tires 4 inches by 1¼ inches. Every day I see two horses drag with ease the load given above, and often one horse traveling with ease with five tuns on the dray, it being a common custom for a single horse to be yoked on one side of the pole. The roads

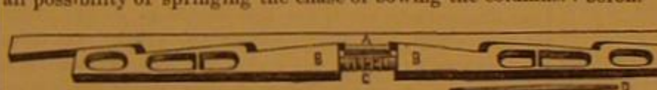


THE BELGIAN DRAY—(End Elevations).

in and about Antwerp are generally level, with occasional short steep places of 1 in 60. For carrying corn, casks, or castings, these drays are peculiarly fitted. There are others where, by raising the body of the dray higher, a heavy load can be carried on top, while a dozen casks or cases can be slung in chains beneath.

M'GRATH'S PATENT SIDE STICK AND QUOINS.

The work of locking up a printer's form, so that, when it is fixed on the bed of the press, every type and space shall be held in its place with perfect firmness, requires, if performed in the old and common way, no small expenditure of time and care, both to insure a perfect register and to avoid all possibility of springing the chase or bowing the columns.



To facilitate this labor and also to provide a device which will be both safer and quicker in operation, Mr. Thomas McGrath, of Albany, N. Y., has recently patented the apparatus illustrated herewith. It consists of a side stick, A, with a series of inclined planes in opposite directions from the center, having quoins, B B, to match, and operated by a screw, C, having a double right and left hand thread. By turning this screw with the lever, D, the quoins are driven in opposite ways on the inclines, thereby throwing an equal pressure on the whole length of the side stick and the chase. A very few movements of the lever suffice to lock up the largest form—the inventor states that the whole operation can be completed inside of two minutes—and the process is so simple that printers can hereafter delegate the work to the "devil," instead of wasting thereon the time of a skilled workman. The device is strongly and durably constructed, and is entirely free from complicated parts, liable to get out of order. It produces an even tension upon the chase and secures the type with sufficient firmness.

New Researches in Magnetism.

The *Revue Industrielle* contains a communication of considerable importance, recently made to the French Academy of Sciences by M. Jamin, relating to new researches into the properties of magnets:

Since the development of physics, steel magnets have been frequently employed, and many have studied carefully their qualities and attempted to discover the best mode for their construction. Up to the present, however, all that has been determined has been without system, and all the processes of fabrication practiced have been at best empirical. In brief, no one could point to any strict theory connecting the phenomena or affording a means of ante-calculating the effects of a magnet. It is this theory which M. Jamin has found and of which he publishes the fundamental principles. Its development, it is safe to add, will not be difficult, for the researches which remain to be accomplished are all indicated and present no serious obstacles.

The following is the course pursued: M. Jamin first sought for the distribution of magnetism in a magnet formed of a single plate, and perceived that it could be represented by a curve of two branches comprised between the line of the poles and two perpendiculars to this line, one above the north pole, for example, and the other below the south pole. A second leaf being added to the magnet, the curve became less concave, and with a third plate a similar and increased effect was produced. Finally, with a certain number of plates, the curve resolved itself into a right line. Thus formed, the magnet is termed by M. Jamin *aimant normal* (normal magnet), and it is easy to see that such a magnet should present especial facilities for study. The quantity of magnetism is measured by the surface of the two rectangular triangles, which the figure forms; the poles of the magnet are at the hight of the centers of gravity of the two triangles, etc.

But this "normal magnet" has a very important property which the above does not necessarily indicate. It is "*maximum;*" that is to say, if new plates also well magnetized be added to the first, no further augmentation of magnetic intensity will be found; a fact explained by the consideration, already indicated by Coulomb, that each plate acts contrary to its neighbors. When we say that the magnet is thus maximum, it must not be concluded therefrom that the addition of new plates would not augment its force if the poles were provided with armatures of soft iron, which imprison the magnetism. In such case, in fact, to give to the armatures a magnetic intensity equal to that of the plates, the number of the latter must be augmented above the maximum noted. The magnet thus armed is able to carry a much greater load than when it is simply composed of plates of steel.

These fundamental points established, M. Jamin has since studied the influence of the breadth of the plates and that of their length, one of which acts on the quantity of magnetism, the other on its intensity. He has finally determined that a magnet of given thickness composed of several plates has more intensity than one formed of a single plate of equal thickness, and he has therefore been led to construct magnets of plates of steel made very thin.

We cannot, in the absence of further and fuller investigations, enter into the subject at present in greater detail; but the reader will understand how greatly the improvement of magnets, which will result from this beautiful theoretic study, will lead to better facilities in the construction of the magneto-electric machines which, under so many different forms, are to-day employed in industrial pursuits.

California Borax.

Very extensive deposits of borax have lately been discovered in California, near Desert Spring station, on the road to Owens river. The deposits on the Slate range, in San Bernardino county, are even more extensive. Crusts of borax are taken out and piled, resembling hay ricks, for reduction or shipment. Borax is composed of soda and boracic acid, the latter being derived from one of the metalloids termed boron. Boron, like sulphur, is not a metal, and elementary substances not metals are termed metal loids. Borax is extensively used in the arts, in metallurgy, glass making, glazing of pottery, soldering, etc.

Australian Method of Cooling Water.

Large buckets of canvas, says the *Bulletin du Musée*, are made about 4 feet high and 15 inches in diameter. A bag of linen or flannel stretched across the top serves as a sieve and a siphon; a wooden cock and a canvas tube inserted below the level of the water are used to draw off the contents. These reservoirs are suspended to branches of trees in shady places and exposed to the light breezes which in summer always exist in Australia. From the damp surface of the vessels a rapid evaporation takes place, which keeps the water within at a temperature much lower than that of the surrounding air.

[This arrangement is on the same principle as the water jars, or "monkeys," used in tropical countries and the east of Europe. The latter are merely unglazed earthenware jugs, having a very small neck and a spout. We have never seen them used in the United States, but should imagine that during the summer months, and particularly in event of ice famines, such as we have been threatened with during the past two years, they might be advantageously employed. The jars may be made by any potter from ordinary clay at a very small expense. By suspending them in a current of air, the water within is kept during the hottest weather at a delicious coolness, and at a temperature much more healthful than that produced by the copious use of ice. The vessels may be molded in fancy shapes, so as to be ornamental for table use, or fashioned as represented in our sketch, which is the ordinary form used in Asia Minor and the East.—EDS.]

BEFORE flowering, the beet contains from eight to ten per cent of sugar; in proportion as the seed forms the sugar disappears, so much so that, when the seed is ripe, there is no trace of sugar in the beet.

ALL new subscriptions to the SCIENTIFIC AMERICAN will be commenced with the number issued in the week the names are received at this office, unless back numbers are ordered. All the numbers back to January 1st may be had, and subscriptions entered from that date if desired.

SANITARY NOTES.---FOOD AND ITS PREPARATION.

We select the third of our series of sanitary notes from an interesting essay by Dr. George Derby, secretary of the State Board of Health of Massachusetts, treating upon the forms of food in common use throughout that State, how they are prepared and how they are eaten, together with the considerations whether this food, as generally used, promotes public health, power and happiness. The question:

IS SUCH AN ARTICLE WHOLESOME OR NOT?

cannot be truly answered in a general sense. Very few articles ranked as food are absolutely unfit, but a man laying a stone wall may digest and thrive on diet which would be very unwholesome to him if employed in shoemaking or other sedentary occupation. Of the many causes of consumption, want of proper food is surely one, and there is good reason to believe that the many forms of dyspepsia so commonly met with are but too often the danger signal that Nature gives us to show that the food, either in its quality, its preparation, or its variety, is unsuited to maintain the vital process. It is but a modified form of starvation, with the mockery of a display of abundance.

BREAD.

Leavened or fermented bread is as old as the time of Moses and its value has been fairly tested. Whatever be the precise action of the leaven, it transforms grain by partial decomposition of its original elements, and leaves as its resultant what men in all ages have approved. Modern substitutes impair the flavor, diminish the nutritive property, and break the staff of life. Bakers' bread is almost universally composed of flour with extraneous substances, alum and carbonate of ammonia being most employed. Bread hastily made in families is mixed in a variety of ways with carbonates of soda or potash, combined with phosphate of lime, with cream of tartar or with sour milk, and is generally imperfectly cooked. Very often the elements of wheat and fat which the body demands are furnished in underdone pastry made of flour and hogs' lard; the first legitimate effect of such food as this with people of average condition is indigestion or dyspepsia; the second is all that train of ailments caused by imperfect nutrition.

Good bread should be made from a mixture of flour such as is generally used in our markets, water, salt and yeast, and nothing else. The yeast is composed of malt, potatoes, and hops, and the dough, kneaded for from one and a half to two hours, is then thoroughly baked. In this connection, regarding the quality of bread retailed in large cities, we should judge from Dr. Derby's report that Boston bread was inferior to that sold in New York. Some time since one of our great dailies, desiring to gather a column or two of sensational matter, made arrangements with a young physician of this city to procure one hundred samples of bread from various localities, analyze the same, and astonish the country with revelations of gross adulteration, swindling of the poor, etc. After gathering a few specimens from corner groceries and other unpromising spots, the investigator was obliged to discontinue his labors for the simple reason that the bread contained no impurities worth mentioning, and such as there were did not exist in any deleterious quantity. It is needless to add that the enterprising journal did not publish the results obtained.

VARIETY OF FOOD.

Experience has proved that, for some reason unknown to science, variety is essential to health after reaching the age when we are free to choose our food. The perpetual recurrence of the same edibles, even though their number be considerable, becomes in all periods of life except infancy not only wearisome but positively injurious. The lack of variety in many cases is due to the poverty of poorer classes and the difficulty of buying fresh provisions in places remote from markets. Salt pork, salt fish, and potatoes, with pies, poor bread, and Japan tea are the staples of food of thousands of families during our long winters. It should be understood how needful a change of diet is from time to time. Fresh vegetables, particularly in the country, are readily obtained and preserved, and should be unsparingly used. The edible roots, as turnips, carrots, onions, and beets, and cabbage, are as well worth preservation as the omnipresent potato. All these vegetables need thorough boiling and more than they generally get.

FRYING MEAT,

a common habit in American cookery, is most unprofitable to the eater. It robs the meat of its juices and hardens its texture. The extreme heat of the fat not only burns the outer layers of the meat, so as to injure their value for nutritive purposes, but also changes the chemical condition of the fatty acids, giving rise to products which obstruct the breathing and cause tingling of the nose and eyes of the cook, and which are more or less harmful to the eater. The peculiar flavor of the meat is in a great measure lost by frying, and for it is substituted the flavor of the fat in which it is cooked. This fat permeates the fibers of the meat in such a way as to render them less soluble in the watery fluids of the mouth and stomach, and thus causes difficult digestion. Broiling on a gridiron over a quick fire costs a little more time and trouble, and very likely fuel also, but by this process the juices of the meat are sealed up (to a certain extent) instead of being evaporated, and the nutritive value is thereby much increased.

PASTRY.

In the New England States, pies are the most constantly recurring form of food, and country bakers often distribute more of them than they do loaves of bread. The average pie is made of flour, water, salt, and generally butter of the lowest grade, together with carbonate of soda. This paste encloses chopped meat seasoned with lard and spices, or fruit squash or custard. The fact that such pastry is ill borne by a feeble stomach requires little explanation. The close incorporation of the gluten with the fat in the process of rolling pastry, needful to make it light by enclosing the materials which will distend it when heat is applied, renders the action of the gastric juice upon the mass extremely difficult. It must, so to speak, pick out from the close union the parts which it is fitted to reduce to a form ready for absorption, and let the remainder pass on.

TIME DEVOTED TO MEALS.

Dr. Derby states that the average time occupied in the process of taking food by the people of Massachusetts does not exceed from twelve to fifteen minutes for each meal. Such haste is injurious to health for many reasons. The process of digestion begins in the mouth with the action of the teeth, and through excitement of the salivary glands by the presence of food. Unless saliva is abundantly mingled with the latter, the first act of digestion is obstructed and Nature's plan is changed. This fluid not only lubricates but acts chemically in the mouth, if a reasonable time be given it, upon all the starchy elements which make up the great bulk of what we eat. Eating in haste, a great deal of air is swallowed. Air is to a certain extent always entangled in the saliva and assists digestion, but when "wads" of food succeed each other very rapidly, they seem to act like pistons in the tube leading from the back of the throat, and drive before and between them into the stomach such amounts of air as to distend that organ and impede its functions. Another effect of eating in this way is that the masses of food, imperfectly mixed with saliva, become impacted in the œsophagus, checking its muscular action which is obviously intended to propel only one piece at a time. This embarrassment is overcome by taking at one gulp as much fluid as the mouth will hold, thus distending the elastic tube and washing the obstructed food into the stomach. All this is unnatural and can hardly fail to work mischief.

TEA AND COFFEE.

Both tea and coffee have properties which are universally recognized as valuable. Without being nutritive, they sustain nutrition by limiting the body's waste and by promoting the absorption of animal food. Their healthfulness depends on the amount taken and the times when taken. They enliven and inspirit the wearied body, and supplement, as it were, nutritious food.

There is nothing simpler than to make good tea or coffee, but nine persons out of ten are unable to do it. Neither should under any circumstances be boiled. Tea should be prepared by placing the leaves in a well warmed (scalded out) tea pot, pouring fiercely boiling water directly upon them and drinking the fresh infusion almost immediately. If left stewing on a fire, the aromatic qualities are boiled away, and there remains a concentrated decoction of theine and the astringent matters with which it is combined. Such tea is intoxicating, produces nervousness and fretful temper, and, as the author remarks, often underlies much domestic unhappiness. Coffee may be prepared either by beating up the ground fresh roasted berries with the white of an egg, adding boiling water and standing back of the range for a short time where it cannot boil, or on the French plan, which is better, by simply pouring the water through the very finely ground beans once or twice. Coffee boiled to death loses all its aroma and is deprived of its aromatic and healthful principle, the caffeine; a strong decoction of tannin is principally the result, which is both indigestible and harmful. Beef tea, Dr. Derby considers is better than either tea or coffee, the pure meat being better for the purpose than any of the extracts sold.

EXCESSIVE USE OF WATER.

In the manufactories of all kinds, water (very often iced) is placed within easy reach of every person, male or female, and the effect of this constant invitation is seen in the drinking of what physicians must regard as unreasonable amounts. The food is thereby diluted, and the stomach is oftentimes chilled below the temperature of the blood, and by repeated drafts may be kept in this condition. The process of digestion is in this way seriously interfered with. A certain amount (70 to 100 ounces) of water is required daily for the nutrition of an average adult; but of this total requirement 20 to 30 ounces are contained in the so-called solid food, leaving about sixty ounces to be supplied in some form of liquid, as tea, coffee, and water. If this amount is greatly exceeded, it forces additional and needless work on the organs of excretion.

Color Making.

A pleasing tint is the splendid blue made from prussiate of potash and copperas, boiled in separate vessels and then run together in the washing tank, in which all the sulphuric and nitric acids are carefully washed from the compound. As the acids disappear, the blue comes out in full force; and after the water has been drawn off, and the pigment dried in hot rooms, hot as the hottest of Turkish baths, the lumps of blue are broken up into small pieces for laundry purposes. All colors made from combinations (with one exception—American vermilion) are made much on the same principle. The chemicals are boiled in one vat, the base of the color in another, and then both are run together to have the acids washed out of them, the chemical action not being complete till the acid is entirely gone. Blue, for instance, looks like a dark green when it is first made. The colors are then carefully filtered, the remaining pigment pressed and dried, and the batch is ready for sale in cakes or to be ground into powder. Yellow is made from a combination of nitrate or sugar of lead and bichromate of potash; green from a combination of the processes for making blue and yellow carried out simultaneously; American vermilion from English white lead and bichromate of potash boiled in a cauldron together. Browns and reds are natural mineral colors; umbers, siennas, and ochers are natural earth colors.

All their grinding and mixing of color with oil is done at the Plymouth Works of Raynolds and Co., Bergen Point, N. J., so says a correspondent of the New York *Times*. The cakes of color, having been crushed to powder, are led into iron mills with a certain quantity of oil, the lower side of the mill revolving. Slowly the sluggish stream of finished paint forces its way through a small aperture into large pans, from which it is packed in any quantity from a one pound tin can to a barrel. The cans are all made on the premises, and are quite a novelty.

Railway Travel in Mexico.

The Republic of Mexico has one railway in operation, that from Vera Cruz on the Atlantic side to the city of Mexico in the interior, 263 miles. The *Railroad Gazette* says:

There is but one passenger train running through, which leaves Vera Cruz at the very unseasonable hour of 3 A. M., and reaches Mexico at 9 P. M. of the same day—not quite 15 miles an hour. Returning, it leaves Mexico at midnight and reaches Vera Cruz at 5.40 P. M.—nearly at the same rate as the trip up, which for some distance is up with a vengeance. There is also one freight train daily, which also takes passengers and makes the trip in 29 hours—laying over all night (from half past nine till half past five down and from seven to a quarter of eight up) at a station on the way. The passenger up has ten minutes about half past four in the morning, ten minutes an hour later, ten minutes half an hour later, ten minutes an hour later, fifteen minutes about nine o'clock, ten minutes an hour and a half later, forty-five minutes about one o'clock, fifteen minutes at half past four, and ten minutes an hour later, for refreshments or other purposes, so that in this trip of 263 miles he waits at stations two hours and a quarter, besides the stops of less than ten minutes. Perhaps Mexicans need a great deal of "refreshing" and perhaps it is intended to give commercial travelers and others opportunities to do business and make visits at all the principal stations on one trip. Besides the through passenger and freight, there is what is known as a "pulque" train, running between Mexico and Soltepec, 112 miles. Pulque, as some of our readers may not know, is the Mexican whisky.

Modern Progress in Egypt.

Henry Day, Esq., a lawyer of eminence from this city, is now traveling in Egypt and writes for the *N. Y. Observer*. In a recent letter he gives some very interesting facts concerning the condition of things in that sandy country, the uplifted bed of an ancient ocean:

All along the Nile, says Mr. Day, there are immense sugar manufactories worked by steam, in which the cane is ground and the boiling and refining done. I visited some of these manufactories, and I have never seen more costly and perfect machinery or more extensive works. One of these factories at Rhoda employs 2,500 men, and covers acres of land. After the juice is pressed out, the cane is dried and used for fuel. The sugar plantations, which surround these establishments, are immense. The Khedive is also the most extensive landowner and agriculturist in the world. I could find little land along the Nile which did not belong to him.

He is tearing down old houses in the city of Cairo and laying out new wide avenues, letting in light and air, putting in gas and water, and rebuilding with fine modern houses. The new parks, water works, gas works, and iron bridge over the Nile, attest his enterprise. [An engraving of this splendid bridge was recently given in the SCIENTIFIC AMERICAN.] Magnificent palaces of the Khedive abound everywhere in and about the city, and they are finished with a splendor far surpassing anything I have ever seen in any other country, and which it is impossible for words to describe. These palaces are surrounded by immense parks, filled with all the beauties that art can devise, and these parks again are surrounded by a wall fifteen feet high. There seems to be a great fondness with the Khedive and his pashas for this kind of display, for in all directions around Cairo you will see these palaces being built and enclosed by immense walls, sometimes enclosing nearly a square mile of land.

The Khedive is now engaged in opening canals, by which he intends to reclaim the lands of the desert. These are now being extended in the vicinity of the Pyramids. He is also building a canal, called the Ismailyeah canal, extending from Cairo to Ismaila, thus affording water communication between the Nile and the Red Sea and irrigation to the desert country through which it passes. The land thus reclaimed belongs to the Khedive. He lets it to the Arabs, charging them a rent for the water, and taking a certain proportion of the crops raised. The canals he builds by forced labor. He makes a requisition on the Governor of each province for a certain number of men to labor on the canals or in his sugar houses. The Governor makes a levy among the poor peasants, and they are taken off, willingly or unwillingly, under a guard, to work for a certain time for little or nothing. I saw a company at Thebes, gathered among the small villages, led off under the lead of the Governor of the province riding on his fine Arab steed. The poor fellows looked like a gang of slaves being driven from home

Correspondence.

The Cause of the Aurora Borealis.

To the Editor of the Scientific American:

Some years ago, probably in 1859, there was a display of the aurora borealis which attracted considerable attention, and convinced me that this phenomena must be electrical in its nature. Thereupon I wrote to three distinguished gentlemen, namely, Professor Henry, Lieutenant Maury and Professor Loomis, calling their attention to some circumstances connected therewith, and suggested that, as dry air was a non-conductor, electricity would be generated by subjecting it to friction. As Lieutenant Maury had established beyond cavil that the currents of air were as regular and produced by the same causes as those of the ocean, and that at almost any given point these causes would produce two currents (moving in directions almost opposite, but one above the other), I suggested that, when the lower and northward bound of these, in low latitudes, was sufficiently dry, the evolution of electricity in sufficient quantity to be visible was inevitable; but that this was seldom the case and consequently it was rarely seen in low latitudes. On the contrary, in high latitudes where the air was necessarily dry, it was of frequent occurrence.

To my suggestions, each of these gentlemen kindly responded. The first two named, and particularly the second, thought the theory "plausible," and suggested that I should demonstrate by actual experiment the truth of my theory. This, for want of means, I was utterly unable to do; and so the matter has remained until the present time, so far as I am informed. Professor Loomis, who I believe is yet alive, thought that there were some facts that could not be explained on this hypothesis. One of these was that, in high latitudes, the aurora was seen between the beholder and some distant hill or mountain. He also sent me a copy of a lecture of his in which many, probably all, the different phenomena were enumerated. I thought then, as now, that my theory would account for all except the last named. Many times since have I thought the matter over; and, at each of the several times when I have had an opportunity of witnessing the aurora, I have imagined that I could see a demonstration of my theory.

Recently, however, during a stormy evening, when more than one weather light could be seen, one seemed to be approaching from the southwest. It came nearer and nearer, and increased in brightness so much that a congregation assembled for worship in our quiet little town was much disturbed and many even went out of doors to see what the matter was. Suddenly a violent whirlwind passed over the town and went toward the northeast accompanied by the light.

Now I suggest that, in the stratum of air between the currents moving in opposite directions, or nearly so, the airy cushion must continually be subject to violent gyrations, which evolve electricity in visible quantities, and that it arranges itself in bars, parallel to the earth's magnetic axis. Thus the appearance of the aurora in high latitudes between the beholder and some distant terrestrial object may easily be accounted for, and thus, doubtless, also the weather lights are produced.

I would be glad to have the opinions of scientific men who have studied the subject. A. C. CARNES.

Livingston, Tenn.

The Egg.

To the Editor of the Scientific American:

As a sequel to the egg lectures by Professor Agassiz, the following statement may not be uninteresting: A week ago I set four hens on eggs. One morning I observed that one of the hens had left her nest; returning four hours afterwards, the nest was still deserted and the eggs entirely cold. Supposing them to be spoiled, I concluded to use them in the interest of science. I broke one of the eggs and poured the contents into a dish for examination. The head and eyes of the embryo chick were plainly recognizable, also the head and numerous blood vessels; but no motion or other signs of life could be detected. The second and third eggs showed like results. I broke the fourth egg. On rupturing some of the blood vessels, the blood oozed out, still uncoagulated, but no motion of the heart or of any other part was visible. I breathed upon the heart; still no motion. I next placed it in the palm of my hand, when, after a few seconds, it commenced beating, showing that (although the eggs had remained uncovered four hours, were entirely cold and circulation was suspended, the weather being cool enough to make overcoats comfortable) there was still vitality in the eggs, and that they needed only external heat to set their functions in motion. The rest of the eggs I placed under the other hens, feeling confident that most, if not all, of them would hatch. J. H. P.

Franklin, N. Y.

Air and Gas Engines.

To the Editor of the Scientific American:

An article taken from a foreign engineering magazine upon the subject of air and gas engines prompts me to make some suggestions upon the same subject. It seems to me that the most feasible method of constructing a hot air engine, or of utilizing hot air as a vehicle of power for working machinery, is the method adopted in the Roper and similar caloric engines, which is to pump or force cold air through the burning fuel in an air-tight furnace, thus utilizing not only the air but the gases of combustion. The furnace having free and ample access to the piston of the engine, the shorter and larger the passage between the piston and the furnace, the greater will be the percentage of power. In fact, if one end of the cylinder in which the piston works could constitute the furnace (without such speedy destruction, by heat, of those most costly and important parts of the engine, the cylinder and piston), the maximum value of the fuel consumed would be obtained: or, if a tolerable vacuum, say of from ten to twelve pounds to the square inch, could be cheaply maintained, into which the engine could exhaust, then the hot air could be used at such low temperature as to be perfectly harmless to the piston and cylinder. The writer of the article above referred to advocates this vacuum idea or method, and suggests that a vacuum be produced by cooling off hot air in two vacuum chambers alternately. His method of cooling, etc., is not fully explained, but I think it hardly possible to cool cheaply and rapidly such highly heated air as would be required to produce a vacuum of five pounds to the square inch. Therefore I believe that all attempts to improve the hot air engine in this direction must prove far more costly than satisfactory. I would suggest that the cylinder be placed vertically beneath the furnace, and the upper portion of the piston be cup shaped, and large enough to embrace the fire so that no ashes or cinder can get into the cylinder; in this position the piston will of course form the bottom of the furnace and its position will be such as to receive the maximum pressure of hot air with only a minimum of heat.

The hot air engine is quite simple and satisfactory as it is; it only needs some little modification in the disposition and proportion of its parts, I believe, to double its efficiency.

F. G. WOODWARD.

Concentration of the Sun's Heat.

To the Editor of the Scientific American:

In your issue of May 14, under the above title, the present theory of terrestrial heat is rejected, because, "on leaving the earth's surface to approach the sun, a feeling of intense cold is soon perceived." The writer has made the mistake of considering but one cause. The intense cold experienced is due to the perfect diathermacy of the ether which fills space. The sun's rays grow more intense as you ascend. It is the universal testimony of travellers that they never suffered such intense heat as when upon some high mountain with one half the atmosphere beneath them, and surrounded by air below 32° Fahr. Our atmosphere acts not as a lens but as a vast garment, which allows the sun's rays to penetrate it readily, but parts with them very grudgingly. Again, our atmosphere has but small refractive power, as is seen in the case of the stars. So that even though it were a convexo-concave lens—which we think cannot be proven—the effect would be but slight. Again, in speaking of gravitation, he says: "I do not believe attraction to be due simply to mass, else a body would weigh more at the poles than at the equator." Now, bodies do weigh more at the poles; the increase from the equator being in proportion to versed sine of double the latitude. Of course the centrifugal force at the equator will increase this difference; the amount given is due simply to mass. His theory of an "equatorial current of magnetism sweeping round the sun from west to east" is the ancient theory of Des Cartes, and was demolished years ago, as it did not account for the simplest phenomena.

The lens theory will scarcely give to the planets the temperature of our earth. The strongest lens atmosphere would be of little use, were there nothing to prevent the escape of radiant heat. Were the aqueous vapor removed from our atmosphere for a single night, "the sun would rise upon an island held fast in the iron grip of frost." C.

Wrinkle No. 3.

To the Editor of the Scientific American:

Those who have set saw teeth with hammer and punch, in lieu of something better, know the tediousness both to hands and eyes, the liability to spring the saw permanently, the chance of knocking out a tooth, and the unsatisfactory result, which belong to this method. Lever sets are not all they are advertised to be.

I find nothing better than an old file with the temper slightly drawn. Formula: Secure your saw in clamps extending the full length; place the file between two teeth as if about to file, keeping the file level, swing your nearest hand to the right and set two teeth at once. By placing the file about the same distance each time from end to end of file and using your knuckle as a gage, you can set a saw in so short a time and so easily as to wish for another job of the same sort. C. H. B.

Chicago, Ill.

Profits of the Patent Office.

To the Editor of the Scientific American:

I noticed a suggestion in your journal that the profits of the Patent Office be applied to advance the interests of science, and I would suggest that it would be well to have the moneys in excess of the expenses of the department applied specially to advance the interest of the inventors who support the Patent Office. This could best be done by publishing all the patents, with the diagrams, in the SCIENTIFIC AMERICAN, thus making the purchasing public familiar with all the patented inventions. If I am not mistaken, this is the course taken by the Canadian Department of Patents, plans of all patents being published in a journal devoted to patent interests. FREDERIC D. JAMES.

Tamworth, N. Y.

Pressure Gages and Safety Valves.

To the Editor of the Scientific American:

Having seen a great many accounts of accidents to steam boilers of different kinds, and being an engineer of some experience, I would like to give the public some ideas which I have not seen in print, and which might be of use to boiler owners.

In my younger days I had charge of an engine; neither the engine nor the fire room was ornamented with steam or water gages except the usual gage cocks. I was never troubled with a stopped gage or a stuck safety valve, or even with one that did not work easily. I had a rope running from the safety valve lever over pulleys to a convenient place, and, the valve being weighted to what the boiler would stand with safety, whenever I wished to know how much steam I had I pulled the rope; and I could tell by that if there were steam enough to start with, or if it were near blowing off, which is all that is necessary to know. In regard to nearly all high pressure boilers, any one can see that the valve would get raised many times during the day, and would therefore never stick.

Every steam user should have a good reliable steam gage, which should not be used except to test the boiler or in case of experiments; after which it should be taken off. I think that one half the explosions, if the truth could be known, could be traced to defective water gages and stuck safety valves. In most manufactories, they depend upon gages of different kinds; and there is no way of raising the safety valve except by getting on top of the boiler.

Owego, N. Y. J. F. KINGSLY.

Tidal Action and the Rotation of the Earth.

To the Editor of the Scientific American:

Having recently read certain articles intended to show that tidal action retards the rotary motion of the earth, I would like your permission to show why I hold a reverse opinion.

To know that the earth rotates, we look up to the sun and apparent revolving heavens. So, to know what effect the tides are likely to have on the earth, we must rise, in imagination, from the surface of the earth altogether, and place ourselves at the north pole of the heavens; and then and therefrom look down upon the earth and tides. Looking from that stand point, we see the earth revolving eastwardly between two great tide waves: the same two tide waves, remember, that rose upon the earth's surface many thousands of years ago—that rose when the earth first attracted the moon toward her, as it was passing by her, comet-like in character and appearance. Those two tide waves never revolve around the earth in a westward or opposite direction to the rotary movement of the earth, but always in the same direction as the earth rotates, and in exact keeping with lunar motion. They move round the earth a little over twelve times per year, and the earth revolves between them over 350 times. All this time the tides are steadily advancing; and the earth's surface is constantly following, coming up to, passing through and by them; then going ahead of them until it overtakes and passes them, again and again for ever. If the tides have any effect, then, upon the rotation of the earth, it must be to hasten or accelerate that motion; it cannot be to retard it. The idea of the westward flow of the tides, coming against the east coast of Africa and America, tending to stop diurnal motion puts me in mind of the man I saw once riding in one of the street cars of Philadelphia, who rose, when he wanted to get out, and stood pushing with all his might against the hinder wall or end of the car, endeavoring to stop it. He was moving at the same rate as the car, was carried on its floor, and if he had been strong enough he might have pushed the end out of the car, but he could do nothing, under such circumstances, to stop the car. So with the tides; they may, in time, if they get strong enough, tear down the rocky coasts and advance upon them; but to retard the rotary motion of the earth is beyond their power and province, I think. JOHN HEPBURN.

Gloucester, N. J.

The Million Dollar Telescope.

To the Editor of the Scientific American:

Of the many interesting productions of the SCIENTIFIC AMERICAN (eagerly read by me), the great telescope project has thus far most attracted my attention. I consider that such an enterprise is of *ne plus ultra* importance, provided the telescope is made of an enormous size and power, the biggest that our mechanical means can produce, and the greatest instrument of the kind yet known. If it will bring the moon apparently within eight miles, animals and plants can be seen, if any there be on that satellite. I am sure that I would be very glad to have one peep in the instrument for $10, and I don't know what miser on earth would not. If such a feat can be accomplished, I hope America will have the honor of it; and besides the honor, it would be of the greatest interest to the scientific world, as not only the moon but other celestial bodies could be seen plainly enough to convince the adherents of the old school that astronomy is not all guess work, as a priest told me not long ago.

Push on and call upon us for our mites of subscription. Let us hurry up with our scientific discoveries that, before we are cast in the old puddle, we may have the satisfaction of seeing the world convinced that science is not madness, as it is called by many leaders of religious sects, who caution their flocks to guard against any conversation with a reader of a scientific paper, as being likely to pervert them.

St. Armand, P. Q. BONA FIDES.

SAVING LIFE FROM SHIPWRECK.—A correspondent, H. F. E., states that Mr. E. W. Furrell's suggestion, published on page 325 of our current volume, is not new, having been anticipated by the detachable deck of Mr. Joseph Sawyer of Detroit, Michigan.

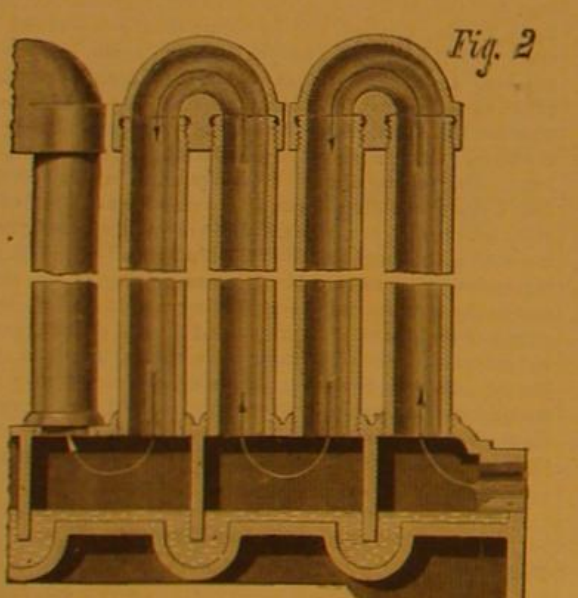
POSITIVE CIRCULATING VERTICAL TUBE RADIATOR.

In the invention herewith illustrated, the object sought is a positive circulation of steam in the tubes of a radiator, thereby expelling the air and utilizing the entire heating surface of the apparatus. In many devices of this description, particularly those having single pipes, either employed separately or connected at the top by a return bend and opening into a common steam chamber at the base, the steam (entering both sides of the single or divided pipe, or both tubes when connected together, as above stated), forces the air to the upper portion of the radiator. The pressure being equal on both branches, there can be no circulation, and hence no radiation from that portion of the pipe exposed to the air, except as the contained air becomes heated by contact with the steam. The consequent defects of unequal heating of the tubes and loss of warmth are, it is claimed, obviated by the circulation afforded by the below described apparatus.

CARR'S POSITIVE CIRCULATING VERTICAL TUBE RADIATOR.

The exterior appearance of the device is shown in Fig. 1. It will be observed, in the section of the base, Fig. 2, that between each pair of pipes that are connected at the top by return bends, there is a depression in the bottom and a corresponding partition extending from the top of the base into this cavity. When the steam is admitted, the water of condensation passes along the bottom of the base, filling the depressions, passing under and covering the lower part of the partitions, forming a water seal, thus preventing the passage of the steam. The latter will, therefore, follow the course of the arrows, passing up the first pipe and down the second into the second chamber, where, meeting with the resistance of the water seal, it will pass up the third pipe, into the third chamber, and thus through any number of pipes to the discharge or return tube. As there is no other course for the steam to follow, it must necessarily expel the air and heat the whole of the pipes, while the water of condensation falls to the bottom of the base, and exits under the partitions of the discharge pipe.

For low pressure or exhaust steam, this radiator is claimed to be especially suitable. It is stated that it will operate with a mere vapor and without any perceptiblr pressure, expelling the air with ease and certainty.



For further particulars address the manufacturer, Mr] A. Carr, 43 Cortlandt street, New York city.

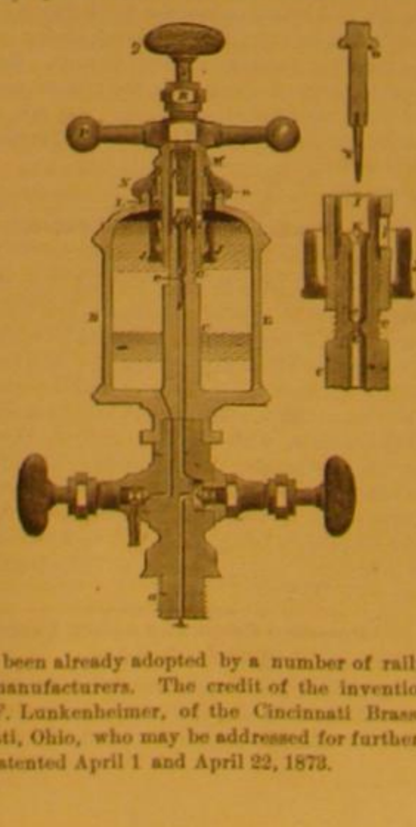
Off the Track in Ireland.

An occasional correspondent who is now traveling in Europe writes of the pleasure he has experienced in running off the track near Cork, and says he would not have missed the occasion by any means, now that he "knows how it is himself." According to the newspapers of the neighborhood, "one of the carriages of the afternoon express to Dublin left the track just out of Cork and caused a detention of an hour to the train;" while, according to the fact, every one of the dozen or more cars—everything except the locomotive—ran off the track, and loss of life was only avoided by the run-off being toward the middle instead of toward the outer edge of a high embankment. He states that very much of the safety of the passengers on the occasion is properly to be awarded to the superior manner of fastening the cars together, no coupling, save that at the engine, having given way, notwithstanding the severe strain put upon each of them. He tells us, moreover, that the strongest possible evidence of the infrequency of such accidents was given by the fright and tremor into which the several employees were thrown, and their utter ignorance of what ought to be done and how to do it. There was absolutely no directing head there until one or two Americans, who were passengers, took the matter in charge so far as to make suggestions, whereby a couple of the cars were returned to the track before another train could be procured. And then our correspondent left, doubting if the entire work of restoration would be accomplished before the close of a second day.

An examination of the track did not at first offer any explanation of the accident. Everything about it seemed right, save that the fish bars at one joint had given out, the bolts being broken short off. While the English passengers gathered in a knot and talked of denouncing the carelessness of the company and the inefficiency of its management, a few Yankee friends were busy studying out how the cars managed to jump the track; and this was the result: A rod or two back of the broken joint was a switch. The strain upon the track caused by passing the switch had, in course of time, spread the main track. The forward car was supplied with wheels of a rather narrow tread, and one of these wheels had dropped inside the track on passing the switch. As it proceeded on, the pressure outward caused the fish bar bolts to yield, and the rail, still held by the outer spikes, turned just enough to let that and all the following wheels pass to the outside of the next rail. Meanwhile nothing had broken except the fish bar bolts; and when all the wheels had passed out of the open gap, the rail, which had not been even bent, sprung back to its place so exactly that at first glance it would seem never to have been moved therefrom.

THE NEEDLE VALVE AUTOMATIC OIL FEEDER.

We present, in the annexed engraving, a sectional view of a new and, it is claimed, efficient lubricating cup for steam cylinders, which possesses many novel and useful features. The lubricant, oil or tallow, is fed into the cylinder by the needle valve, D, which oscillates with each stroke of the piston, the flow being minutely regulated by the gage, H. In order to prevent congelation of the lubricating material in cold weather, when the device is used upon locomotives, an adjustable bowl, J, is provided, which regulates the condensation of the steam in the cup, B. The channel, K, in the valve seat serves to admit a small quantity of oil into the cylinder when steam is shut off, as when descending a grade. The inventor states that it effects a saving of fully half the oil ordinarily used, and permits no impurity to enter the cylinder, or lubricant to pass into the boiler. Simple and durably made, its points remain tight without the use of a wrench; cheapness, tasteful appearance, and its working with promptness and regularity, are the remainder of the claims made by the patentee, who adds the information that the de-



vice has been already adopted by a number of railroad and engine manufacturers. The credit of the invention is due to Mr. F. Lunkenheimer, of the Cincinnati Brass Works, Cincinnati, Ohio, who may be addressed for further particulars. Patented April 1 and April 22, 1873.

A Musical Blackboard.

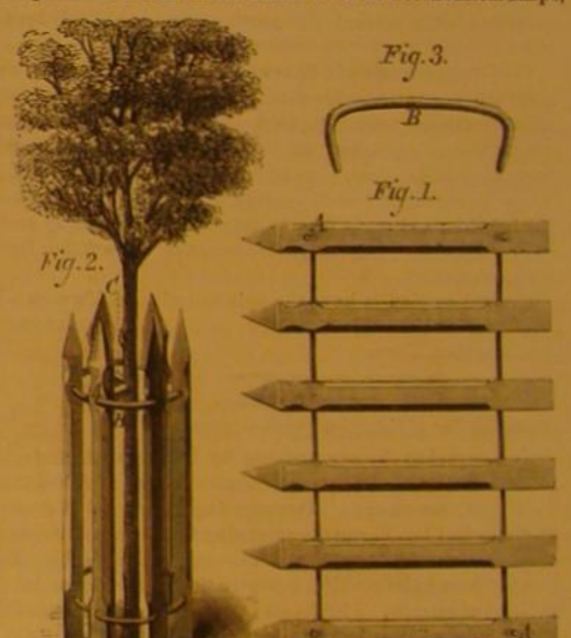
A recently patented improvement in devices for musical instruction consists of a blackboard on which are painted, in large characters, the usual notes of the musical scale. In the center of each note is a movable key, which connects behind the board with an organ. The arrangement is such that when the teacher, with rod in hand, points out a note and touches its center, the organ sounds the corresponding tone, and thus both eye and ear are instructed.

SCOTTON'S PATENT ROUND TREE BOX.

Our illustrations represent an improved form of tree box which, it is claimed, is much cheaper and also more durable than the rough devices ordinarily employed. The patent under which it is made is quite comprehensive, and includes a number of valuable articles of similar construction.

This particular invention consists of a number of wooden pickets, Fig. 1, each containing one foot of lumber, and of suitable dimensions, fastened together by rods of one quarter inch round iron, the latter being forced through holes of less diameter by means of machinery, thus giving the completed work great solidity and firmness. In this condition it is packed and shipped to purchasers. The agents for its sale, however, are furnished with a wooden cylinder which has a hook in each end. This apparatus is placed upon the flattened box and the hook caused to grasp the outer picket. The operator then revolves the cylinder, which thus rolls the boxinto suitable form, ready to be placed around the tree, as shown in Fig. 2. A hatchet is now the only tool needed to secure the box in position. Four holes having been previously bored in the outer pickets, A, Fig. 1, with a tapered bit, staples, B, Figs. 2 and 3, are driven in, thus completing the circular form. Three blocks, C, are inserted between the tree in the box for steadying or supporting the former.

It will be observed that, the box being round like the trunks, there is no waste of material in square corners, by which the trees are rubbed and scarred, causing decay and dwarfage in after years. The tops of the pickets are pointed on four sides. The tasteful and economical shape,



as well as the ready portability of the box, render it a convenient and suitable article for all who wish to encourage the planting and healthy growth of shade trees on our sidewalks.

For further particulars, and also for proposals concerning the manufacture of this device, address the patentee, Mr. Stephen Scotton, Richmond, Ind.

Railroad Progress of 1873.—It is believed that, under favorable conditions, 8,500 miles of new railroad will be built in 1873, divided among the several sections of the country as follows: North eastern states, 435 miles; Middle states, 1,205 miles; Western states and territories, 3,080 miles; Southern states, 2,510 miles; Pacific states, etc., 710 miles. The capital required to complete this extension will amount to $240,000,000. The money necessary to advance this railroad progress will probably, for most part, come from abroad. There is a great plethora of capital in Germany, seeking a good investment in the United States, and with this foreign capital and the supplies of capital from our domestic resources, the $240,000,000 will doubtless be forthcoming.

The Novel Marine Propeller.—Mr. C. A. Bennetti, of Racine, Wis., states that the originality of this invention, described on page 258 of our current volume, is due to him and not to M. A. Huet, and he forwards us, in support of his assertion, a communication which is much too long for publication.

PORTABLE STEAM RENOVATOR.

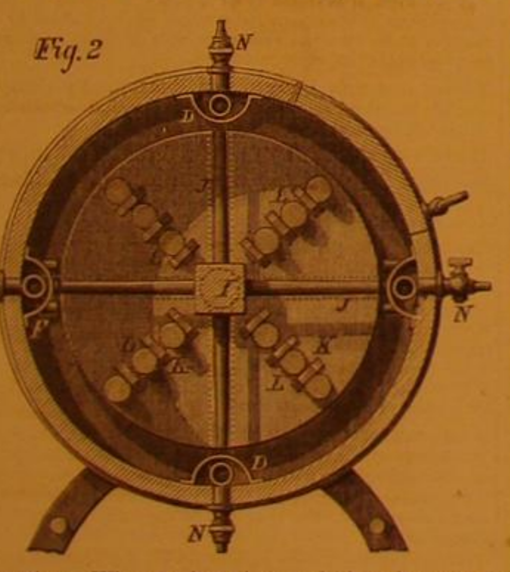
The invention represented in our illustrations is a portable apparatus for renovating carpets, hair, feathers, etc., by steam. The material to be operated upon is placed within a hollow revolving cylinder and first acted upon by steam directly distributed throughout its mass. It is then dried by the heat of the steam confined in closed pipes within the machine.

Fig. 1 is a perspective view and Fig. 2, a vertical transverse section. The cylinder is mounted on the portable stand, as shown, by hollow journals, A and B. The journal, A, is, by a steam tight joint, connected with the supply pipe of the steam boiler, and has two branches, C, which form conduits to the drying tubes, D, Fig. 2, within the cylinder. Two other branches, E, are also arranged at right angles to those above mentioned, which communicate with the interior distributing pipes, F. Upon the periphery of the latter, nozzles are formed which serve to conduct the steam in direct contact with the contents of the cylinder. The branch pipes, C, have cocks at G, to regulate the admission of steam to the drying tubes, and the latter are provided with escape orifices and cocks at H.

I is a horizontal shaft in the axis of the cylinder, having a bearing at one end in the cylinder head and passing at the other through a hollow journal, and carrying at its extremity a crank handle by which it is turned. Upon this shaft, and within the cylinder, are arms or beaters, J, which serve to agitate the mass of feathers or hair, in order to insure the thorough penetration of the steam. The arms are made detachable so as to be readily removed when carpets are to be treated. On the shaft, near each cylinder head, are disks, K, to which, by means of tongues and clips, are detachably connected the bars, L, upon which carpets are rolled. The fabric is first attached to pins, M, on the shaft, and wrapped around the inner row of bars, which are the only ones applied at the time. Then the next row is set in place and the carpet rolled on them, and so on until the machine is filled.

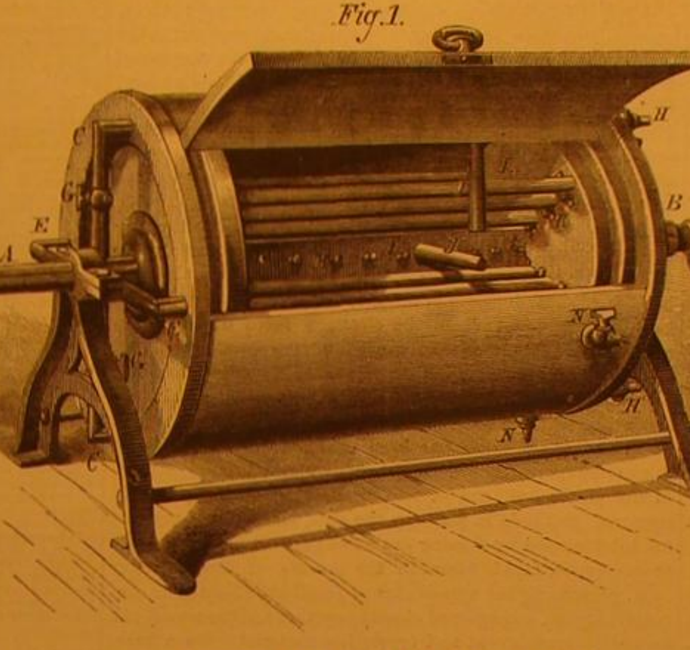
The operation consists in closing the door and admitting steam through the pipes, E and F, turning the shaft by its handle as long as the direct application of the steam to the material is desired. The supply is then shut off from the distributing pipes and turned on to the drying tubes, the heat of which quickly absorbs the moisture remaining upon the contents of the cylinder. Exhaust pipes, N, are applied to the tubes, D and F, to allow of the escape of the water of condensation. When feathers, hair, and like substances are to be acted upon, the bars, L, are removed, and the beaters, J, placed in position. The material is then packed in the cylinder, and the subsequent operation is the same as above described. It is proposed to construct the machine in sections so that it can be readily taken apart and packed for transportation.

Fig. 2



Patented through the Scientific American Patent Agency, April 29, 1873. For further particulars regarding sale of State and county rights, etc., address Messrs. Groff & Ramsey, Mahanoy city, Schuylkill county, Pa.

Fig. 1.



PORTABLE STEAM RENOVATOR.

TANNATE OF SODA.

There being at present much inquiry in reference to the use of this agent for the prevention of boiler incrustation, we deem it a matter of public interest to refer to the history of its introduction. In 1860, Dr. Jos. G. Rogers, of Madison, Ind., began a course of investigations on the formation, consequences, and prevention of scale, as it occurs in the boilers in use on the Ohio river. Subsequently the analysis of a large number of specimens of incrustation, from all parts of the United States, developed the fact that they consisted uniformly of crystalline deposits of the carbonates of lime and magnesia and the sulphate of lime, in varying proportions. Other elements were variously found, but in such small proportion as to be of no moment practically. Marine, river, lake, and well water scales, all these exhibited but little difference, and that was in the relative proportion of the above constituents. After futile attempts to safely prevent the deposits by solution, Dr. Rogers then turned his attention to the conversion of the form of the precipitates from crystalline to non-crystalline or amorphous, with a view to preventing their agglutination into compact scale. After a long search through the list of available chemical agents, tannic acid was found to most satisfactorily meet this aim, affording as it did a non-crystalline precipitate of tannate of lime and magnesia, of such light specific gravity that it was kept constantly in suspension by the boiler currents, and was only deposited when it reached the sediment receiver, whence, owing to its non-adherent quality, it was readily blown out. This acid, however, in its free state was found to have a decided action on the iron of the boiler, and it became needful to find an agent which would neutralize it as far as regards the iron, and still leave it the power of decomposing the elements of the usual deposit of lime, etc. After much investigation soda was found to best answer this purpose, which it did perfectly when definitely combined with the tannic acid so as to form a neutral tannate of soda.

In 1871, Dr. Rogers read a paper on the subject before the American Association for the Advancement of Science. This paper attracted much attention throughout the country, and re-appeared in the New York *Tribune*, the *Galaxy*, the *American Chemist*, and many other scientific and popular journals. In view of the demand for the tannate of soda which this wide attention created, and the high price of the commercial salt, Dr. Rogers found it necessary to go still further, and he devised a method of manufacture which, he states, affords a product containing 85 per cent of pure tannate at one tenth the cost of that as ordinarily made. This article is solid, unchangeable, entirely soluble, easy of use, causes no foaming, and is not liable to conversion into useless gallate of soda.

Within the last two years this preparation, known as Rogers' Scale Preventive, has been extensively used throughout the United States, and has commanded the approval of very many of our most practical and scientific men.

The use of tannate of soda for this purpose, and the method of manufacture, has been patented. We are informed that W. H. Rogers, manufacturing chemist, Madison, Ind., is prepared to supply the preparation, and parties interested in the article can derive further information by addressing as above.

ADJUSTABLE PULLEY BOLT.

This is one of those useful little inventions which will, from its convenience and simplicity, doubtless find ready application for innumerable purposes. It is an ordinary screw eye bolt, with which is combined a movable pulley wheel. In the inner side of the eye a grove is formed. The pulley revolves on an axle the ends of which are made in segments of circles, A, the circumferences of which fit into the groove in the eye. By this construction the pulley may be turned in any desired direction by moving the ends of its axle. The screw eye may also be turned in its support, so that the cord passing around the wheel may be led as required. Patented, February 11, 1873, by Mr. Charles C. Moore, of New York city.

A NOVEL BATH.—One of the therapeutic novelties in London, recently introduced from the Continent, consists in the erection of establishments for administering hot sand baths as a remedy for rheumatism, recent cases of nervous disorders, affection of the kidneys, and all cases where heat is wanted as the chief therapeutic agent. The advantages of this treatment are that it does not suppress respiration like the hot water bath, but rather increases it, and does not interfere with the respiration like the steam bath or Turkish bath. The body can endure its influence for a much longer time, and a much higher temperature can be applied.

Telegraphy in the United States.

The *Journal of the Telegraph*, in an editorial on the efficiency of the Western Union Company's telegraphic service and lines, says that the same is as greatly due to the condition of the lines as conductors of electricity as to the machinery of transmission. Not very long ago a heavy mist or storm of rain was sufficient to interrupt communication even between near offices, and defective insulation and bad joints in the wire utterly precluded the possibility of working more than three or four hundred miles in one circuit, except when the wire was newly erected. At present the lines are kept at a regular standard, joints and splices of the wires are soldered, and insulation is made perfect by the use of non-conducting substances suitable to the atmospheric and other incidences, which vary in different sections of the country.

Two systems of operation are employed, the Morse and the House and Hughes. Fully nineteen twentieths of the business is done on the Morse. The ingenious arrangement of wires and circuits known as the duplex system, by which messages are transmitted in both directions at the same time, is also largely used. This invention has practically doubled the capacity of the lines.

The affairs of the company are managed by an executive committee, chosen by the Board of Directors. The territory covered by its lines is divided into four divisions, each in charge of a general superintendent, and subdivided into districts, of which there are twenty-nine in the United States and British Provinces.

The electrician of the corporation has charge of and is responsible for the maintenance of the lines at the established standard of efficiency. To this officer is referred all machinery offered for the service of the company. Offices are established in every town and city in the country not reached by the lines of other companies with which those of the Western Union connect. There are in all about 5,000 offices, and nearly 8,000 persons are employed.

WHIFFLETREE STUB.

This is an ingenious little device, for more conveniently hitching and detaching the ends of traces to whiffletrees. The end of the stub is made in tapering form and is slotted to receive the pivoted button A. When it is desired to fasten the trace, the latter can be turned in the slot in the direction of the arrow, until it is stopped by the projection B.

Fig. 1.

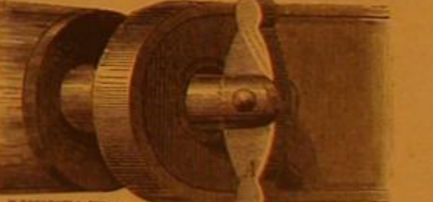
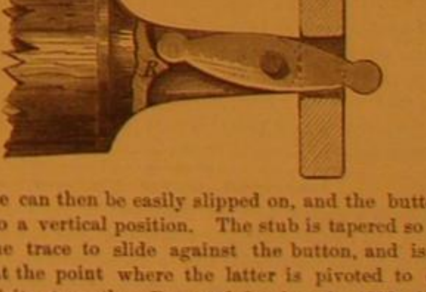


Fig. 2.



The trace can then be easily slipped on, and the button returned to a vertical position. The stub is tapered so as to cause the trace to slide against the button, and is made thicker at the point where the latter is pivoted to ensure the requisite strength. Patented October 1, 1872, by Mr. William C. Shepherd, of Cleveland, Ohio.

HOOSAC TUNNEL.—While the air in the shaft is warmer than that above, it rushes up, and a strong draft is created in cold weather, so that a lamp would not burn in the narrow passages of the tunnel. But now that the air on the mountains has become the warmer, the current has changed, and the cold air moving down grade toward the eastern portal creates a draft in that direction. A light can now be seen at the bottom of the shaft, 1,030 feet, and the timbering is visible half way down.

NOTHING, says Elisée Réclus, can convey a more impressive idea of the tremendous power of water as a natural agent than the wonderful cañons of Mexico, Texas, and the Rocky Mountains, where the torrent may be seen rushing along, through the incision it has cut out for itself in the hard rock, at a depth of several thousand feet between perpendicular walls. The greatest of these cañons, that of the Colorado, is 298 miles in length, and its sides rise perpendicularly to a hight of 5,000 or 6,000 feet.

C. T. D. says: "I think that no one who has read your paper can do without it, or excuse himself if he is ignorant of the progress of the world in science and the mechanical arts."

THE SOUTHERN CANAL.

A lecture was recently delivered before the Polytechnic Association of the American Institute, by Professor H. E. Colton, on the proposed canal from the waters of the Mississippi to the Atlantic ocean, and the resources of the country through which it would pass. To make this canal, it is proposed to dredge the Ohio from its mouth at Cairo to the mouth of the Tennessee at Paducah, then to dredge and improve the Tennessee to Florence, Ala., being the foot of the Muscle Shoals, then to canal around these shoals and lock and dam the river to Guntersville; thence to cut a canal to Gadsden on the Coosa; from this point to Rome, Ga., the river is navigable at all seasons to vessels drawing five feet of water. To make the Georgia canal, it is proposed to lock and dam the Etowah, or cut a canal on its banks from Rome to near the head of Owl Creek, thence across the hills to the Chattahoochee, across that stream by an aqueduct 170 feet high; then by a tunnel 3,200 feet long through the Blue Ridge to the Yellow River, one of the head streams of the Ocmulgee; down the Yellow River, by canal, to navigable water in the Ocmulgee below Macon; thence by that river and the Alatamaha to Darien and thence by canal to Brunswick, making a total distance of 1,508 miles. From Cairo to Guntersville will cost $4,596,000. The canal from Guntersville to the Coosa, with its reservoirs, sufficient to accommodate 78 boats daily during the dry season, will cost $11,570,607. The Georgia canal will cost, from Rome to Macon, $20,435,684, from Macon to Brunswick $3,500,000, a total of $23,935,684. In surveying these routes, Major McFarland also surveyed the Coosa river below Gadsden, and reported to Congress that it could easily be made navigable from that point to Montgomery for $2,393,686. From Montgomery to Mobile, the river is now navigable. Professor Colton suggested that, as a means of reaching the Atlantic ocean, a canal might be cut from Montgomery to Eufaula, 80 miles, thence down the Chattahoochee to the Flint, thence by canal to Brunswick (*via* Fernandina, if desired), not over 150 miles. The Chattahoochee is always navigable from Eufaula down, or can be improved at a small expense; he estimates the cost of this 230 miles of canal at $11,500,000, and we have a canal and river from Cairo to the ocean at a cost of $29,393,686, which would be over $11,000,000, cheaper than the route through upper Georgia, while the distance by the Chattahoochee route would be only 968 miles. Major McFarland reports that, by the construction of two storage reservoirs, 10,125,000 cubic feet of water for lockage purposes can be obtained and used daily on the route from the Tennessee river to the Coosa. This would be needed only in very dry weather. The lecturer stated that the country which these improvements would accommodate, even if they were extended only to Montgomery, raised in seventeen counties nearly one tenth of the whole cotton crop, while they consumed six million bushels more of grain than they produced. It now costs 33½ cents per bushel to get corn from St. Louis to Selma and Montgomery; while, if the canal were built, it should not cost as much as 16 cents. The country was also rich in mineral wealth, and, with navigation on the Tennessee, iron ore and coal could be shipped to St. Louis about as cheaply as by rail from Iron Mountain; besides, it was just the ore that was wanted for mixing with the Iron Mountain ore, etc. Lumber would also be an important article of return freight, also naval stores. The cotton factories of the South were already sending their goods to the West instead of to New York, and also cotton factories were springing up in the West. With this new and cheap transportation, these industries would be greatly increased. The government is already at work improving the navigation of the Tennessee below, at and above the Muscle Shoals, even as far as Knoxville in East Tennessee, and they will no doubt make it complete. The canal and the Coosa improvement only remain to give the West another outlet to the Gulf and a means of access to a section consuming large quantities of their grain which is now such an incumbrance. Besides this, millions of acres of land, now of little value, would be brought into market, and also immense water power would be placed in a condition for immediate utilization in the heart of a cotton country.

Improved Water Elevator.

Captain Thomas Bell, of Bellport, L. I., a venerable inventor and one whose long and useful life has been largely devoted to the production and perfection of devices having for their end the welfare of the people rather than his own individual benefit, has recently received a patent for a novel and colossal scheme for supplying New York city and Brooklyn with salt water for the extinguishment of fires and other purposes. Captain Bell is no supporter of the steam engine as a motor, so long as the great natural forces of winds, tides, and currents remain undeveloped and unapplied to their full extent to the uses of mankind. Hence in the present plan, as well as in others contemplated, Dame Nature herself does the work, and, in the instance under notice, by means of the swift flood which rushes through the channel at Hell Gate, between Long Island and the Metropolis. Here a huge undershot wheel, he suggests, may be erected and caused to revolve by the powerful impetus of the stream. To the ends of the arms of the apparatus are attached self-filling tanks, which are dipped in the water in succession as the wheel rotates. On each vessel arriving at the highest point of the circumference, a valve, which closes itself when the tank is filled, is by an ingenious device caused to open, so that the water escaping is discharged into a reservoir, from which receptacle it is distributed by suitable conduits through the two cities.

The inventor manifests much interest in the furtherance of his philanthropic project, and demonstrates its efficacy and practicability with an enthusiasm which it seems should carry conviction to the most sceptical. It may be that in the press and turmoil of political strife, or among the multiplicity of schemes now afoot for the improvement of our great city, this offspring of his later years may not meet with that ready appreciation which is doubtless hoped and expected. But thoughts that are embodiments of genius are immortal, and though they may slumber forgotten, no one can tell when the emergency may arise which may call them into useful existence, securing for their inventors, if living, fame and fortune, if passed away, at least one "footprint on the sands of time."

[For the Scientific American.]

Zinc in Ohio.

It will interest a large number of your western readers, especially in Ohio, and many who spend their summer in the recreation of collecting for cabinets, to learn that a very novel form of zinc sulphide occurs at Greenfield, Highland county, Ohio, immediately upon the Marietta & Cincinnati railroad. The rocks in the vicinity are of the lower Helderburg series, and are composed of carbonate of lime and silica; they are almost universally tinted by organic matter, or bituminous specks and skins, or blackened by superficial and interposed laminæ. All the limestone that I have examined in the laboratory leaves, in the filter paper, organic matter. But to mineralogists, the most interesting feature exists in the very prettily colored deposits of sulphide of zinc occurring in lenticular masses, and set in the cleavage faces of the limestone rocks. These masses consist of the fossils replaced by the zinc sulphide which seems to owe its origin to infiltration into their cavities from the superposed rock. In some cases this infiltration is composed partly or entirely of silex, so that the fossil has been changed into a geode of minute but perfectly formed quartz crystals; in one specimen in my possession, one or two crystals are perfectly doubly terminal, and held in place by the side, and all the crystals are interspersed by shining grains of pure bitumen. Another interesting fact is found in the masses of concretionary rock, presenting the appearance of small balls formed of concentric layers, compressed closely together and possessed of a somewhat translucent and crystaline material. On a careful analysis of an average sample, I find this rock to contain over six per cent metallic zinc. One mass, weighing little more than seventy-eight pounds, averages more than the amount just stated. Some nodular masses seem almost altogether zinc sulphide, and show evident traces of cadmium sulphide on the surface, which do not pass off even when heated in the lime kiln. About three miles west of the village, at Wright's quarry, the zinc sulphide specimens are rare, but they occur in small crystaline masses, generally intercallated, and of a very unusual dark fawn color, having no trace of red or yellow in the shade or hue.

The region is a very interesting one to mineralogists, and I would point it out to tourists who may be making summer excursions. H. S. S.

The Metal Industries of Ancient Egypt.

A correspondent of *Iron* gives some interesting facts regarding the metallurgical knowledge of the inhabitants of the land of the Pharaohs. Iron is believed to have gradually superseded copper in the manufacture of the implements with which the great monuments were carved and hewn from the stone. The minuteness and finish with which the hieroglyphics are sculptured on obelisks and similar structures may also be considered as strong arguments that the workmen possessed steel chisels, quite as finely tempered as any we at present can manufacture.

The skill of the first smelters was evidently not great, much more care being bestowed upon working the metal obtained than upon gaining a fair product from the ores. If the ancient mines of gold and silver can be found, the *débris* worked over, would doubtless yield a rich harvest. Old turquoise mines have been already discovered, and it is stated that large numbers of very fine stones have been extracted and sent to Europe. In the same locality a system of fortifications has been traced out, by which the Pharaohs protected their works and workmen, and, what is still more wonderful, the remains of vast iron works have been found of such magnitude that many thousand people must have been employed upon them, unless the plant used was on as grand a scale as the largest English furnaces. These works were commenced in very early times; each Pharaoh, as he continued them, added a large engraved stone to indicate the labor completed. It is believed that the hieroglyphics on these monuments are still legible, and from them much valuable historical information may be gleaned.

The Length of Days.—The days of summer grow longer as we go northward, and the days of winter shorter. At Hamburgh, the longest day has seventeen hours, and the shortest seven. At Stockholm, the longest has eighteen and a half hours, and the shortest five and a half. At St. Petersburgh, the longest has nineteen, and the shortest five hours. At Finland, the longest has twenty-one and a half, and the shortest two and a half hours. At Wandorbus, in Norway, the day lasts from the twenty-first of May to the second of July, the sun not getting below the horizon for the whole time, but skimming along very close to it in the north. At Spitzbergen, the longest day lasts three months and a half.

Winchendon, Mass., boasts of fifteen firms engaged in the manufacture of almost all kinds of wooden ware, tubs, pails, buckets, boxes, saw horses etc., and three new stock companies, with from $5,000 to $20,000 capital each, have recently been formed for the manufacture of chairs.

Components of the Potato.

In 100 parts of Irish potato, there are: Water, 70·00; starch, 24·00; azotic matter, 1·60; fatty matter, ·10; sugar, 1·09; skin, 1·65; mineral matter (salts), 1·56: total, 100·00. The potato produces at least 30 per 100 of dry matter, 1·65 of which must be subtracted for the skin, which reduces the food part to 28 per 100, 24 parts of which are starch.

DECISIONS OF THE COURTS.

United States Circuit Court--District of New Jersey.

WOOD PAVEMENT PATENT.—THE AMERICAN NICOLSON PAVEMENT COMPANY *vs.* THE CITY OF ELIZABETH *et al.*

This was a bill in equity, brought against the city of Elizabeth and others, for an alleged infringement of the reissued letters patent for an improvement for wooden pavements, granted Samuel Nicolson, August 20, 1867, the original of which bore date August 8, 1854. *

Nixon, *Judge.* *

The complainant's patent, if valid, is doubtless for a combination. The several parts that make up the structure are:

1. A continuous foundation directly upon the roadway.
2. A series of blocks, with parallel sides, standing endwise in rows, that form the wooden surface of the pavement.
3. An auxiliary set of blocks or strips of board, which form no part of the surface, but determine the width of the grooves between the principal blocks.
4. The filling of the grooves, when so formed, between the principal blocks with broken stone, gravel, or tar, or other like material.

It is not claimed that any one of these parts is new, but that in their combination they produce a new and useful result.

1. Was Nicolson the original and first inventor, or is the patent void for want of novelty?

I have carefully examined the copies of specifications and the large number of models produced, representing the pavements described in eighteen English patents issued previous to the date of the Nicolson patent; and, while nearly all of them have some one or more of its elements, I find that none of them, except perhaps the Hosking patent, * suggests the combination which Nicolson has made.

There are strong presumptions in favor of the novelty of Nicolson's invention. The issue of the patent, its reissue, its extension by the Commissioner, its long use and the public acquiescence, the judgment of competent legal tribunals where the question of its novelty was directly involved—are all facts to be taken into the account.

The burden is upon the defendants to rebut and overthrow these presumptions, which, in the opinion of the court, they have failed to do. *

The affidavits of Brocklebank and Trainer, taken in 1868, to be used upon the application of the administrator of Nicolson for an extension of the Nicolson patent, and exhibited in this case, fully disclose the estimate in which the patent was held by these defendants. They not only recognize its novelty, but are very extravagant in their praises of its utility and value. Not mentioning their specifications of its merits in particular cases, they are of opinion that its general introduction into the streets of the cities and towns of the United States would save to the people in various ways, in the next seven years, from five to seven hundred millions of dollars.

If it be commendable in them to strive to make it more useful by improvements, it is hardly just that they should seek to rob such a benefactor of his race of the glory of his invention, or deprive his legal representatives of the profits from the extension, which they did so much, I doubt not honestly, to obtain.

I am of the opinion that the patent of the defendants infringes the first and second claims of the extended patent of the complainant, and that a decree should be entered according to the prayer of the bill.

[*C. A. Seward* and *B. Williamson*, for complainant.
C. F. Blake and *C. M. Keller*, for defendants.]

NEW BOOKS AND PUBLICATIONS.

A Manual of Photography, founded on Hardwich's Photographic Chemistry. By George Dawson, M.A., Ph. D., Lecturer on Photography in King's College, London. Eighth Edition. Philadelphia: Lindsay and Blakiston.

We have here a reissue of one of the most complete theoretical and practical treatises on photography extant. It is carried down to the latest date and contains the most recent discoveries in the wonderful art.

The Manufacture of Steel, containing the Practice and Principles of Working and Making Steel. By Frederick Overman, Mining Engineer and Author of "The Manufacture of Iron," etc. Price $1.50. Philadelphia: Henry Carey Baird.

We have here a new edition of a valuable and well known text book, which we frequently consult with confidence in the accuracy of its information. Its value is enhanced by an appendix, describing the most recent improvements in steel metallurgy, which has been added by Professor Fesquet, whose labors in connection with Mr. Baird's publications are deserving of the highest commendation.

Steam and the Locomotive Engine. By Henry Evers, LL.D., Professor of Mathematics and Applied Science. Also, by the same author,

Steam and the Steam Engine, Land and Marine.

Machine Construction and Drawing. By Edward Tomkins, Lecturer on Engineering, Queen's College, Liverpool.

Practical Plane and Solid Geometry, for use in Science Classes and Higher and Middle Class Schools. By Henry Angel, Science Master of the Islington School of Art.

These are four volumes from a valuable series of elementary text books on the practical sciences, which have been compiled to meet the ever growing demand for technical instruction. We wish that the study of such literature formed a part of every school curriculum. They are issued by G. P. Putnam's Sons, of Fourth avenue and 23rd street, New York city, at the nominal price of 75 cents each.

A Compendium of the Ninth Census—June 1, 1870. Compiled by Francis A. Walker, Superintendent of Census. Washington: Government Printing Office.

The results of the last census are here summarized, and printed in a handy form for reference. The book will be especially useful to editors and statisticians.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From April 22 to May 15, 1873, inclusive.

Baling Cotton, etc.—J. A. Drake, New Orleans, La.
Blind Cord Pulley Rack.—H. L. Hall (of Chicago, Ill.), London, Eng.
Boiler and Furnace.—F. A. Huntington, San Francisco, Cal.
Car Axle Box.—S. F. Gates, Taunton, Mass., *et al.*
Clutch.—D. McC. Weston, Boston, Mass.
Fettling Puddling Furnaces.—T. L. B. Edgcomb, New York city.
Fire Arm.—E. Remington & Sons, Ilion, N.Y.
Fire Arm.—L. C. Rodier, F. G. Bates, Springfield, Mass.
Fire Extinguisher.—W. K. Platt, Philadelphia, Pa.
Fitting Gores.—J. Walden, Newark, N. J.
Fluid Brake and Signal.—G. Westinghouse, Jr., Pittsburgh, Pa.
Furniture Caster.—C. B. Sheldon, New York city.
Journal Box.—R. Brewer, New York city.
Loom.—E. P. Chapin, Providence, R. I.
Lowering Boats.—T. Shaw, Philadelphia, Pa.
Lubricator.—W. Burnett (of San Francisco, Cal.), London, Eng.
Making Paper Bags.—E. J. Howlett, J. P. Onderdonk, Philadelphia, Pa.
Operating Boats.—G. W. Mallory, Mystic Bridge, Conn.
Paper Box Machine, etc.—S. Wheeler, *et al.*, New York city.
Plow, etc.—J. Remington, Vosburgh, Pa.
Repairing Veneers.—A. H. Allen, Boston, Mass.
Rolling Machine, etc.—R. H. Thomas, Cincinnati, O.
Rotary Pump.—J. P. Carll, Brooklyn, N. Y., *et al.*
Separating Liquids.—F. L. Pope, Elizabeth, N. J., *et al.*
Ship's Berth.—I. A. Chomel (of New York city), Liverpool, Eng.
Spade Bayonet, etc.—F. Chillingworth, Springfield, Mass.
Steam Vessel.—T. Winans, Baltimore, Md., *et al.*
Tempering Steel, etc.—S. S. Lewis (of New York city), London, Eng.
Traction Engine.—W. Sprague, South Kingstown, R. I.
Treating Coffee, etc.—J. Ashcroft, Brooklyn, N. Y.
Valve.—J. W. Willis, Boston, Mass.
Water Power.—W. Burnett (of San Francisco, Cal.), London, Eng.
Wheel, etc.—S. W. Wilson (of Philadelphia, Pa.), London, Eng.

Recent American and Foreign Patents.

Improved Electro-magnetic Induction Coil.

Jose S. Camacho, Havana, Cuba.—The object of this invention is to produce electric currents of great intensity, which are applicable to the production of light in lighthouses, of magnetism for electro-magnetic motors, and to all other purposes requiring very intense electric currents. Another object is to combine the above mentioned features with the advantages of economical construction, durability, portability, convenient dimensions, and to dispense with the necessity of a motor for producing the currents. The invention is based upon the well known property of soft iron, which causes (when a silk-covered copper wire is in a multitude of coils contained within a cylinder of this metal, and when, by contact with a magnet charged by an electric current, said cylinder is magnetized) an induced current to be developed in said wire in one direction, which current is reversed as soon as the magnet is withdrawn from the cylinder. The intensity of these alternately reversed induced currents is the more marked the more rapidly the soft iron cylinder is magnetized and demagnetized. By guiding all these currents in equal manner—that is, utilizing the same alternately as though they were continuous—and causing them to pass in a continuous stream over a conductor, all the effects of the voltaic pile are obtained.

Improved Folding Seat for Street Railway Cars.

Kieran Egan, New York city.—This invention has for its object to furnish an improved folding seat for use in street railroad cars, steamboats, excursion boats, and in other places. The seat is folded by contracting a standard, sliding the seat and its attachments up upon a bar, and allowing the seat to swing down upon its hinge. In raising the seat for use, the bar is swung up into a horizontal position, which causes the seat and its attachments to slide to the end of the said bar and standard to drop into a vertical position. The standard is then extended to the proper length, and the seat is ready for use.

Improved Cradle.

William T. Doremus, New York city.—This invention consists in the improvement of cradles for children. By suitable construction the cradle may be oscillated longitudinally upon cranks with a gentle movement; or more vigorously by adding the sway of flexible supporting columns to the swing of the said cranks; or the cradle may be rocked laterally by the sway of the columns.

Improved Washing Machine.

Daniel W. Helfrich, Corry, Pa.—This invention has for its object to furnish an improved washing machine that will not tear or injure the clothes. The box of the machine is supported upon legs at a convenient hight. The cover rests upon cleats attached to the upper edges of the sides of the box. A short shaft works in bearings in the center of the cover, and to its lower end are attached the centers of two bars, which cross each other at right angles, and to the ends of which are attached downwardly projecting arms. To the upper end of the shaft is attached a short crank which receives a hook formed upon the end of the connecting rod, the other end of which is pivoted to a short crank, which gives a reciprocating movement to the crank and consequently to the arms. To the shaft is attached a small gear wheel which connects with another shaft which revolves in bearings in brackets, and to one of its ends is attached a crank by means of which the machine is operated. Two of the legs, upon the opposite side of the machine from the gearing, project upward and receive the wringer. The water from the wringer falls upon an inclined board and runs back into the box. By this construction, by simply unhooking the rod from the crank, the cover and its attachments may be turned back out of the way for convenience in putting in and taking out the clothes.

Improved Machine for Driving Brush Handles.

Peter Peartree, Lansingburg, N. Y., assignor to John Ames, of same place.—This invention has for its object to improve the construction of the machine for driving brush handles for which letters patent No. 129,748 were granted to John Ames (Peter Peartree, inventor), July 23, 1872. Two guide plates are firmly connected by arms with each other and with slides. Through the plates are formed holes for the passage of a vertical rod, to the lower end of which is attached a treadle. The rod is held up by a spring, and to its upper end are pivoted two bars which connect with two levers. The two rods are so arranged that they may be lengthened as may be desired. The levers are pivoted to lugs, and to their upper ends are pivoted the outer ends of the short bars, which pass through slots in the slides, and their inner ends are pivoted to the outer ends of arms. The lower or free ends of the arms may be moved in and out by the movements of the levers, and are notched to receive small grooved wheels, which may be adjusted laterally by turning pins in one or the other direction. By suitable construction, by operating a crank, the guide slides may be raised and lowered to adjust the guide wheels to the size of the brush to be operated upon. As the slides are moved up and down, they carry all the arms, rods, levers, guides, etc., with them, so that said parts are always kept in the said relative position with respect to each other so as to require no adjustment of their pivoting points. The butt of the brush head, while being operated upon, rests upon a die having a hole formed through its center for the passage of the brush handle. The stem or shank of the die fits into a hole in the bed plate or table of the machine, where it may be secured. In the case of filled brush heads, the die must be made with a central ring projection to fit into the open end of the brush ferrule, so that the ends of the bristles may have a firm support while the handle is being driven. In the case of solid brush heads, the die should be made with a shallow socket or recess to receive the butt of the brush head, so that it may be held securely and steadily while the handle is being driven. The handle is driven by the plunger, upon the lower end of which are attached spurs to penetrate the end of the brush handle, and thus keep it in place. By suitable construction, when the brush handle and brush head have been arranged in place as hereinbefore described, by moving a lever in one direction the handle will be forced down into the brush head, and by moving said handle in the other direction the driver will be raised to receive another handle. The said plate is lowered to drive the brush handles, so that the forward end of a set screw may strike against the top bar of the frame and stop the driver at the required point. This construction enables the operator, by simply adjusting the set screw, to drive all the handles to exactly the same point.

Improved Manufacture of Corrugated Metal Shutters.

Alexander Clark, London, England.—The object of this invention is to so coil corrugated metal revolving shutters that they will occupy comparatively little space and make less noise in coiling and uncoiling than hitherto. A curved frame of the same width as the sheet to be corrugated forms a curve correspondent to that of a former and table. Within said former revolves a corrugating cylinder or mandrel, while a series of dies laid side by side on table are brought within reach of said rotary cylinder. A continuous sheet of metal is placed on the dies, and the edge of the sheet placed between the first die and a corrugation of cylinder, so as to be griped. The sheet of metal and the loose die are both drawn in together between the mandrel and the table or former. The dies, which are fed in successively, force the sheet metal between the corrugations of cylinder, are carried round by the rotation of said cylinder or roll, and are discharged at the opening, the shutter being retained on the roll or cylinder. Other sheets are run successively upon die roll until the shutter is completed, each successive convolution having its corrugations smaller than the preceding. In this manner the first coil serves to form the next, and so on.

Rolling Wire for Making Wire Cards, etc.

William Walton and John Thomas Fallows, Ienton, near Manchester, England.—This invention consists in forming two wires simultaneously by passing them through a single groove formed partly in an upper and partly in a lower roll.

Improved Refrigerator.

William M. Baker, Fortville, Ind.—This refrigerator consists of three distinct parts, the provision chamber, the air chamber, and the ice chamber. The air is cooled by the ice around the ice chamber without coming in contact with it, and passes through apertures into the provision chamber and out again. The ice water is collected, filtered, and drawn off for use in such a manner that the water may escape but no air enter to the air chamber.

Improved Carpet Stretcher.

Joseph S. Greene and Thomas D. Bradt, Watertown, N. Y.—The object of this invention is to furnish an improved carpet stretcher, by the use of which the carpets are not injured and defaced, allowing one person to stretch and tack the same. The metal top plate is provided with a strong handle, and contains a slotted lateral recess which serves for the insertion of a claw. The top plate is provided at its lower side with bristles or teeth of steel or iron wire, inclined slightly toward the fore part and taking a firm hold of the carpet. The claw or hook is applied at the back of the stretcher. It is made of strong wire, twisted, and ends in two downward projecting hooks or teeth, which, on being pressed down with the foot, hold the stretcher and carpet rigidly in position and allow the tacking on of the stretched part of the carpet.

Improved Reverberatory Furnace.

William Hoyland, Newcastle, Pa.—This invention has for its object to furnish an improved set of furnace plates, to be used in the construction of puddling furnaces. The lower ends of the supporting columns rest upon flag stones. When two furnaces are placed side by side there are no division plates between them below the tops of the columns; but the inner columns of the two furnaces are bolted back to back. The columns and the brackets attached to the end plates thus take the whole weight of the furnace. This construction leaves a clear open space beneath the furnaces, which greatly assists in keeping the bottom of the furnace cool. Plates, resting one end upon the brackets and the other upon the columns, carry the side walls of the fire grate. The bearers, which sustain the weight of the whole interior of the furnace, have each three lugs upon the top to keep the bottom plates from spreading. When it becomes necessary to change the middle plate the breast plate is removed, and a chock or wedge drawn out. This allows the end of the bearer to drop upon the head of the column. The half of the bottom plate drops with the bearer and may be drawn out by means of a pair of blacksmiths' tongs. The new plate may then be put in through the said opening and recess, and the plate and bearer raised into place by a crowbar, a little fire clay being put upon the lip to joint them firmly together. In this way the plate can be changed without delaying the furnace more than fifteen minutes. The breast plate can be changed alone, by suitable means, without delaying the furnace at all. The end wall plate may be removed by knocking out the iron pieces beneath the ends, which allows the said plate to drop three fourths of an inch, when it may be drawn out through the recess. This enables the plate to be changed without stopping the furnace or cutting away the brick work above the said plate. A pipe is arranged for drawing the air through the chills, and also to carry off the gases that accumulate under the furnace, and carry them above the heads of the workmen.

Improved Potato Digger.

George W. Haag, Cairo, Pa.—This invention consists of two sets of strong prongs or teeth projecting radially from a couple of rims or wheels mounted on a truck parallel to each other, to revolve in vertical planes. The wheels are vertically adjustable, so that the prongs may be forced more or less into the ground as the machine moves along, one set on each side of the row of potatoes to be dug. The prongs of each set are arranged to swing toward and from each other, and have cams so combined with them that, while being forced into the ground by the weight of the truck and rotated thereby as it is drawn along, the points of the two sets are caused to swing together under the potatoes so as to hold and raise them, together with some earth, and carry them over the lower end of an elevator, and then open and let them fall thereon, to be carried up and, at the same time, be separated from the earth, which partly falls away from the teeth and partly through the elevator. The potatoes are then delivered into a receptacle behind, which has a trap bottom with devices for opening and closing it to discharge the accumulations from time to time. The invention also consists of an elevator composed of fluted rollers arranged side by side, sufficiently close together to convey the potatoes along from one to another and let the earth fall between in the grooves, the said rollers being connected, by cranks and bars at one end, with one to which the driving power is applied, in a simple manner, for imparting rotary motion to all.

Improved Self Closing Stop Cock.

James Pigot, Brooklyn, N. Y.—This invention consists of a coiled spring and an arm, combined with the plug of a stop cock to close the cock self-actingly, the spring being arranged on a curved rod for keeping it in place, and the arm being attached to the plug at one end, and arranged at the other end so as to swing along the rod, so that the spring thereon will bear against it and be contracted when the cock is opened, and will press the arm around and close the cock as soon as the handle is let go. In order to insure the plug against being pressed into the hole, in which it works with such force as to hold it with too much friction for the spring to close it, and yet to hold it with sufficient pressure to be watertight, a presser rod, a coiled spring and an adjustable nut are employed. The presser rod has a bearing in the center of the top of the plug and passes through a supporting piece so as to have endwise motion. The spring is arranged on the rod on the other side of the support, and is held by a nut which causes it to press the rod on the plug with the exact pressure required.

Improved Carpet Stretcher.

Peter Kelly, New York city.—The object of this invention is to furnish a strong and effective vise for stretching heavy carpets and oil cloths, which holds the same with a powerful gripe, increasing as the strain exerted upon it is stronger; at the same time it works quickly and opens and shuts with ease. The invention consists of two jaw levers, pivoted to two intermediate links, which connect to the handle lever, forming a powerful stretching instrument.

Improved Bed Spring.

F. Rollin Smith, Bennington, Vt.—This invention consists in constructing the ends of angular or V shaped springs with a tongue or tongues for holding on the slats of a bed bottom. The spring consists of a flat piece of steel bent into the form of two sides of a triangle, and fastened at one side to a cross bar, so that the end of the other side will project upward suitably to support one end of a slat.

Improved Bung Bush Inserter.

Lomax Littlejohn, New York city.—This invention has for its object to furnish a simple, convenient, and effective instrument for inserting metallic bung bushes in barrels and casks. The invention consists in the combination of an elliptical journal, formed upon the end of a shank, with the split sleeve, made with an elongated cavity. By this construction, when the sleeve has been inserted in the bush and the shank turned, the elliptical journal will expand the sleeve, causing it to grasp the bush firmly and screw it into the bung hole in the stave.

Improved Pruning Shears.

Missjah C. Malone, Palmyra, Ill.—This invention has for its object to furnish an improved pruning shears which shall be so constructed as to open itself when held erect, so that it may be operated by a single handle. The handle is made in sections. To the opposite sides of the lower end of each upper section are attached two springs, having inwardly projecting points attached to their lower ends, which enter holes in the opposite sides of the upper end of each lower section, where they are held in place. The joint is strengthened by a band which is slipped down. This construction enables the handle to be made of any required length. To the upper end of the handle is attached a plate having lugs formed upon its outer side. A rod is passed through holes in the lugs and has a head upon its lower end to keep it from being drawn out. Upon the upper end of the rod is formed a hook to be hooked over and to hold the limb to be cut. The blade is pivoted to the upper part of the rod in such a position that when turned upon its pivot it will operate upon the limb held by the hook. By suitable construction, when the shears are held erect, the weight of the rod, hook, and blade will cause the rod to slide down in the lugs, which opens the shears so that the hook can be passed over the limb to be cut. When the hook has been passed over the limb, by pulling upon the handle, the blade will be operated to cut off the limb.

Improved Production of Colors on Fabrics.

Frederick Albert Gatty, Accrington, England.—This invention consists in the use of neutral soap or emulsions of fatty acids, or of oils or fats either saponified or in their natural state, or the two combined, for the operation commonly called dunging or cleansing.

Improved Pruning Knife.

Joseph S. Crum, Palmyra, Ill.—This invention consists in constructing the pruning knife in a novel and peculiar manner. It has a hook and slotted convex-edged blade connected by a sliding bolt, while their shanks are pivoted between straps of the handle.

Improved Shingle Machine.

Samuel M. King, Lancaster, Pa.—This invention consists in combining a bolt cutter with two surface planers, all three placed side by side, and each operating successively so as to complete the shingle at one continuous operation in a perfect manner and in a brief time.

Improved Safety Guard for Pocket Books.

Thaddeus Potter, Jackson, Miss.—In this invention it is proposed to have one or more hooks arranged within or between the cover and an inside partition of a pocket book, and contrivances for causing them to project so as to hook into the pocket of the garment to prevent the book from being picked out of the pocket. The device for throwing them out is so arranged that the hooks are withdrawn readily from the pocket when it is wished to take out the book. The device will also be contrived so that when the hooks are thrown out they will be locked so that they cannot be withdrawn except by the mechanism for throwing them out.

Improved Extension Table.

Samuel H. Martin, Mount Vernon, N. Y.—The object of this invention is to so construct an extension table that there shall be no loose pieces belonging to it to be put on when it is extended and taken off when it is contracted. This table is supported by legs on rollers, which rollers revolve on pivots in the bottoms of the legs, and, consequently, extend transversely from one leg to the other. The two central legs are connected with the two end legs and form a frame work which supports a transverse octagonal shaft. The flexible top of the table is composed of sections which are hinged together, and is supported by a chain on each side. The two chains are connected by transverse rods. One end of each chain is attached to the insides of flanges on the ends of the shaft. The flanges are octagons, the sides of which correspond with the width of the sections of the flexible top. The other ends of the two chains are attached to the under side of the other end of the table by means of rods connected together by a cross bar which has longitudinal play in a slot plate. As the shaft is revolved the chains wind up on it, and the flexible top winds up on the flanges to which the first section is rigidly attached. The two chains are not parallel with each other, but approach each other as they recede from the shaft, so that, when winding up, they fold toward the center of of the shaft.

Improved Fruit Gatherer.

Horace Kelsey, Ottawa, Kansas.—This invention is an improvement in the class of fruit gatherers in which a cloth is temporarily attached to the body of the tree and supported at its outer edge by suitable braces; and the improvement consists mainly in a peculiar arrangement of a spout and of blocks for supporting the inner edge of the cloth body or fruit receiver, in such relation to each other as to insure the delivery of the fruit through a single spout in an efficient manner, without injury to the fruit. See advertisement on another page.

Improved Window.

Joshua Perkins, Danielsonville, Conn.—This invention consists of one or more of the panes of a window made in two parts, and one or both of the said parts arranged in suitable guide ways for sliding along the other par for opening a space for the passage of air for ventilation.

Improved Drilling Machine.

Henry Martin, Duncan, Pa.—This invention consists of a cylindrical standard having a base plate adapted to be bolted or clamped on a support, on which standard is a horizontal arm capable of shifting up and down and swinging around. The arm carries a sliding head and an adjusting screw to shift the head toward or from the standard. The sliding head is provided with a vertical feed screw with a socket in the lower end, in which the upper end of the hand drill brace is centered to hold it and feed the drill, the whole comprising a simple and cheap substitute for the common ratchet drill and its adjuncts.

Improved Machine for Thrashing and Hulling Clover.

James Bradley and James Nicholas, Gomer, Ohio.—This invention has for its object to improve the construction of the machine for which letters patent No. 66,765 were issued to Isaac N. Young, July 16, 1867, so as to adapt it for use with grain or clover, as may be desired. The grain and clover pass to an endless carrier which is arranged to pass around a stationary inclined table. The straw or hay is taken from the carrier by the pickers and transferred to the straw carrier. A beater is placed over the middle part of the carrier to beat the straw or hay, and thus knock out the grain or seed. The grain or seed from the upper end of the table and carrier, and that knocked out by the pickers, falls upon and slides down a table, the lower part of which is made with a steep incline, and is partially cut away, being replaced by the feed board. The latter may be turned into an inclined position with respect to the plane of the steeper part of the table to guide the grain to the screens of the shoe, and by suitable means is agitated to prevent lodging of the grain. When the machine is used for thrashing and cleaning clover seed, the feed board is adjusted into the plane of the lower and more steeply inclined part of the table so as to form a part of the said inclined part, and thus guide the clover balls and seed to the hulling cylinder.

Improved Can Filler.

Robert Newton, Millville, N. J.—This invention consists of a hopper, in which tomatoes or other vegetables or fruit are placed, which tapers down to a cylindrical chamber at the lower part about the size of the can. There is a collar at the lower end to enter a hole in the top of the can while the latter is being filled, and a self-closing valve to prevent the escape of the tomatoes while the cans are being changed. In the hopper there is a plunger with which a lever is arranged to force it down to fill the can, and a sprin to lift and hold it up after filling, and below the nozzle of the hopper is a vertical movable rest for the cans, which is so connected with the lever f working the plunger that the can is raised up to the nozzle, and the nozzle caused to enter the can, into which the plunger begins to act to discharg the tomatoes. Below the rest for the can is a receptacle for the juice an fine matters escaping in the operation, into which they pass through a grating, over which the filled cans are passed along in being delivered from the machine.

Improved Wash Boiler.

Franz J. Schirmayer, Milwaukee, Wis.—The object of this invention is to improve on what is known as the Tilton wash boiler; and it consists in wire rods passing vertically through the hot water passages of the boiler to the bottom, being pivoted to forked lever arms, which raise the movable bottom at will, and allow therefore the full control of the boiler. It consists, further, in the extension of the hot water passages to the top of the boiler, and the substitution of the perforations and movable bottom by pivot wing pieces, to be operated by the lever arms.

Improved Crow and Tamping Bar.

Allen Wright and Alvin F. Tew, Westfield, N. Y.—This invention consists of the handle part of a crow, mill, tamping, or other hand bar, made of tubing, with the end for work made of steel, and detachably connected to the handle part, so that a point for tamping, or a claw, or other kind of point, can be substituted for the claw point. The object is to make the handle part as large as is required for filling the hand of the workman to the extent naturally required for the greatest convenience without being too heavy.

Improved Plane.

J. Ceville Spencer, Phelps, N. Y., assignor to himself and Francis X. Gervis, of same place.—This invention has for its object to furnish an improved plane, so constructed that it may be conveniently, quickly, and accurately adjusted to cut a thicker or thinner shaving, as may be desired. A plate is placed in a recess in the face of the plane stock in front of the plane irons, and is so arranged as to move with the plane stock, longitudinally but not laterally. The recess in which the plate is placed is made deeper than the thickness of the said plate, which plate rests upon the heads of screws, screwed into the said stock. By this construction when it becomes necessary to dress off the face of the plane stock the screws are turned in a little so that the recess does not have to be deepened every time the face of the plane stock is dressed off. There is other mechanism by which, by loosening a nut and operating a lever, the plate may be adjusted as required.

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There is no form of protection that is more easily obtained, or which gives better satisfaction so far as it extends than the copyright, and the simplicity and excellent practical working of the law ought to afford useful instruction to those who constantly aim to add complexity to our mechanical patent laws.

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But it should be remembered that the copyright must be applied for *before the work is publicly introduced*, or, in other words, before it is published. A valid copyright cannot be had for a work that has been issued to the public prior to application for the copyright. Nor can a valid copyright be obtained for a mere trade mark, word, or name.

Further information in regard to obtaining copyrights may be had gratis by addressing Messrs. Munn & Co., 37 Park Row, Solicitors of Patents and Publishers of the SCIENTIFIC AMERICAN.

Notes & Queries

J. K. W. asks how to season hickory cogs quickly. Would steaming, previous to putting them in the dry kiln, do? How long should they be steamed?

W. A. W. asks for a dip or other method of brightening small articles of tin plate which are much tarnished in the manufacture.

O. S. T. asks: 1. What is used for plastering over the outside of chimneys and buildings? 2. What is used for tuck-pointing? 3. Have any of the planets a satellite which has a retrogressive movement?

W. asks for a formula for extracting the mercury from old battery zincs.

V. says: Would it not be well to request Mr. Alvan Clark, the optician, who was the first to gaze on the satellite of Sirius, to give us an essay on the manufacture of telescopic glasses? Beyond all doubt he would have received an order for a six feet lens if he could have made it. I would like to draw him out. 2. Please ask the galaxy at Poughkeepsie to give us poor laboring men an easy method of distinguishing the principal stars. The usual method may be just the thing for the educated, but it is a little too much for a chap that I know well. It may be that they can tell us at what point of the compass we must stand, how far away, and at what hight our eyes should be while gazing into a looking glass, flat on its back on the ground.

W. H. says: I have a well the water of which is unfit to drink. Until last summer I was never troubled in the least, always having a never failing supply of the best water in the neighborhood. At that time I placed a copper pump in my kitchen, using a block tin pipe. The pump being at the opposite side of the room, the pipe was carried two feet deep in the ground, encased in a wooden box to the well, perhaps twenty-five feet. Just outside the kitchen and next to the pump, I have a cesspool, into which the waste water from the sink runs. At first I thought this the cause, and that the water soaked through the earth and ran through the wooden box, whereupon I had a new cesspool dug at a greater distance, and filled up the old one. I then had the well pumped dry and examined. This year it troubles me more than ever. Will some one please solve the mystery?

E. R. D. asks for a plan for making a still for extracting the oil or essence from hemlock seeds, wintergreen, etc.

J. F. asks for a process for filling engraved letters on hand plated door plates, so that the material will not crack or peel off.

S. W. G. asks: Is there any cheap process of cutting or shaping carnelian pebbles by means of acids or similar agents? The method should leave a polished surface.

A. H. asks what is used to give black door handles their hard, glossy coating?

Answers to Correspondents

G. B. will find recipes for tempering steel for all purposes in the recent numbers of our journal; and for soldering on p. 251 of vol. 28. For directions for galvanizing, for painting buggies, and for varnishing furniture, consult the handbooks constantly advertised in our columns.—M. H. K. will find directions for preserving eggs on p. 107, vol. 28.—H. C. J.'s question about the deterioration of coal is answered by anticipation on p. 367 of vol. 32.—J. P. G. can prepare oxygen by following the directions on p. 203 of vol. 27, and hydrogen by those on p. 89 of vol. 24.

F. H. asks: 1. What is the best charcoal used in filtering rain water for cooking and drinking purposes? Is it not animal charcoal? Where can it be got? I have burnt some bones; some are burnt black, others white; if this makes any difference, which are the best? What sand is the best to use with it for the above purpose? 2. What are the ingredients of the French dressing for boots and shoes applied by sponge? Is it injurious to the leather? 3. How is baker's liquid yeast prepared? Is it like the yeast sold in a putty-like consistence, known in some European countries and there manufactured by the brandy distillers? 4. Is it possible to clean stains off white marble? If so, by what means? 5. Can you or any of your readers tell me why the nationality of the Netherlands (here better known by the wrong name of Holland) is called Dutch, making such a difference between the names of the country and the nation? No other such exists in the English language, but all are called after their country's name. Even a great many editors in America do not know what Dutch is, and take "Deutsch" (German) for it, there being as much difference as there is between Spanish and French. Answers: 1. Animal charcoal, for filtering water, is obtained by igniting bones in close vessels; if air is admitted, the carbon is all consumed, and the remaining phosphate of lime is white. Use clean, sharp sand with it. 2. The process is a secret. 3. Vienna yeast is made of previously malted rye, maize and barley, which is first ground and mixed, then put in water of 65° to 75° Fahr. After some hours the liquor is decanted and fermented by adding yeast. The scum is skimmed off, filtered on cloth, washed, drained, pressed into any desired shape, and covered with stout canvas. 4. What caused the stains? Try strong soap lees and quicklime, as thick as milk; let it lie 24 hours and wash with soap and water. 5. Dutch is, as you say, entirely distinct from Deutsch, but has come into popular use in a very loose way for nearly all inhabitants of northern Europe. It properly refers only to Hollanders, or Netherlanders, as you call them, although Webster says it was formerly used by good writers for German. Both come from the Anglo-Saxon *theod*, the people. The English often give to a city or country a name quite unlike that by which it is known at home; thus Vienna for Wien, Leghorn for Livorno, Geneva for Genf, and Munich for München.

S. P. S. asks if metals can be burned as fuel. Answer: The use of metals as fuel has been discussed by various writers, who seem to forget that the reduction of the oxide involves an expenditure which more than balances the saving. No metal which, like zinc, could be employed is found native, but must first be reduced by the use of coal. One pound of zinc requires far more coal in its reduction than would be required to produce the amount of steam generated by a pound of zinc. For these reasons, we doubt whether zinc, or any other metal, will ever meet with extended use as a fuel.

T. C. H. K. asks: What is the simplest and easiest method of tinning cast and wrought iron; and also of what material the tanks for melting the tin in should be made? Answer: Pins, hooks and eyes, etc., are tinned by being boiled in a tinned boiler filled with water, granulated tin, and cream of tartar. They are then dried by being rubbed with sawdust or bran. In tinning sheet iron, the iron is thoroughly scoured and immersed in baths of molten tin, covered with a layer of molten tallow to prevent oxidation of the metal. They are next immersed in molten tallow to remove any excess of tin, wiped with a brush of hemp and cleaned with bran. A one-sixteenth part nickel renders the tin less fusible.

A. O. G. asks: Is there any rule for getting the number of revolutions an ordinary governor has to run before it acts on the valve? Answer: Each manufacturer determines the proper speed and should inform purchasers. The rule to determine the speed of a regulator when the distance from the point of suspension to the level of the circle in which the balls revolve is known, is as follows: $R = \frac{187 \cdot 6}{\sqrt{H}}$, or $= \sqrt{\frac{35208}{H}}$; or the number of revolutions per minute is obtained by dividing the number 187·6 by the square root of the hight of the point of suspension above the level in which the balls revolve; or: divide 35208 by this hight and extract the square root of the quotient.

C. R. says: Can you inform me how to get my slide valve tight between the ports and exhaust? The outer edge of the valve and seat cuts slower than the center. Answer: Find a good mechanic, if not skillful yourself, and let him bring it into good shape by carefully using a scraping tool.

J. H. S. asks: Which is the most economical and regular power, all having fly wheels and governors: One engine with 70 square inches on piston head, or 2 engines with 35 square inches on each, one being on one end of main shaft, the other on the other end, properly adjusted? Will the two not overcome the dead points so as to make the power more regular, for flouring mills? If so, will it not be cheaper, taking less steam and fuel? Answer: The double engine would give the most perfectly uniform speed, but the additional expense prevents the adoption of that plan, except for very large power; and in the latter case the double engine is usually adopted because the cost of building exceptionally large engines is also excessive, and because it is frequently, in the latter case, advisable to have a pair, so that one may be run, should a break down occur to the other. The larger an engine, other things being equal, the more economically it can be run.

R. S. asks: What cement is best adapted for hollow prisms holding bisulphide of carbon? I have made a number of them, using simply sealing wax, which answers very well for ordinary liquids, but the bisulphide attacks the sealing wax and thereby causes the liquid to lose its transparency, unfitting the same for the purpose intended, namely, to view the Fraunhofer lines. What material, besides silk and India rubber, is best adapted (or can be made so, not increasing the price to any large amount) to hold air? The material must be strong, elastic, and cheap. Answer: For bisulphide of carbon prisms, Mr. Lewis M. Rutherfurd, who has had much experience in this subject, employs a cement of glue and molasses. The surfaces must be perfectly clean; they are then warmed and dusted with a fine camel's hair brush, and placed in contact. A hot and fluid mixture of glue and molasses is then applied around the edges, and penetrates by capillary attraction. It must be left a day or two to harden, before preparing the next side. The ground stopper was also rendered tight by a little molasses. (See Silliman's *American Journal*, March, 1865). Marine glue is also employed, and we suppose that the cement from glycerin and litharge may be.

Y. W. M. asks: Is there a greater strain on the teeth of one wheel than of the other, of two working together whose diameters are 1 and 6 or 1 and 20, respectively? Answer: No. Each presses on the other with the same force; and as the teeth must necessarily be of equal length and pitch, their liability to fracture is the same.

G. A. H. asks: Can you give me some information about aluminum bronze, as to its malleability, its hardness and its susceptibility of corrosion, as compared with copper? Where can it be obtained, and in what form or forms is it wrought? What are the comparative expenses? Answer: Aluminum bronze, composed of 9 parts copper and 1 part aluminum, was proposed in 1864 as a material for small coins, and with this object in view the assayer of the United States mint made a number of careful experiments with it. From his report it will be seen that aluminum bronze possesses much greater hardness than copper alone, but less malleability and ductility. When rolled into sheets, it requires annealing at every third passage through the rolls; when drawn into wire it must also be frequently annealed. To strike a coin of this bronze required unusual force. It also tarnishes quite readily, but not more so than copper. Unlike brass, it does not form verdigris when used for candlesticks.

S. J. N. asks: How is vulcanite rubber made and hardened? When it is in a state of fusion, what can be used to make it strongly adhesive? Answer: India rubber may be vulcanized by immersing for 1 or 2 minutes in a mixture of 30 or 40 parts bisulphide of carbon and 1 part chloride of sulphur. It is then heated in a closed vessel, nearly to its charring point. At this temperature it may be compressed into molds. There are several patents covering details of manipulation and improvements. Magnesia is employed to give hardness to rubber combs. A cement for attaching rubber to wood or metals is made of finely pulverized lac dissolved in 10 times its weight of concentrated ammonia. The solution takes place in a few days in the cold, and more quickly if warmed.

P. W. S. takes the upper part of a pendulum rod and hangs the weight to it by two cotton cords, keeping the cords apart by passing each through a hole in one end of a slip of wood. He wishes to know if this arrangement will ensure regular motion in all weathers. Answer: It would probably run as well as any pendulum, and would be principally affected by changes of humidity, moisture causing contraction and dryness, expansion.

E. M. C. asks for a process by which steel springs exposed to the action of sea water may be prevented from rusting, which will not draw the temper as does the so-called galvanizing. If electro-plated, say with zinc, would the electricity have the effect of drawing or impairing the temper? Answer: If electro-plated with nickel, the springs will be preserved from rust. No injury to the temper from electro-plating.

D. McK. says: I have a portable threshing engine; and in order to do work properly, I have to keep it at 100 lbs. pressure. Is it safe to move from one setting to the other, under the above pressure? Answer: It depends altogether upon the construction of the boiler. Ask the makers.

J. M. H.—There are patents on music boxes; and some are manufactured here, we believe, but the greatest number are imported.

L. S. questions the accuracy of our reply to J. B. D.'s question on rainbows, and asserts that rainbows can be seen in the north and in any other direction. Answer: As the center of the arc of a rainbow is always opposite the sun, when that center is in the north the sun must be in the south, on the meridian; and when the sun reaches a hight of 42° 2', the rainbow disappears below the horizon. See Ganot's "Physics," page 779 edition 1866.

P. P. Jr. asks how to fasten rubber belting to wood. Answer: Paint the wood with white lead in oil and let it dry; stick the rubber on with glue.

L. P. D. asks how manifold writing paper is made. Answer: By coating the paper with lamp black mixed with a non-drying oil; also by rolling it with printing ink and drying between sheets of blotting paper for some weeks. The white paper employed with it is thin oiled paper, as you will have perceived from the odor.

L. P. D. asks: How is nickel plating done? Answer: The object to be plated is immersed in a solution of some double salt of nickel and ammonia, and attached to the negative pole of a battery, while a nickel electrode is attached to the positive pole. The solution should be slightly acid. The details can only be learned by practice, and are mostly trade secrets and beyond our reach.

J. J. asks if water engines or small turbines are best adapted for running domestic machinery; such as sewing machines. Answer: Consult an engineer; we do not know the circumstances of your case.

J. A. C asks: 1. How can I produce light without heat sufficient to light a cellar? 2. Does it injure cotton to store it in a cellar, where it rests on boards and does not touch the wall? Answer: If the ordinary sources of light, such as gas and petroleum, produce too much heat, you may place them in a flue with a draft sufficient to carry up the heated air surrounding the flame. Ordinary window glass, under these circumstances, will cut off most of the heat. Or, you may employ reflectors, and pass the light so reflected through an alum solution, which permits light to pass but not heat. 2. We do not suppose your cotton would be seriously affected unless the cellar is very damp.

A Lady asks: What will darken the hair without injuring the health? Iron enters into a good many mixtures for the hair, but I think it weakens the eyes. Is this so? Answer: Lead is one constituent of nearly every hair dye in market; a few contain silver. Both are detrimental. A decoction of chestnut burrs will darken the hair and is less injurious.

H. H. D. asks what method and apparatus are made use of in taking micro-photographs. "Where can I find full directions for the same?" Answer: Micro-photographs are extremely small images of objects intended to be viewed by the microscope. It a negative be placed in a suitable apparatus and its image, extremely reduced in size, be thrown by a very short focus lens upon a sensitized albumen plate, that image may readily be developed by appropriate means and a sharp, fine, positive image be got, which, when viewed by a sufficient magnifying power, may exhibit satisfactory details, if all the manipulations have been well performed. The only real difficulty is that the development requires to be followed by the microscope. Microscopic photography consists in enlarging the images greatly above the natural size. Dr. Woodward, Surgeon General of the United States army, has been particularly successful in this, enlarging to 10,000 diameters. A description of the process is given in Carey Lea's "Manual of Photography."

R. B. asks: Does camphor have a tendency to turn furs yellow? Answer: Camphor is but little used to keep furs. Furriers generally think camphor will not injure the colors of the fur, but they also deny that it will preserve them from moth, etc.

J. S. R. asks: 1. Can some of your readers give a formula for mixing the red brick color, used for what is termed tuck work on brick houses? 2. Also for a good cement or concrete for a walk in the garden; one that will endure cold weather? Answers: 1. Spanish brown is mixed with oil to a suitable consistency for the purpose. 2. A perfect concrete for a garden walk to endure frost has not yet, so far as we know, been invented. Perhaps small stones covered with hydraulic cement might suffice for your purpose; or you may put down an asphalte or coal tar composition.

Aunt Clara asks: How is silent gunpowder made? I wish to know of what it is composed and the quantity of each ingredient. Can it be made in small quantities and be not too expensive for shooting ducks? Answer: White gunpowder is composed of chlorate of potash 2 parts, white sugar 1 part, and ferrocyanide of potassium 1 part. The ingredients are mixed and granulated in the ordinary manner. It is apt to oxidize gun barrels, otherwise is a very safe and effective powder, not liable to become damp.

M. W. B. says: I have seen glass jars filled with zinc crystals, and I understand that it is done by filling the jar with water and a piece of zinc suspended from the cork with a piece of copper wire. The crystals hang down from the zinc and fill the jar. Answer: The jar which you saw was probably what is called a "lead tree." Dissolve some sugar of lead in the water and put the solution in a jar, suspending a piece of zinc shaped something like a pine tree in it. In a little while, the lead begins to be deposited upon the zinc in brilliant metallic spangles. A solution of alum will also crystallize upon a string or wire suspended in a saturated solution, and beautiful alum baskets are thus constructed. From your imperfect description of the crystals, we cannot say positively what they were composed of or how they were formed.

L. H. B. says: I have been trying to bleach palmetto, and cannot succeed. You will find an unbleached sample enclosed. Answer: The following process, employed for bleaching sponge, may perhaps also answer for palmetto: It is first placed in a solution of 180 grains of permanganate of potassa in five pints of water and left a few minutes until dark brown; it is next dropped, a few pieces at a time, into the following bleaching solution: Hyposulphite of soda, 10 ozs., water, 68 ozs.; when dissolved, add 5 ozs. muriatic acid. This solution should be made a day or two before using, and strained through muslin into a glazed vessel. But a few minutes immersion in this liquid is required. If necessary to deodorize, a very weak solution of bicarbonate of soda is used, and the material is again washed in water several times.

C. W. asks (1) if the hydrometers of Baumé are constructed in the United States so that the 66th degree corresponds to the density of commercial sulphuric acid (commonly presumed to be 1·835) or so that the 10th degree is equal to the density of a solution containing 10 per cent of common salt. 2. In what work can I find an accurate and reliable table for converting the degrees of Baumé into specific gravities and *vice versa*, adaptable to this hydrometer as generally manufactured and used in the United States? Answers: 1. Baumé's hydrometer is graduated by being placed in a solution of 15 parts dry NaCl in 85 parts water, and marking this 15°. It will be found that sulphuric acid of specific gravity 1·767 stands at 66° B. The following formula serves to convert Baumé into specific gravity for liquid heavier than water: $g=152\div(152-d)$. Thus if a solution stands at 29° B., we have: $g=152\div(152-29)$, or $g=1·23$. A comparative table is given in Morfit's "Chemical Manipulations."

J. K. S. asks: What is the best thing to clean type that has printing ink on? Answer: Benzine.

P. H. S. M. says, in reply to W. L.: If you steam elm hubs for five hours and let them get cold, then place them in a drying room with a light heat, they will be dry in eight days.

J. E. says: In answer to G. C.'s query in regard to the pressure required to balance the force of the blow of a 2,500 lbs. pile driver falling 25 feet, I would suggest the following rule: The weight of the falling body multiplied by the square of its velocity at the moment of impact, and the product divided by the acceleratrix 32·166. Now a body falling 25 feet will be moving at the rate of 40 feet per second at the end of fall; and 2,500 × 40 × 40 ÷ 32·166 = 124,356 lbs., the weight required to balance the force of the blow.

L. says that I. E. W., who asked how to transmit motion from one of his shafts to the other, can do it by rigging another short shaft, or arbor, parallel to the line of the two, in any direction and at any convenient distance therefrom, and using suitable pulleys and drum, with belts of width and thickness sufficient to transmit the required power. Where the motion is so great as he proposes, the drum on his applied shaft should be ten or more times as large in diameter as the pulleys on the shafts. "If I were constructing such machinery afresh, I should run the driving, or first shaft, at half or two thirds the speed of the driven one."

H. W. B. says, in answer to W. F. H., who asked how to clean an empty cider cask: Let him start the hoops on one end, take the head out carefully, mark it, and use soap, warm water, and a rag, which is the only way in which it can be done.

S. P. S. says, in reply to G. C., who asked: Suppose a pile driver of 2,500 lbs. weight, when it has just completed the distance of 25 feet in falling, strikes one end of a scale beam: with how many pounds will the pressure with which it strikes the beam be balanced? In order to simplify matters, we will suppose in the first place that the beam is without weight, perfectly rigid, and moves upon its center without friction. A body in falling from a hight accumulates just sufficient force to raise that body to the same hight again; or, taking one foot as the unit of hight and one pound as the unit of mass (and denoting the hight by h, and the mass by m), we then have $m\,h$ as the force developed. If now, on striking the end of the beam, it moves it through the space of one foot, the formula then becomes $(1+h)m$, and the weight required to balance this must also equal $(1+h)m$ pounds moved through one foot, or, in the case given, $25+1\times2500=65000$ foot pounds. Now it will be readily seen that, if the beam only moves through the tenth of a foot, the formula becomes $(25+0·1)\times2500=62750$ foot pounds; but in this case, the weight being lifted only through one tenth of a foot instead of through one foot, it must be ten times as great, or 627500 pounds lifted one tenth of a foot; and finally, if the beam is not moved, the force applied at one end of the beam becomes $25\times2500=62500$ foot pounds, and the force required to balance it will be $62500\times\infty$, or, in other words, it will be infinitely great. The question is therefore incapable of a numerical solution with the data given, as theoretically no weight can be found sufficiently great to just balance the impact of a falling body. In Mr. Nystrom's reply to a similar question, he assumes, in order to give a definite answer, that the body struck moves through one tenth of a foot, the weight being 3 tuns and the fall four feet; and he solves the question as follows: $3\times4\div0·1=120$ tuns, assuming in this case that the striking weight imparts all its force at once to the anvil, and that it does not follow the surface through the tenth of a foot through which it is compressed. But what does he mean by 120 tuns? Evidently 120 tuns raised through one tenth of a foot; or using the customary unit of one foot, 12 tuns raised one foot, which is identical with the answer given by W. H. P., of Iowa, in your issue of July 13, 1872, and again on August 10th, 1872.

C. H. B. says that G. E. K. can keep his dog wood from season checking by sawing the ends smooth and sizing with glue, not too thin, and spreading on pieces of paper and rubbing them smooth. "I have used this process on ends of maple lagging for threshing machine cylinders with good effect."

C. H. B. says that A. McK., who asked how to prevent the escape of smoke from his hot air pipes, should make direct connection with uptake instead of sending the smoke through the many turns. "I think you will then get ahead of your trouble. Put a damper in direct connection; and if you choose, connect said damper with the door, so that the opening of the door will open a draft in the direct connection."

A. C. says in reply to A. W. P.'s query about renovating oilstones: Try turpentine to clean with. You will have a stone as good as new. The reason of oilstones becoming hard is that the pores fill up by the oil becoming viscid or gummy and mixed with the particles of steel rubbed off in the process of sharpening, thus preventing the tool from touching the stone by causing it to ride upon the surface of a substance as hard as itself. There is a secret, known only to a limited number, that oil mixed with a small portion of turpentine makes a stone cut freely; and here let me remark that no oil that is of a vegetable character, such as sweet oil, is fit for a stone; petroleum is little better. The very best that can be used is neat's foot oil, which may become thick and pasty, but is always reliable; so are all of the animal or fish oils. That which is obtained from poultry is good; some prefer goose oil to use on a stone for razors, and some mechanics in Philadelphia substitute soap suds for the purpose.

W. L. W. says, in reply to G. T. R.'s question as to atmospheric pressure in water in a pump over which clay is tamped: I can say that my well is covered over with a large stone, through the middle of which passes the pump pipe, all the chinks being closed tight with mortar, and that the whole is then buried six feet deep in sand and underlies part of my garden. I never have any difficulty in drawing water, to the full capacity of the pump, the pipe being an inch or an inch and a quarter in diameter. This method secures the well perfectly from the introduction of rubbish, and does away with the drowning of children, and with the necessity of even cleaning it out. Put in good pipe that will not collapse (none of the tin-lined), and if the supply of water is good, you will never need to disturb a well put down in this way.

E. V. says, in answer to F. S., who asked for a recipe for a liquid for marking boxes with a brush: Try lamp black and coal oil. We are using it and find that it answers very well.

H. B. says: On page 314 of your current volume, J. E. E. explains to C. W. O. and to A. M. the cause of the heating of their saw mandrels at the end next the saw, while the opposite end, which carries the belt, runs cool: I have had not a little experience in the running of circular saws, and have observed the same peculiarity, but I arrived at a different conclusion as to the cause from any one who has yet made his opinions public by means of printer's ink. The end that carries the driving belt always rests steadily in its bearing. The end next the saw is exposed to all manner of dirt that is upon the logs, and to the filings made by sharpening the saw. The unsteady bearing allows this dirt to get in between the bearing and the box in some position. My rule, which has always been successful, has been to use every precaution to keep the dirt out, but if it begins to heat, stop and take it up, clean the box and the bearing thoroughly. I pour in a very little lard oil and then fill with tallow. I use boxes that keep themselves in line. This, gentlemen, is all there is of it. I have had more than twenty years of constant experience in the running of circular saws of all sizes, and I never could find any other remedy that would always answer the purpose. Sometimes after much use the mandrel will wear out of round, more particularly for the same reason here given for heating, and because the material of which it is made is not entirely homogeneous, of equal hardness and like texture.

D. M. K. says, in reply to E. W. W., who asked: Given the chord and versed sine of a segment of a circle, how can I find the length of the arc?—From the sum of the chords of half the arc, subtract the chord of the whole arc, and one third of this remainder, added to the sum of the chords of half the arc, will give the length of the whole arc, nearly. This rule never makes the arc quite long enough, but will, I think, be found sufficiently accurate for most practical purposes. A more accurate result may be obtained by finding the area of the segment, and the area of the triangle formed by given chord and the radii of the circle (which meet in the center and terminate at the extremities of the chord) the sum of these areas being the area of the sector, or of that part of the circle included between the said radii and the required arc. Then, having found the area and circumference of the whole circle: As the area of the whole circle is to its circumference, so is the area of the sector to the required arc. The diameter of the circle may be found by dividing the square of half the given chord by the versed sine, and adding the versed sine to the quotient. Then the altitude of the triangle formed by the chord and two radii meeting in the center of the circle may be found by subtracting the versed sine from the radius of the circle; and its area will be the product of the chord into half this altitude, or the product of this altitude into half the chord. The following rule will give the area of the segment with great exactness: Multiply the square of the versed sine by the decimal ·39167; to the product add the square of half the chord, extract the square root of this sum, and multiply this root by $\frac{2}{3}$ of the versed sine, and the product will be the area of the segment, which area added to the area of the triangle gives the area of the sector whose arc is required.

C. W. S., in reply to D. H. E.'s query as to how to adjust his platform scale, says: The answer of C. E. G. may be classed with Pat's directions for building a chimney: "Begin at the top and build down; keep the first brick up by putting another brick right under it." Let D. H. E. put 100 lbs. standard weight on the platform and have a new pea, heavy enough to balance the beam at 100 lbs. Now remove the 100 lbs. weight, and set the pea at zero, and balance with shot in the cup. Replace the weight on the platform, set the pea at 100 and balance by cutting off a portion of the pea. Again remove the weight and set the pea at zero, and add more shot. Continue the process till the pea will balance the 100 lbs. weight at 100, and the empty platform at zero; and unless there is some derangement not mentioned in the case, the scales will be in good adjustment. I tested this method on my own scales by setting the pea aside and emptying the shot cup. Taking a string of washers for a new pea, after a half dozen trials I had the washers of precisely the weight of the pea, and the shot of the same weight as the first lot.

A. W. C. says that P. F. B. may restore old files in the following manner: Boil the files in a solution made by dissolving 4 ozs of saleratus in 1 quart of water, for half an hour. Then wash and dry them, and stand them in a solution of sulphuric acid and water, mixed in proportion of 4 ozs. acid to 1 quart of water. If the files are coarse, they will need to remain in about 12 hours, but for fine files, 6 or 8 hours will suffice. When taken out, they should be washed clean and oiled.

D. M. K. says, in answer to J. H. P.'s query as to the contents of a barrel or cask when partly full: Rule.—Divide the number of wet inches by the bung diameter, and if the quotient is less than ·5, deduct from it ¼ of what it wants of ·5; but when the quotient is greater than ·5, add ¼ of that excess to it; then, if the remainder in the former case, or the sum in the latter, be multiplied by the contents of the cask, the product will be the content, or ullage of the part filled. The rule for the ullage of the filled part of a standing cask is this: Divide the number of wet inches by the length of the cask; then if the quotient is less than ·5, subtract from it one tenth of what it wants of ·5; but if it is greater than ·5, add one tenth of its excess above ·5; then multiply the remainder in the former case, or the sum in the latter, by the content of the cask, and the product will be the required ullage. Example: The content of a lying cask is 98 gallons, the bung diameter is 32 inches, and the wet inches under the bung are 10; required the ullage of the part filled. Answer: 26·03 gallons.

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

N. B.—The sample of sand contains no silver, but fine particles of iron pyrites.

J. W.—1. A highly bituminous brown coal. 2. Very pure blende or sulphuret of zinc. 3. A rock composed mainly of alumina and silex. 4. A silicious rock, containing a fragment of galena.

B. F. W.—Iron pyrites.

M. H.—It is iron pyrites. If found in large quantity, it may be profitable to work for the manufacture of copperas and oil of vitriol.

D. B.—Nothing but rounded fragments of pure quartz.

J. E. E.—Fragments of clear rock crystal.

G. E. P.—It is a silicious rock, colored with iron. It is not of sufficiently fine, even texture, or absorbent enough to answer for lithography.

DeW. McB.—Ferruginous quartz with scales of black mica; of no value.

G. B. S.—A fine grained, compact argillaceous rock, slightly silicious. If it can be found abundant and homogeneous, it would answer for marble.

A. H.—Remarkably pure kaolin, which might be used for fine earthenware.

R. M. L.—It is a variety of red hematite or specular iron ore. Its gravity (which is one half that required) shows at once that it cannot be antimonial silver.

R. F.—A very fine and pure indurated clay, which ought to be put to some use.

P. S. W.—This specimen, found in Mitchell county, N. C., is not magnesia, but kaolin or decomposed feldspar.

COMMUNICATIONS RECEIVED.

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

On Universal Language. By J. S. A.

On Pressure Gages and Gage Cocks. By J. F. K.

On the Patent Laws. By J. S.

On Construction of Buildings. By H. H & Co.

On Storm Phenomena. By J. B.

On American Hones. By J. M. S.

On Spontaneous Combustion. By J. N.

On a Boiler Explosion in Kentucky. By W. T. H.

Also enquiries from the following:

E. McC.—G. F. S.—M.—M. L. D.—E. F. B.—A. H. G.—H. W. B.—B. C.—O.—W. B. B.—C. W. R.—B. F.—W. H. P—G. W. T.—J. B. H. B.—J. P. Jr.—D. H. B.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

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Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

May 13, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Alarm, electrical, H. E. Walter	138,965
Auger, earth, J. B. Christian	138,788
Awnings, painting, C. E. Wheeler	138,773
Axle and axle box, F. Hunsinger	138,800
Bag holder, Hunter & Clayton	138,754
Bale tie, cotton, McClintock & Cumberland (r)	5,404
Barrels, etc, steaming, A. K. Lee	138,810
Basket form, A. F. Scow	138,751
Bed bottom, N. O. Wilcox	138,971
Bedstead, H. D. Olds	138,756
Bedstead, folding, Bayles, Carroll & Miner	138,840
Bed-tead, sofa, C. Rossow	138,819
Belt lacing tool, F. N. Du Bois	138,740
Billiard table, G. Buntin	138,820
Blind, inside, W. Potter, Jr	138,761
Blocks, forming building, J. S. Elliott (r)	5,401
Bobbin journals, pointing, D. M. Church	138,789
Boiler, wash, H. W. Williams	138,974
Boiler, wash, Covey & Slafter	138,738
Boiler, wash, J. Cramer	138,739
Boiler feed heater, S. T. Taylor	138,957
Boiler water gage, etc., A. S. Goodrich	138,882
Bolt cutter, J. S. Ryder	138,940
Bolt heading device, W. M. Thoroughgood	138,958
Boot channel opener, F. Gussetti	138,883
Boots, etc., shank for, F. P. Buren	138,831
Boring machine, H. Pitcher	138,927
Bottles, cork for, I. B. Sampson	138,820
Box and cooler, resin, A. K. Lee	138,809
Box, work, E. Heath	138,896
Brick machine, G. C. Bovey	138,721
Brick machine, H. Martin	138,754
Bricklayer's pointer, J. S. Merriken	138,911
Bridle, safety, Elder & Bishop	138,873
Brush, paint, G. H. Chinnock	138,787
Brushes, etc., holder for, I. Smith	138,846
Buckle, J. A. Mashmeyer (r)	5,411
Burner, argand gas, T. Clough	138,838
Burner, vapor, F. G. Palmer	138,923
Butter paddle, D. L. Grover	138,800
Button attachment, H. Freeman	138,745
Button fastening, E. F. Lee (r)	5,403
Car axle box, W. W. Crane	138,794
Car brake wheel, C. A. Waterbury	138,968
Car coupling, M. Goolaven	138,748
Car coupling, H. Millard	138,912
Car, railway oil, Murray & Lamason (r)	5,406
Car seat, railway, R. J. La Mothe	138,899
Car spring, E. Myers	138,930
Car starter, S. H. & A. C. Bradley	138,848
Car truck wheel, S. Spelman	138,949
Car wheel, F. A. Fouts	138,718
Car steam power, W. W. Crane	138,753
Carriage axle iron, S. J. Deanis	138,795
Carriage, child's, T. Galt	138,716
Carriage curtain fastening, J. H. Gleason	138,799
Carriage shaft iron, W. W. Knowles	138,753

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

24,987.—Fishing Reel.—W. Billinghurst. July 23.
25,115.—Self Acting Brake.—B. S. Healy. July 30.
25,149.—Pegging Blanks.—B. F. Sturtevant. July 30.
25,166.—Fence.—J. B. Wickersham, H. Jenkins. July 30.
25,364.—Watch.—C. E. Jacot. August 20.

EXTENSIONS GRANTED.

23,399.—Harvester.—I. S. & H. R. Russell.
23,996.—Surgical Instrument.—D. Ahl.
24,009.—Tyre Upsetting Machine.—C. L. Crowell *et al.*
24,021.—Sewing Machine.—J. Gray.
24,034.—Railroad Frog.—D. D. Lewis.
24,046.—Machine for Rolling Fabrics.—T. H. Murphy.

DESIGNS PATENTED.

6,647.—Foot Rest.—R. W. & G. W. Archer, Rochester, N.Y.
6,648.—Chair.—R. W. & G. W. Archer, Rochester, N. Y.
6,649.—Knife Bolster, etc.—C. H. Crump, Boston, Mass.
6,650.—Ruffle Stand.—L. Sutro, New York city.

TRADE MARKS REGISTERED.

1,257 to 1,261.—Compound.—D. Ransom & Co., Buffalo, N.Y.
1,262.—Cutter Section.—Wood Mowing Machine Co., Hoosick Falls, N.Y.
1,263.—Colors, etc.—F. Bredt & Co., New York city.
1,264.—Woolen Goods.—G. F. Ellis, Terre Haute, Ind.
1,265.—Medical Compound.—H. W. Fuller, Chicago, Ill.
1,266.—Flour.—Gallego Mills Co., Richmond, Va.
1,267.—Polishing Material.—Coffin & Co., N. Y. city.
1,268.—Hams.—Evans, *et al.*, Cincinnati, O.
1,269.—Rice Starch.—W. J. Rand, New York city.

SCHEDULE OF PATENT FEES:

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On an application for Design (7 years)	$15
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VALUE OF PATENTS

And How to Obtain Them.

Practical Hints to Inventors

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than Fifty Thousand inventors have availed themselves of the services of Munn & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the Scientific American. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables Munn & Co. to do everything appertaining to patents better and cheaper than any other reliable agency.

HOW TO OBTAIN Patents

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to Munn & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to Munn & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

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Caveats.

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Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of fomer, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing Munn & Co., 37 Park Row, New York.

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On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee $20), or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with Munn & Co., 37 Park Row, New York, who will give prompt attention to the business and furnish full instruction.

To Make an Application for a Patent

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of Munn & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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

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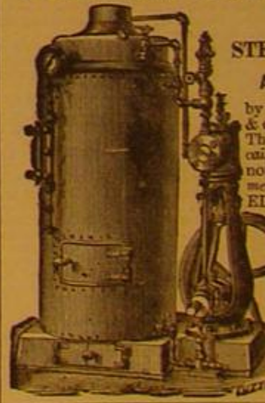

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