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AUTOMATIC STEAM ENGINE.

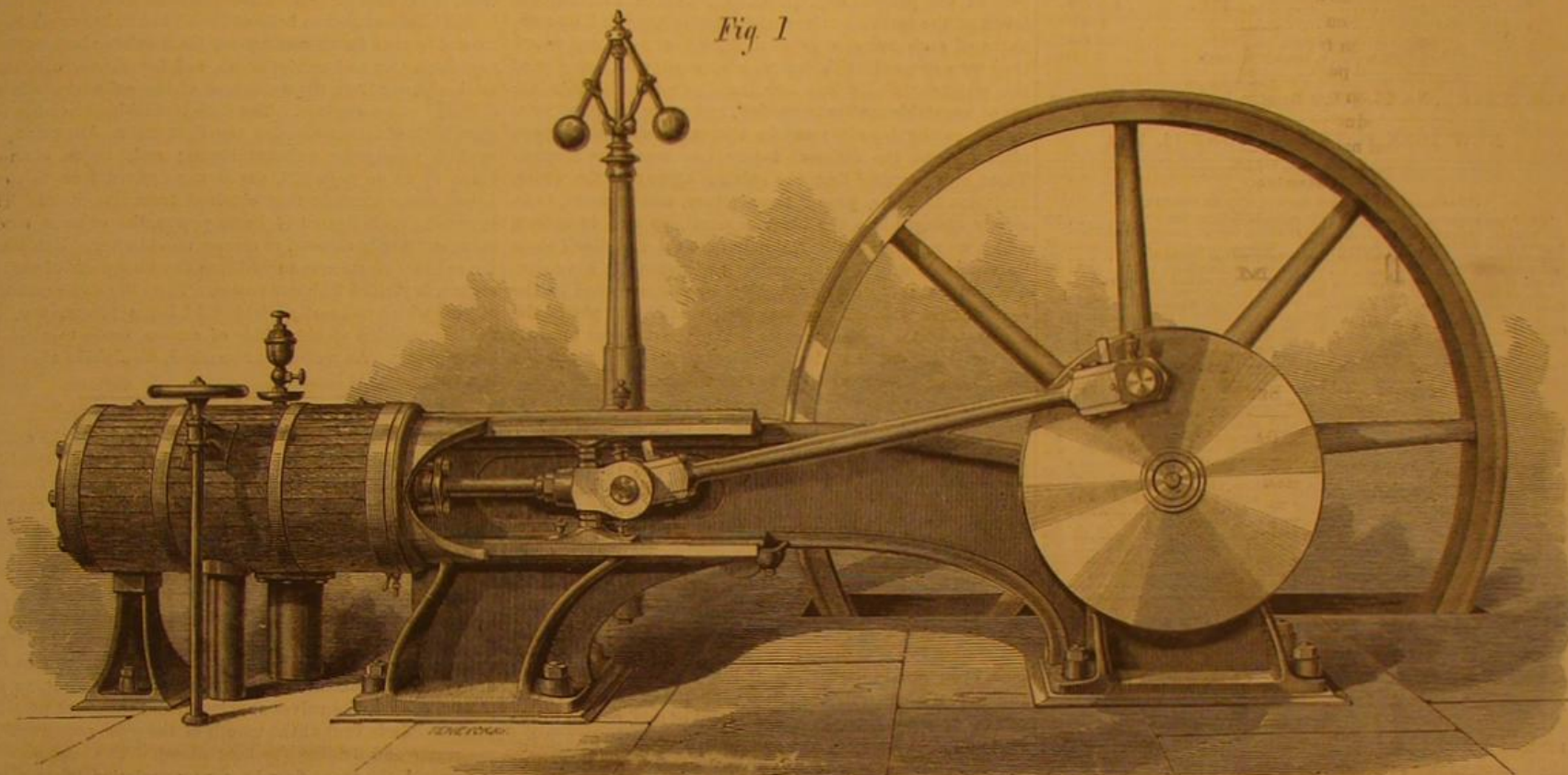
In the accompanying illustrations we present front (Fig. 1) and back (Fig. 2) views of an automatic steam engine, built at Mount Vernon, Ohio, which may be considered as the result of the first successful effort to construct, in the West, a complete machine of this description, not only combining

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

mandated 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

Fig 1



COOPER'S AUTOMATIC STEAM ENGINE.

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

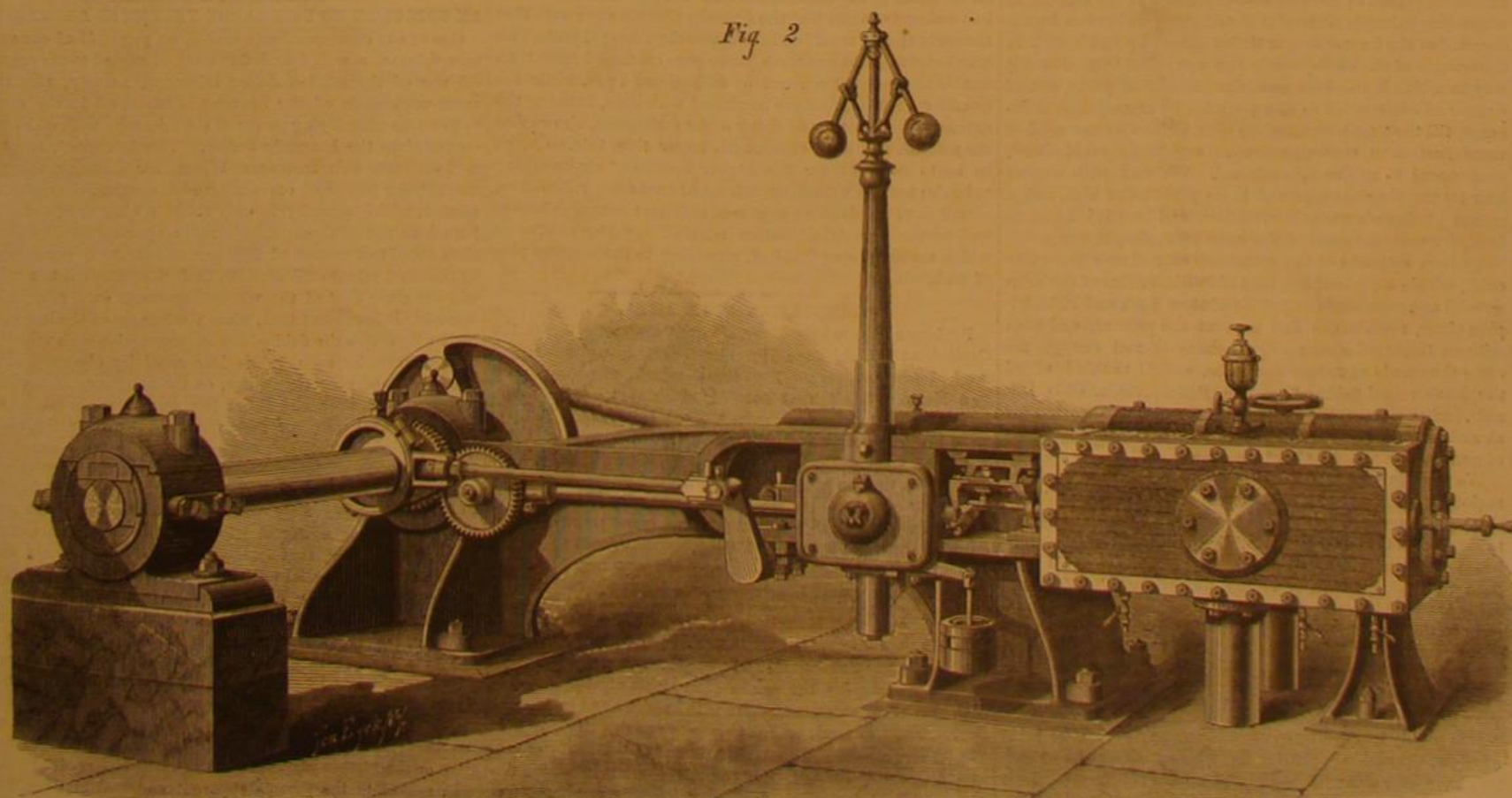
when completed it is as though the structure were of one piece. This principle of construction allows for the free expansion of the cylinder when heated by the steam, thereby avoiding all strain on the foundations, while the engine remains as perfectly in line, with the same clearances, lap, and lead, 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 de-

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 2



theoretical power of the indicator diagram, and a development of a horse power on 2.7 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.)

Air and gas engines	271
Air engine, heated	272
Answers to correspondents	273
Aurora borealis, the cause of the	274
Bisulphide of carbon	275
Borax, California	276
Business and personal	277
Coal deposits, our—Their formation and extent	278
Color making	279
Cooling water, Australian method of	280
Dray, the Belgian	281
Egg, the	282
Egypt, modern progress in	283
Fire arms, electrical	284
Fireproof floor	285
Gas-propelled boat, S.	286
Hoe, improved	287
Inventions patented in England by Americans	288
Ladder, a man with	289
Magnetism, new researches in	290
Metal industries of ancient Egypt	291
Musical blackboard, a	292
New books and publications	293
Notes and queries	294
Off the track in Ireland	295
Oil feeder, automatic	296
Patent decisions, recent	297
Patent Office, profits of the	298
Patents, official list of	299
Patents, recent American and foreign	300
Pearl fishing, Australian	301
Potato, components of the	302
Pressure gages and safety valves	303
Pulley bolt, adjustable	304
Pumping engine, beam	305
Radiator, positive circulating	306
Railway travel in Mexico	307
Renovator, portable steam	308
Sanitary notes	309
Scientific and practical information	310
Side stick and quoin, improved	311
Southern canal, the	312
Steam engine, automatic	313
Sun's heat, concentration of the	314
Tannate of soda	315
Telegraphy in the United States	316
Telescope answered, an objection to the large	317
Telescope, the million dollar	318
Tidal action and the rotation of the earth	319
Tree box, round	320
Vienna exposition, the	321
Water elevator, improved	322
Whiffletree stub	323
Wrinkle No. 3	324
Zinc in Ohio	325

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 dumb-founded 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 $4\pi r^2$, equal to $4 \times 4,000^2 \times 3.1416$, or very nearly 201,000,000 square miles, which gives nearly 4,000,000,000,000 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 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. Rutherford 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 participants 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. Lavassière *et fils*, of Paris, copper workers, display an old 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 manufac-

ture. 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 3 1/2 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 height 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 Tecnico* 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 tons. Of these Great Britain has 2,538, aggregating 2,382,145 tons, and the United States 420, of 282,150 tons.

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 develop.

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. Letaille 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 pyrogallol 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 30 tons. 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.

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 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 be-

low 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

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 equilibrium 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.

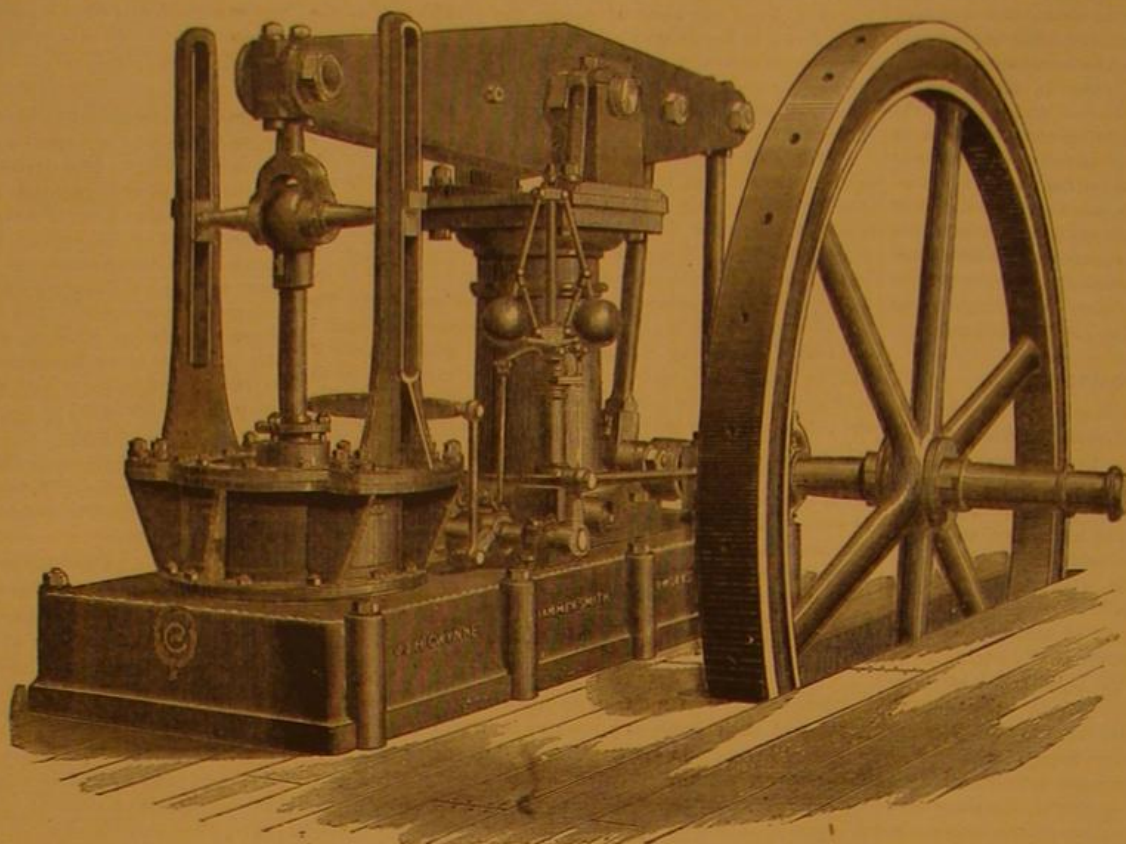
Mr. Cooke observed that air engines on this principle cannot be worked advantageously at a high pressure. The air is found to enter the working cylinder at 1127° Fah., and to leave it at 466° Fah. About 8 lbs. of coal per horse are found to be consumed per hour.

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-explosive, small prime motor.

Australian Pearl Fishing.

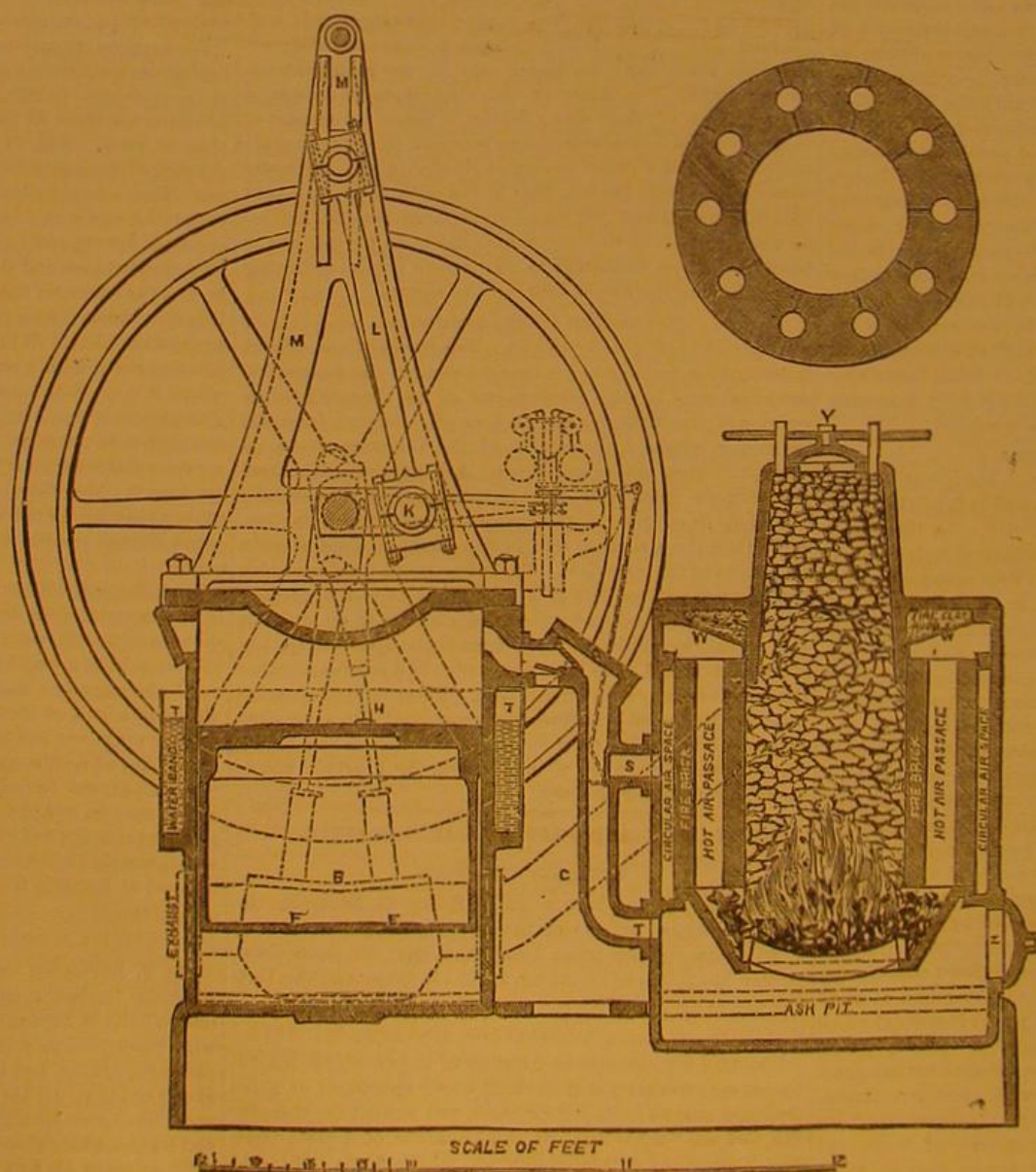
Pearl fishing on the coast of Western Australia is rapidly assuming importance, one English speculator having had no fewer than 400 Malay divers at work during the season of 1872-73. The fishing grounds lie about two to three miles from the coast. Small schooners anchor near these, and the diving takes 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.



BEAM PUMPING ENGINE.

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

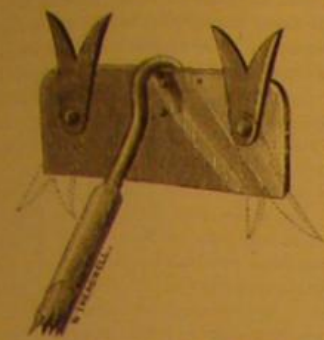


WENHAM'S HEATED AIR ENGINE.

the amount of work performed. The engine is of the steep 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

IMPROVED GARDEN HOE.

This invention is a garden hoe, provided with swinging forks, one being attached to each edge of 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. Buttle, of Mansfield, Pa.



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

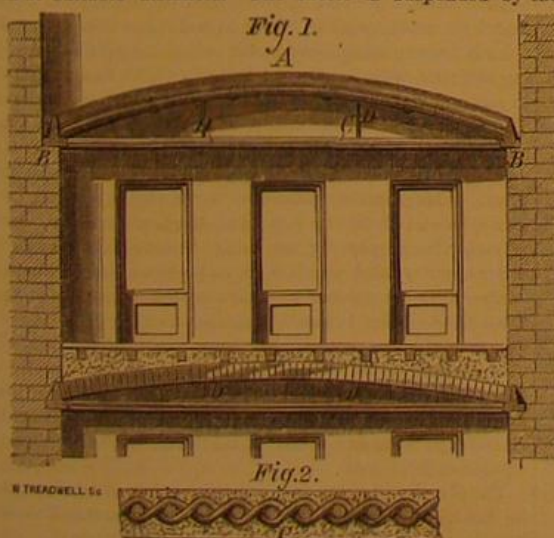
Old Mr. Watson on Nelson street has got a nice little bill to pay. He sent a man down town for a pot of paint and a ladder. The man got the paint, and then went to a lumber yard after a ladder. Then he tied the paint pot on the end of the ladder, and put the ladder on his shoulder. This was a very smart 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

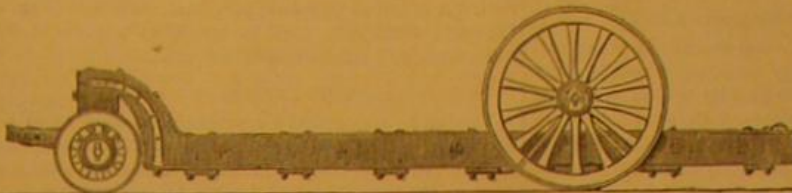


short rods, D, from above, and upon it the plaster is applied in the ordinary manner. The device is necessarily fireproof, and is said to form firm floors, incapable of transmitting sound to any considerable extent. Patented through the Scientific American Patent Agency, April 1, 1873.

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.

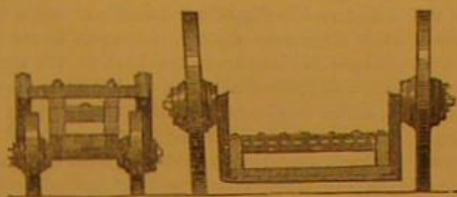
THE BELGIAN DRAY.

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 1½ 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

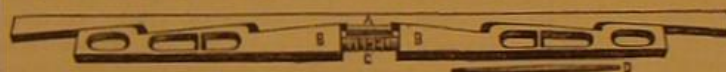


THE BELGIAN DRAY—(End Elevation).

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 height 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 Seate range, in San Bernardino county, are even more extensive. Crystals 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 metalloids. 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.—*Eng.*]



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 oesophagus, 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 care-

fully 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 of 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 Reynolds 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 23 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 pachas 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 Ismailiah canal, extending from Cairo to Ismailia, 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 air 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 calorific 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 diathermancy 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 convex-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. KINGSLEY.

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 HEBURN.
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 no 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.

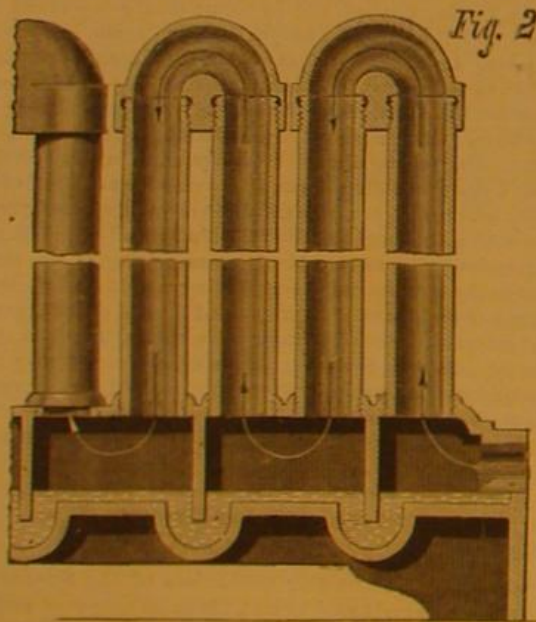
SAVING LIFE FROM SHIPWRECK.—A correspondent, H. F. E., states that Mr. E. W. Furrell's suggestion, published on page 325 of our current volume, is not new, having been anticipated by the detachable deck of Mr. Joseph Sawyer of Detroit, Michigan.

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.

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 perceptible 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.

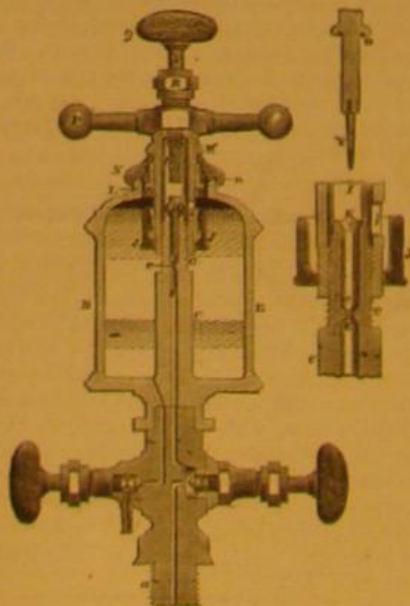
An examination of the track did not at first offer any explanation of the accident. Everything about it seemed right, save that the fish bars at one joint had given out, the bolts being broken short off. While the English passengers gathered in a knot and talked of denouncing the carelessness of the 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.

**CARR'S POSITIVE CIRCULATING VERTICAL TUBE RADIATOR.**

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.

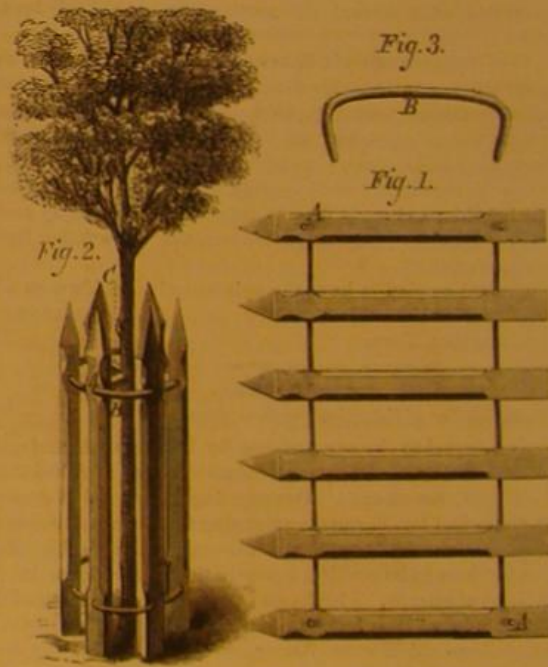
A recently patented improvement in devices for musical instruction consists of a blackboard on which are painted, in large characters, the usual notes of the musical scale. In the center of each note is a movable key, which connects behind the board with an organ. The arrangement is such that when the 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 box into 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 steady- ing 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. Bennett, 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.

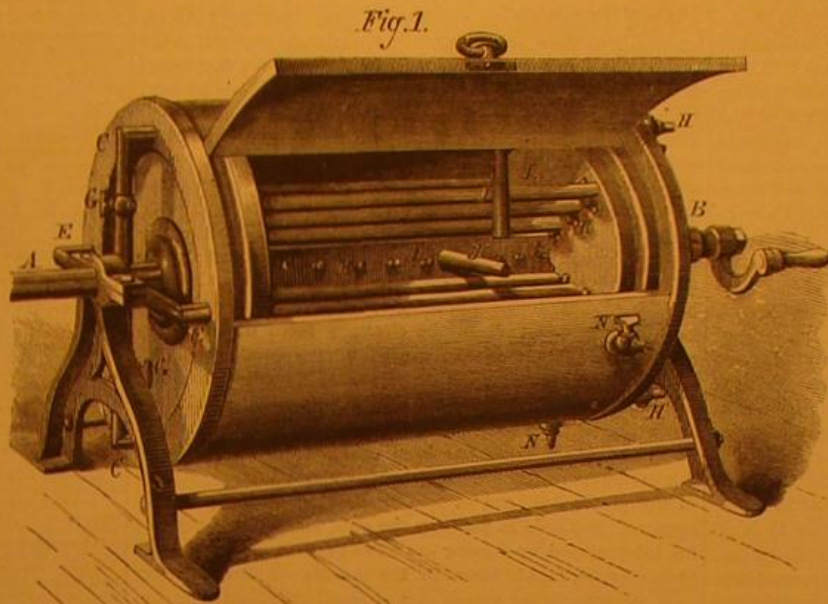
The invention represented in our illustrations is a portable apparatus for renovating carpets, hair, feathers, etc., by steam. The material to be operated upon is placed within a hollow revolving cylinder and first acted upon by steam directly distributed throughout its mass. It is then dried by the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

vent 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



PORTABLE STEAM RENOVATOR.

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.

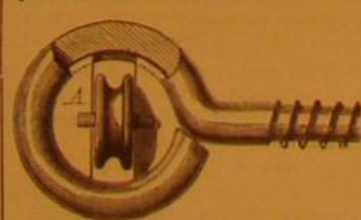
In 1871, Dr. Rogers read a paper on the subject before the American Association for the Advancement of Science. This paper attracted much attention throughout the country, and re-appeared in the New York Tribune, the Galaxy, the American Chemist, and many other scientific and popular journals. In view 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 groove 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.

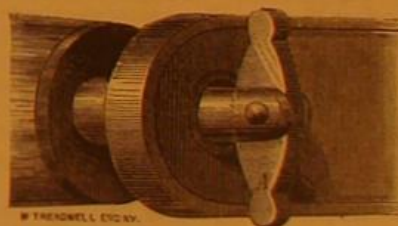


Fig. 2.



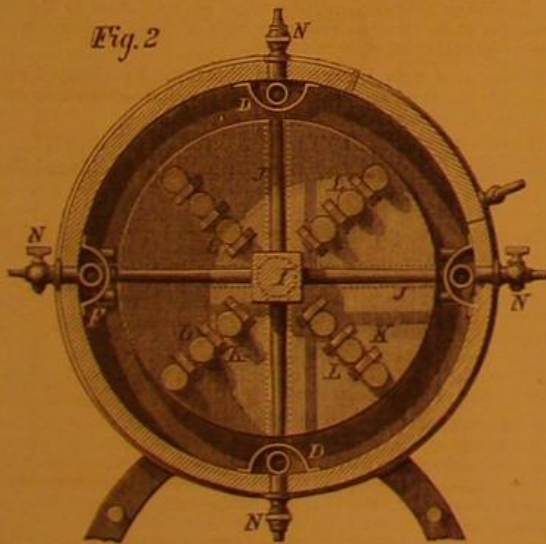
The trace can then be easily slipped on, and the button returned to a vertical position. The stub is tapered so as to cause the trace to slide against the button, and is made thicker at the point where the latter is pivoted to ensure the requisite strength. Patented October 1, 1872, by Mr. William C.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

Fig. 2.



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.

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.

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 waterscales, all these exhibited but little difference, and that was in the relative proportion of the above constituents. After futile attempts to safely pre-

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 Altamaha 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 Helderberg 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 laminae. 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 siliceous, 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 crystalline 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 crystalline masses, generally intercalated, 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 debris 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 Hamburg, 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. Petersburg, 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 NICHOLSON PAVEMENT COMPANY vs. THE CITY OF ELIZABETH & 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 Nicholson, August 20, 1867, the original of which bore date August 8, 1864.

NICHOLSON, 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 any 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 Nicholson 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 Nicholson 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 Nicholson has made.

There are strong presumptions in favor of the novelty of Nicholson'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 Nicholson for an extension of the Nicholson 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. Rodler, 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 CARTER.—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, Voshburgh, Pa.
REPAIRING VESSELS.—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 DAYNET, etc.—F. Chillingworth, Springfield, Mass.
STEAM VESSEL.—T. Wharls, 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. Barnett (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 softiron 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. Holfrich, 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 height. 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. 123,748 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 corresponding 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 gripped. 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, Lenton, 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 dog 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 blacksmith's 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. Hoag, 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 to gether 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 Insertter.

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.

Misjah 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, Acorington, 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 slot-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 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, Danversville, 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 part 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 Hauling 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. 65,765 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 spring 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 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 discharge the tomatoes. Below the rest for the can is a receptacle for the juice and 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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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 retrograde 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 height 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?



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. 23. 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. 23.—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 consistency, 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 lyes 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 Netherlandsers, as you call them, although Webster says it was formerly used by good writers for German. Both came 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: Pans, 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:
$$R = \frac{187.6}{\sqrt{H}}$$
 or
$$R = \frac{3000}{H}$$
 or the number of revolutions per minute is obtained by dividing the number 1.76 by the square root of the height of the point of suspension above the level in which the balls revolve; or, divide 3536 by this height 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 30 square inches on piston head, or 2 engines with 25 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 breakdown 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. Rutherford, 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 slide. 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 30, 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 a spring 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 height of 42° 3', the rainbow disappears below the horizon. See Ganot's "Physics," page 773 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 due 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. If 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 truck work on brick houses? 2. Also for a good cement or concrete for a walk in the garden; one that will endure cold weather? Answer: 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 asphalt 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 150 grains of permanganate of potash in five pints of water and left a few minutes until dark brown; it is next dropped, a few places at a time, into the following bleaching solution: Hypophosphite 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 decolorize, 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? Answer: 1. Baumé's hydrometer is graduated by being placed in a solution of 15 parts dry NaCl in 85 parts water, and marking this 10°. It will be found that sulphuric acid of specific gravity 1.767 stands at 66°. The following formula serves to convert Baumé into specific gravity for liquid heavier than water: $g = 152 + (152 - 20) \cdot B$. Thus if a solution stands at 20° B., we have: $g = 152 + (152 - 20) \cdot 20$, or $g = 1.15$. A comparative table is given in Morf'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 lb. 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 acceleration 32.16 . Now a body falling 25 feet will be moving at the rate of 39 feet per second at the end of fall; and $2,500 \times 39 \times 39 = 3,802,500$ 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 an other 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 elder 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 height accumulates just sufficient force to raise that body to the same height again; or, taking one foot as the unit of height and one pound as the unit of mass (and denoting the height by A , and the mass by m), we then have $m \cdot A$ 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 $(1+A)m$, and the weight required to balance this must also equal $(1+A)m$ pounds moved through one foot, or, in the case given, $25+1 \times 2500 = 62500$ foot pounds. Now it will be readily seen that, if the beam only moves through the tenth of a foot, the formula becomes $(25+0.1) \times 2500 = 62750$ 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 $25 \times 2500 = 62500$ foot pounds, and the force required to balance it will be 62500×10 , 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 tons and the fall four feet; and he solves the question as follows: $3 \times 4 \times 0.1 = 120$ tons, 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 tons? Evidently 120 tons raised through one tenth of a foot; or using the customary unit of one foot, 12 tons 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, and 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 flings 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 B. 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 $\frac{1}{2}$ 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 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 a 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 a 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 $\frac{1}{4}$ of what it wants of .5; but when the quotient is greater than .5, add $\frac{1}{4}$ 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 silica. 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.

H. 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 magnesite, 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. 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.

BEST MODE OF INTRODUCING NEW INVENTIONS.

Manufacturers and patentees of Iron and Wood Working Machines, Agricultural Implements and Household articles, can have their inventions illustrated in the SCIENTIFIC AMERICAN on favorable terms, after examination and approval by the editor. Civil and mechanical engineering works, such as bridges, docks, foundries, rolling mills, architecture, and new industrial enterprises of all kinds possessing interest can find a place in these columns. The publishers are prepared to execute illustrations in the best style of the engraving art, for this paper only. The engraving will be subject to patentee's order, after publication. (No orders executed for engravings not intended for this paper.) They may be copied from good photographs or well executed drawings, and artists will be sent to any part of the country to make the necessary sketches. The furnishing of photographs, drawings, or models is the least expensive, and we recommend that course as preferable. The examination of either enables us to determine if it is a subject we would like to publish, and to state the cost of its engraving in advance of its execution, so that parties may decline the conditions without incurring much expense. The advantage to manufacturers, patentees and contractors of having their machines, inventions and engineering works illustrated in a paper of such large circulation as the SCIENTIFIC AMERICAN is obvious. Every issue now exceeds 45,000 and the extent of its circulation is limited by no boundary. There is not a country or a large city on the face of the globe where the paper does not circulate. We have the best authority for stating that some of the largest orders for machinery and patented articles from abroad have come to our manufacturers through the medium of the SCIENTIFIC AMERICAN, the parties ordering having seen the article illustrated and described or advertised in these columns. Address

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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.....	128,963
Anger, earth, J. B. Christian.....	128,288
Awnings, painting, C. E. Wheeler.....	128,772
Axle and axle box, F. Hunsinger.....	128,800
Bag holder, Hunter & Clayton.....	128,732
Bale tie, cotton, McClintock & Cumberland (r).....	5,404
Barrels, etc., steaming, A. K. Lee.....	128,810
Basket form, A. F. Secor.....	128,751
Bed bottom, N. O. Wilcox.....	128,971
Bedstead, H. D. Olds.....	128,736
Bedstead, folding, Bayles, Carroll & Miner.....	128,840
Bedstead, sofa, C. Rossow.....	128,819
Belt lacing tool, F. N. Du Bois.....	128,740
Billiard table, G. Buntin.....	128,820
Blind, inside, W. Potter, Jr.....	128,761
Blocks, forming building, J. S. Elliott (r).....	5,401
Bobbin journals, pointing, D. M. Church.....	128,789
Boller, wash, H. W. Williams.....	128,974
Boller, wash, Covey & Blaffer.....	128,728
Boller, wash, J. Cramer.....	128,729
Boller feed heater, S. T. Taylor.....	128,587
Boiler water gage, etc., A. S. Goodrich.....	128,882
Bolt cutter, J. S. Ryder.....	128,940
Booth heading device, W. M. Thoroughgood.....	128,558
Boot channel opener, F. Gassetti.....	128,883
Boots, etc., shank for, F. Buren.....	128,831
Boring machine, H. Pitcher.....	128,927
Bottles, cork for, I. B. Sampson.....	128,820
Box and cooler, resin, A. K. Lee.....	128,809
Box, work, E. Heath.....	128,896
Brick machine, G. C. Bevey.....	128,731
Brick machine, H. Martin.....	128,734
Bricklayer's pointer, J. S. Merriken.....	128,911
Bridle, safety, Elder & Bishop.....	128,872
Brush, paint, G. H. Chinnock.....	128,787
Brushes, etc., holder for, I. Smith.....	128,544
Buckle, J. A. Mashmeyer (r).....	5,411
Burner, argand gas, T. Clough.....	128,808
Burner, vapor, F. G. Palmer.....	128,923
Butter paddle, D. L. Grover.....	128,900
Button attachment, H. Freeman.....	128,745
Button fastening, E. F. Lee (r).....	5,403
Car axle box, W. W. Crane.....	128,794
Car brake wheel, C. A. Waterbury.....	128,968
Car coupling, M. Goolaven.....	128,748
Car coupling, H. Millard.....	128,912
Car, railway oil, Murray & Lamason (r).....	5,406
Car seat, railway, R. J. La Mothe.....	128,899
Car spring, E. Myers.....	128,550
Car starter, S. B. & A. C. Bradley.....	128,848
Car truck wheel, S. Spelman.....	128,949
Car wheel, F. A. Fouts.....	128,718
Car steam power, W. W. Crane.....	128,755
Carriage axle iron, S. J. Dennis.....	128,785
Carriage, child's, T. Galt.....	128,718
Carriage curtain fastening, J. H. Olsson.....	128,799
Carriage shaft iron, W. W. Knowles.....	128,723

Cart, self-loading, H. B. Cantrell.....	138,574	Sawing machine, scroll, H. Lawrence.....	138,508
Cartridge box, T. F. Brabson.....	138,575	Screw, wood, W. Bourne.....	138,509
Ceilings, etc., Breproof, L. A. Tartiere.....	138,576	Setter, extension, C. Beatty.....	138,510
Cement, manufacture of, J. E. Park.....	138,577	Sewing machine, Koch & Brass.....	138,511
Cement, hydraulic, W. B. Tucker.....	138,578	Sewing machine, Lewis & Boothill.....	138,512
Cement, rubber, W. Mosher.....	138,579	Sewing machine, L. M. N. Wolf.....	138,513
Chair, folding, G. Hanzinger.....	138,580	Sewing machine, L. M. N. Wolf.....	138,514
Chair, spring, rocking, A. H. Ordway.....	138,581	Sewing machine, L. M. N. Wolf.....	138,515
Cheese cutter, J. Locke.....	138,582	Sewing machine, L. M. N. Wolf.....	138,516
Churn, reciprocating, O. M. Helm.....	138,583	Sewing machine, L. M. N. Wolf.....	138,517
Clothes line reel, J. Brize.....	138,584	Sewing machine, L. M. N. Wolf.....	138,518
Clothes wringer, C. E. Haynes.....	138,585	Sewing machine, L. M. N. Wolf.....	138,519
Cock, etc., stop, A. T. Waldron.....	138,586	Sewing machine, L. M. N. Wolf.....	138,520
Coffin handle, C. Strong.....	138,587	Sewing machine, L. M. N. Wolf.....	138,521
Collar, paper, C. A. Brown.....	138,588	Sewing machine, L. M. N. Wolf.....	138,522
Column, metallic, J. L. Piper.....	138,589	Sewing machine, L. M. N. Wolf.....	138,523
Converter, rolling compound, J. E. Atwood.....	138,590	Sewing machine, L. M. N. Wolf.....	138,524
Cooking vessel, L. P. & J. S. Bodkin.....	138,591	Sewing machine, L. M. N. Wolf.....	138,525
Copy holder, French & Chase.....	138,592	Sewing machine, L. M. N. Wolf.....	138,526
Core, sectional, W. A. Butler.....	138,593	Sewing machine, L. M. N. Wolf.....	138,527
Cotton lint room, W. T. Crenshaw.....	138,594	Sewing machine, L. M. N. Wolf.....	138,528
Crane, F. Farrell.....	138,595	Sewing machine, L. M. N. Wolf.....	138,529
Cultivator, D. C. Baker.....	138,596	Sewing machine, L. M. N. Wolf.....	138,530
Cultivator, W. T. Walker.....	138,597	Sewing machine, L. M. N. Wolf.....	138,531
Cultivator, wheel, J. H. Randolph, Jr.....	138,598	Sewing machine, L. M. N. Wolf.....	138,532
Curtain cord fastener, C. Gammel.....	138,599	Sewing machine, L. M. N. Wolf.....	138,533
Curtain roller, W. W. Grier.....	138,600	Sewing machine, L. M. N. Wolf.....	138,534
Dental chair, stool for, Downs & Morris.....	138,601	Sewing machine, L. M. N. Wolf.....	138,535
Digger, potato, J. D. Benfink.....	138,602	Sewing machine, L. M. N. Wolf.....	138,536
Digger, potato, L. Schaefer, Jr.....	138,603	Sewing machine, L. M. N. Wolf.....	138,537
Drawing board, Keuffel & Esser.....	138,604	Sewing machine, L. M. N. Wolf.....	138,538
Drill carriage, rock, Towne & Bailey.....	138,605	Sewing machine, L. M. N. Wolf.....	138,539
Drill bit stock, H. B. Williams.....	138,606	Sewing machine, L. M. N. Wolf.....	138,540
Drilling machine, rock, D. V. Wood.....	138,607	Sewing machine, L. M. N. Wolf.....	138,541
Ear protector, M. Isidor.....	138,608	Sewing machine, L. M. N. Wolf.....	138,542
Electro-magnetic motor, S. C. Carter.....	138,609	Sewing machine, L. M. N. Wolf.....	138,543
Engine, rotary, M. Elsasner.....	138,610	Sewing machine, L. M. N. Wolf.....	138,544
Engine, rotary steam, W. Crum.....	138,611	Sewing machine, L. M. N. Wolf.....	138,545
Engine valve, steam, A. Henry.....	138,612	Sewing machine, L. M. N. Wolf.....	138,546
Engine rotary valve, G. Westinghouse, Jr.....	138,613	Sewing machine, L. M. N. Wolf.....	138,547
Engines, steam fire, Gilbert & Topham.....	138,614	Sewing machine, L. M. N. Wolf.....	138,548
Explosive compound, T. S. Beach.....	138,615	Sewing machine, L. M. N. Wolf.....	138,549
Fan, automatic, E. Duffner.....	138,616	Sewing machine, L. M. N. Wolf.....	138,550
Fare box, H. Barsinger.....	138,617	Sewing machine, L. M. N. Wolf.....	138,551
Fence, portable, L. Gates.....	138,618	Sewing machine, L. M. N. Wolf.....	138,552
Fence, wire, H. M. Rose.....	138,619	Sewing machine, L. M. N. Wolf.....	138,553
Filling book, paper, L. H. Beckwith.....	138,620	Sewing machine, L. M. N. Wolf.....	138,554
Fire arm, J. A. Johnston.....	138,621	Sewing machine, L. M. N. Wolf.....	138,555
Fire arm, J. S. Heath.....	138,622	Sewing machine, L. M. N. Wolf.....	138,556
Fire arm charger, A. Hall.....	138,623	Sewing machine, L. M. N. Wolf.....	138,557
Fire fender, grate, etc., W. N. Hall.....	138,624	Sewing machine, L. M. N. Wolf.....	138,558
Fire kindler, A. Bushnell.....	138,625	Sewing machine, L. M. N. Wolf.....	138,559
Fireproof roofing, C. Parker.....	138,626	Sewing machine, L. M. N. Wolf.....	138,560
Fisk, molder's, C. Truesdale.....	138,627	Sewing machine, L. M. N. Wolf.....	138,561
Folder, binding, E. P. West.....	138,628	Sewing machine, L. M. N. Wolf.....	138,562
Furnace, steam boiler, M. A. Foster.....	138,629	Sewing machine, L. M. N. Wolf.....	138,563
Game table, F. Uebel.....	138,630	Sewing machine, L. M. N. Wolf.....	138,564
Gas fixture, G. G. Sheldon.....	138,631	Sewing machine, L. M. N. Wolf.....	138,565
Gas pipe machine, J. S. Patric.....	138,632	Sewing machine, L. M. N. Wolf.....	138,566
Gate, farm, H. W. Mullennex.....	138,633	Sewing machine, L. M. N. Wolf.....	138,567
Generator, etc., carbolic acid, J. Matthews.....	138,634	Sewing machine, L. M. N. Wolf.....	138,568
Generator, gas, J. S. Wood.....	138,635	Sewing machine, L. M. N. Wolf.....	138,569
Generator, steam, W. W. Crane.....	138,636	Sewing machine, L. M. N. Wolf.....	138,570
Generator, steam, W. W. Crane.....	138,637	Sewing machine, L. M. N. Wolf.....	138,571
Generator, steam, M. T. Davidson.....	138,638	Sewing machine, L. M. N. Wolf.....	138,572
Gold and silver, separating, Rowag et al.....	138,639	Sewing machine, L. M. N. Wolf.....	138,573
Governor, etc., heat, F. E. Chatard, Jr.....	138,640	Sewing machine, L. M. N. Wolf.....	138,574
Hammer, bush, E. J. Worcester.....	138,641	Sewing machine, L. M. N. Wolf.....	138,575
Harrow and seeder, L. G. Jackson.....	138,642	Sewing machine, L. M. N. Wolf.....	138,576
Harvester, J. D. Wilber.....	138,643	Sewing machine, L. M. N. Wolf.....	138,577
Harvester, clover, D. B. Branton.....	138,644	Sewing machine, L. M. N. Wolf.....	138,578
Harvester knives, sharpening, J. S. Elliott.....	138,645	Sewing machine, L. M. N. Wolf.....	138,579
Harvester attachment, T. Webb.....	138,646	Sewing machine, L. M. N. Wolf.....	138,580
Hat press, R. Eickemeyer.....	138,647	Sewing machine, L. M. N. Wolf.....	138,581
Hay carrier, E. B. Tanner.....	138,648	Sewing machine, L. M. N. Wolf.....	138,582
Heater, fire, F. Stratton.....	138,649	Sewing machine, L. M. N. Wolf.....	138,583
Heater, steam, G. B. Higgins.....	138,650	Sewing machine, L. M. N. Wolf.....	138,584
Holst, O. T. McIntosh.....	138,651	Sewing machine, L. M. N. Wolf.....	138,585
Holst, G. Stanchiff.....	138,652	Sewing machine, L. M. N. Wolf.....	138,586
Holting wheel, J. C. Marshall.....	138,653	Sewing machine, L. M. N. Wolf.....	138,587
Hook, snap, S. Reynolds.....	138,654	Sewing machine, L. M. N. Wolf.....	138,588
Horse power, W. P. Emerson.....	138,655	Sewing machine, L. M. N. Wolf.....	138,589
Hose, hydraulic, L. B. Blake.....	138,656	Sewing machine, L. M. N. Wolf.....	138,590
Hose, hydraulic, L. B. Downing.....	138,657	Sewing machine, L. M. N. Wolf.....	138,591
Hubs, boring, J. Eisenmann.....	138,658	Sewing machine, L. M. N. Wolf.....	138,592
Jelly glasses, lid for, J. Adams.....	138,659	Sewing machine, L. M. N. Wolf.....	138,593
Jelly glasses, lid for, D. Chailleur.....	138,660	Sewing machine, L. M. N. Wolf.....	138,594
Journal box, J. R. Morris.....	138,661	Sewing machine, L. M. N. Wolf.....	138,595
Klin, brick, A. W. M. Maass.....	138,662	Sewing machine, L. M. N. Wolf.....	138,596
Knobs, manufacture of door, J. Otter.....	138,663	Sewing machine, L. M. N. Wolf.....	138,597
Ladder, step, S. Wright.....	138,664	Sewing machine, L. M. N. Wolf.....	138,598
Lamp, C. Mayer.....	138,665	Sewing machine, L. M. N. Wolf.....	138,599
Lamp, candle, J. A. Pease.....	138,666	Sewing machine, L. M. N. Wolf.....	138,600
Lantern, G. B. Ishan.....	138,667	Sewing machine, L. M. N. Wolf.....	138,601
Latch, reversible, W. T. Munger.....	138,668	Sewing machine, L. M. N. Wolf.....	138,602
Latch handle plate, F. Corbin.....	138,669	Sewing machine, L. M. N. Wolf.....	138,603
Leather dressing machine, J. A. Enos.....	138,670	Sewing machine, L. M. N. Wolf.....	138,604
Leather skiving machine, E. B. Stimpson.....	138,671	Sewing machine, L. M. N. Wolf.....	138,605
Liquids, freezing, F. Sajno.....	138,672	Sewing machine, L. M. N. Wolf.....	138,606
Liquors, improving, Wolters et al.....	138,673	Sewing machine, L. M. N. Wolf.....	138,607
Lock cutting machine, L. L. Penney.....	138,674	Sewing machine, L. M. N. Wolf.....	138,608
Loom stop mechanism, Isherwood et al.....	138,675	Sewing machine, L. M. N. Wolf.....	138,609
Mandrel, expanding, J. D. Smith.....	138,676	Sewing machine, L. M. N. Wolf.....	138,610
Marine scale, G. F. Abraham.....	138,677	Sewing machine, L. M. N. Wolf.....	138,611
Meats, curing, L. A. Atkinson, (r).....	138,678	Sewing machine, L. M. N. Wolf.....	138,612
Medical compound, D. Parlow.....	138,679	Sewing machine, L. M. N. Wolf.....	138,613
Metallic molds, casting, J. Williams.....	138,680	Sewing machine, L. M. N. Wolf.....	138,614
Motion, frame stop, A. I. Earle.....	138,681	Sewing machine, L. M. N. Wolf.....	138,615
Motor, M. Comstock.....	138,682	Sewing machine, L. M. N. Wolf.....	138,616
Nails, assorting, B. Revelander.....	138,683	Sewing machine, L. M. N. Wolf.....	138,617
Paddle wheel, J. C. Chaffee.....	138,684	Sewing machine, L. M. N. Wolf.....	138,618
Paddle wheels, feathering, A. Lefebvre.....	138,685	Sewing machine, L. M. N. Wolf.....	138,619
Painting broom handles, etc., S. A. Shepard.....	138,686	Sewing machine, L. M. N. Wolf.....	138,620
Paper bag machine, L. D. Benner.....	138,687	Sewing machine, L. M. N. Wolf.....	138,621
Pencil sharpener, A. E. Schatz.....	138,688	Sewing machine, L. M. N. Wolf.....	138,622
Piano pedal attachment, G. C. A. Class.....	138,689	Sewing machine, L. M. N. Wolf.....	138,623
Picture frame, H. S. Hale.....	138,690	Sewing machine, L. M. N. Wolf.....	138,624
Piles, etc., sinking, F. E. Sicksle.....	138,691	Sewing machine, L. M. N. Wolf.....	138,625
Pipe or car coupling, A. G. Story.....	138,692	Sewing machine, L. M. N. Wolf.....	138,626
Pipe tips, milling, A. B. Weiss.....	138,693	Sewing machine, L. M. N. Wolf.....	138,627
Planter, hand corn, J. Preston.....	138,694	Sewing machine, L. M. N. Wolf.....	138,628
Plow, Jackson & Childs.....	138,695	Sewing machine, L. M. N. Wolf.....	138,629
Plumb bob, G. B. Cowles.....	138,696	Sewing machine, L. M. N. Wolf.....	138,630
Pottery stock, preparing, S. B. Thompson.....	138,697	Sewing machine, L. M. N. Wolf.....	138,631
Press, glass, J. Haley.....	138,698	Sewing machine, L. M. N. Wolf.....	138,632
Press, etc., hay, W. H. McBurney.....	138,699	Sewing machine, L. M. N. Wolf.....	138,633
Printer's chase, E. A. Warren.....	138,700	Sewing machine, L. M. N. Wolf.....	138,634
Projectile, explosive, F. A. Markey.....	138,701	Sewing machine, L. M. N. Wolf.....	138,635
Railroad frog, W. B. Atkinson.....	138,702	Sewing machine, L. M. N. Wolf.....	138,636
Railroad switch, J. B. Adams.....	138,703	Sewing machine, L. M. N. Wolf.....	138,637
Railway snow plow, J. W. Arnold.....	138,704	Sewing machine, L. M. N. Wolf.....	138,638
Razor stop, O. B. Howard, (r).....	138,705	Sewing machine, L. M. N. Wolf.....	138,639
Receptor, J. O. Belknap.....	138,706	Sewing machine, L. M. N. Wolf.....	138,640
Rockers for chairs, F. J. Welsh et al.....	138,707	Sewing machine, L. M. N. Wolf.....	138,641
Rowlock, G. C. Wilen.....	138,708	Sewing machine, L. M. N. Wolf.....	138,642
Rodder, etc., boom, L. W. Pond.....	138,709	Sewing machine, L. M. N. Wolf.....	138,643
Rudder, J. W. Van Fani.....	138,710	Sewing machine, L. M. N. Wolf.....	138,644
Sash cord guide, W. Shaw.....	138,711	Sewing machine, L. M. N. Wolf.....	138,645
Sash, window, W. L. McDowell.....	138,712	Sewing machine, L. M. N. Wolf.....	138,646
Sash, window, D. W. Noyes.....	138,713	Sewing machine, L. M. N. Wolf.....	138,647
Sawdust for use, preparing, F. H. Snyder.....	138,714	Sewing machine, L. M. N. Wolf.....	138,648

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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.

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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.

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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 instructions.

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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SCIENTIFIC AMERICAN

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

Vol. XXVIII.--No. 25.
[NEW SERIES.]

NEW YORK, JUNE 21, 1873.

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IN ADVANCE.

NEW DOUBLE SPINDLE DRILL.

We present herewith an engraving of a spindle drill which has been recently introduced into the market, and which, we learn, is coming largely into use for locomotive and railroad shops. The chief point of advantage to be noted is that both drills, having an automatic feed, can be attended by a single workman. The drills are also entirely independent of each other, and both can be moved to either end or any point in the frame. The table is so arranged as to rise

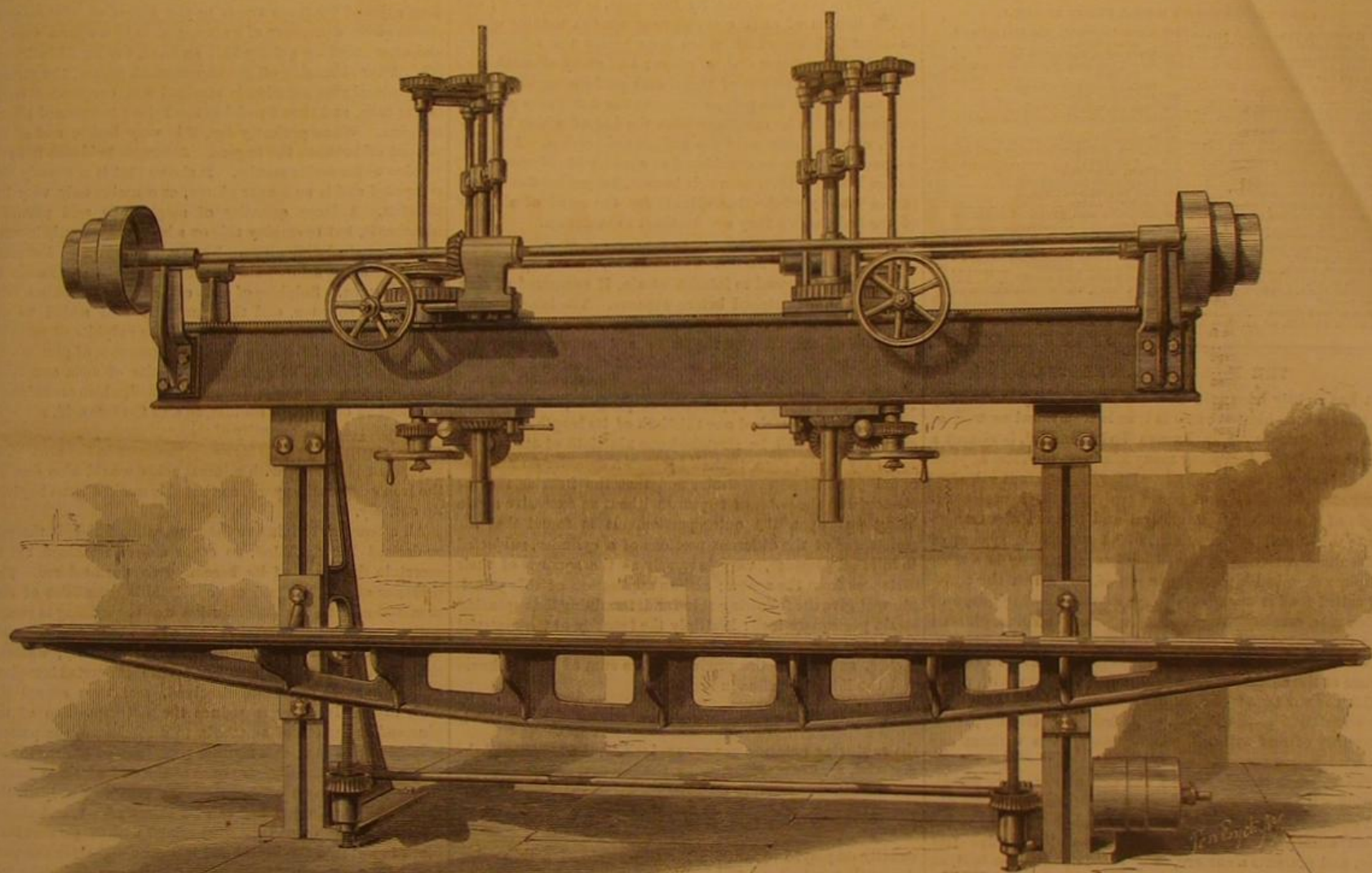
Patent Bath Tub for Birds.

The shyness of birds in performing their ablutions is well known; but until A. D. 1873, no inventor has applied his powers in behalf of the feathered tribe, and they have been obliged to wash themselves in public. Cage birds have especially suffered in this respect, but, if their owners are sensible, they will suffer no longer. Mr. G. T. Peters, of Jersey City, N. J., has lately patented a bath tub for birds, in which a hood covers the water dish. The entrance is at

which, when the vessel is being emptied of its liquid, are pressed upon by the ball, thus holding the lid in place. On the side of the pot is made a projection, to which a handle is applied and the utensils thus readily tilted. Patented Sept. 17, 1872, by Mr. W. W. Tice, of California, Ohio.

The Origin of Mountains.

Professor James D. Dana contributes to the *American Journal of Science and Arts* a very learned treatise on some



NEW DOUBLE SPINDLE DRILL.

and fall to suit the work to be operated upon. The tool is claimed to have all the advantages of two complete drill presses. The side frames of a locomotive may be placed upon the table against an angle plate, and all the holes, for nine feet, drilled without moving the work; this, we understand, has been accomplished. The table is made long enough to move the locomotive frame on end to drill the balance of the holes.

The machine has also been found to save a great amount of labor in drilling the bottom rings around the locomotive boiler furnace, where many holes have to be placed. It is stated, by a party using two of these drills, that one man is running all four of the spindles on water bottoms.

To Mr. W. S. Hudson, superintendent of the Rogers Locomotive and Machine Works, is due the credit of having suggested the idea and produced the plans which were the original of this machine. For further information address Hilles & Jones, makers of machinists' tools, Wilmington, Del.

An Invention Wanted.

A correspondent, L. L. B., says: "Plowshares, as now used, are enough to make any farmer complain, especially if they are steel ones, which are generally ruined after being sharpened once. The cast steel ones will not scour in black lands. Why could not the share be made smaller, so that it would not be necessary to weld a plate of iron on it? The share and point might be made of two pieces, and the point used in some way to fasten the share. Plugs or wedges could be used instead of bolts, which are so placed that they are hard to unscrew. Would not such a contrivance be as successful as the movable saw teeth? I think so. If such a thing could be made, it would be one of the most paying inventions."

one end only, and birdy creeps therein, as into a diminutive bath room, to enjoy a swim, without spattering the cage, in water not soiled by matter falling from the perches.

IMPROVED COOKING VESSEL.

This is an ingenious device, which may be easily arranged



in connection with any ordinary pot, serving to retain the lid while draining the water from the contents. It consists in attaching to the cover two lugs or ears, A, by which the ball is supported in convenient position for grasping, and

results of the earth's contraction from cooling, including a discussion of the origin of mountains and the nature of the earth's interior. In speaking of the kinds and structure of mountains, he draws a hitherto neglected distinction between: 1. A simple or individual mountain range or mass which is the result of one process of making, like an individual in any process of evolution, and which may be distinguished as a monogenetic range being one in genesis; and 2. A composite or polygenetic range or chain made up of two or more monogenetic ranges combined. The Appalachian chain—the mountain region along the Atlantic border of North America—is a polygenetic chain and consists of several other ranges, principal among which are the Green Mountains, the Alleghenies and the Highland, including the Blue Ridge and Adirondacks. Of these the first was completed essentially after the lower silurian era, the second immediately after the carboniferous era, and the third are pre-silurian in formation.

Mountain making is shown to be very slow work. After the beginning of the primordial, the first period of disturbance of North America of special note was that at the close of the lower silurian, when the Green Mountains were finished. This interval between the beginning of the primordial and the metamorphism of the above range was at least 10,000,000 years. The next epoch of great disturbance in the same Appalachian region was that at the close of the carboniferous era, in which the Alleghenies were folded up; and altogether it is stated that the Appalachians were at least 35,000,000 years in making. The displacements of the Connecticut river sandstone and the accompanying igneous ejections, which occurred before the cretaceous era, took place for some 7,000,000 years after the Appalachian revolution. Thus it is demonstrated that the lateral pressure resulting from the earth's contraction required an ex-

ceedingly long era in order to accumulate force sufficient to produce a general yielding and plication or displacement of the beds, and to start off a new range of prominent elevations over the earth's crust.

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Contents.

(Illustrated articles are marked with an asterisk.)

A B C process, the	282	Magnetic needle, the diurnal vari-	288
American Institute fair, the	282	ation of the	288
Anaesthetics	282	Mountains, the origin of	288
Answers to correspondents	282	New York city North River traf-	288
Bath tub for birds	282	fic, the	288
Belt, a new preventive for ship-	282	Nickel plated specimen	288
ping	282	Notes and queries	288
Belt, the power transmitted by	282	Patents, official list of	288
Boiler explosion at Syracuse	282	Patents, recent American and for-	288
Business and personal	282	reign	288
Canal in Scotland, ship	282	Perfumery and the sense of smell	288
Carmine, manufacture of	282	Planet between Mercury and the	288
Chicago Industrial exposition, the	282	sun, the	288
Chlorates for calico printing	282	Plow, improved	288
Cooking vessel, improved	282	Pneumatic foundations	288
Cooking vessel, improved	282	Salt deposits of Canada	288
Decision, a common sense	282	Sanitary notes	288
Digestive apparatus, the	282	Scientific and practical informa-	288
Diseases, prevention of artisans	282	tion	288
Diving bells	282	Ship construction, iron	288
Electricity on metals, the effect of	282	Silk worms	288
Elevator, car and passenger	282	Spectroscope simplified, the	288
Envelope, lock	282	Spindle drill, double	288
Fire escape, a new	282	Spindle step, improved	288
Gelatin, preparation of	282	Sun's heat, the concentration of	288
Hallmarks at St. Louis, Mo., &c.	282	the	288
Horse power	282	Tanite grinder and table	288
Iguana or tree lizard	282	Telegraph in Austria, the	288
Invention wanted, an	282	Thick cylinders	288

THE DIGESTIVE APPARATUS.

It has rightly been said that the greatest object of study for man is man himself; this is true in a physical as well as in a moral sense. The human body, indeed, is almost a universe in itself, including many kinds of physical apparatus, statical, dynamical, hydraulic, chemical, optical, electrical, etc. The system of bones and muscles gives an example of the most perfect statical and dynamical arrangement; the heart, arteries, etc., of an admirable system of hydraulic contrivances; the digestive apparatus is a most complete chemical laboratory in itself, by which the material called food is metamorphosed into the living tissue of which man consists. We have, on a former occasion, glanced over the most striking features of man's hydraulic system, of which the heart is the main organ; let us now take a glance at the chemical laboratory which we carry with us, of which the stomach is the main organ, and which, as well as the circulation of the blood, is carried on incessantly, independently of our will and, when perfect, even without our knowledge.

The stomach is only one of the organs necessary for digestion. This operation, indeed, commences in the mouth, and extends nearly throughout the whole length of the so-called alimentary canal, which is about twenty-five feet long, and presents a surface, to be acted upon by the food, of some 4,000 square inches. In the mouth the food undergoes two operations, one mechanical and another chemical. The movements of the teeth, aided by the tongue, grind it up into small particles of proper size, while the simultaneous intermixture of the liquids secreted from three pair of salivary glands constitute the first chemical operation. Coated with a glary juice, the food passes along the oesophagus into the stomach (which is only an expansion between the oesophagus and the duodenum); this consists of three coats, one mucous, one muscular, and one serous, which is exterior. The interior or mucous coat has a velvety appearance, and is folded in wrinkles, so as to admit of much extension. When thus extended, certain appendages are stimulated and secrete three more liquids required for digestion. They are the gastric, pancreatic, and biliary juices.

The chemistry of these different agents, in the process of digestion has, during our time, been most minutely investigated. The saliva consists of a mixture of liquids, which differ for each of the three pairs of glands from which they originate; to these a fourth liquid is added, the buccal, proceeding from the lining membrane of the whole mouth; this mixture has the capacity of changing starch into grape sugar and, further, into lactic acid, which is essential to normal digestion. At the same time, the atmospheric oxygen is entangled in the saliva during mastication, and exerts an important influence in promoting the action of the saliva and gastric juice in the stomach.

The practical lesson which we draw from these well established facts are most important in a hygienic point of view. It deeply impresses us with the importance of well chewing our food, and with the injury which we do ourselves by eating hastily, by washing down imperfectly masticated food with water, tea, coffee, or something worse, and (which is the most injurious of all) by indulging in the bad habit of spitting, and thus intentionally wasting one of the main substances required for a healthy digestion. The result of the latter habit is a reduced quantity of urine secreted by the

kidneys, and a consequent increase of the saline ingredients in the saliva, the salivary glands being thus induced to take up part of the functions of the kidneys; and, as Dr. John W. Draper very forcibly remarks, the dirty habit of profuse spitting results in "a partial conversion of the mouth into an urinary aqueduct."

Another important fact has been discovered by physiologists, namely, that the saliva of an infant, before it has its teeth, is incapable of converting starch into sugar. This explains at once why all attempts of substituting farinaceous food in place of mother's milk, in the case of infants, invariably fail; such children cannot digest starch, and are underfed, or even starved, dying finally of marasmus. Starch, arrowroot, sago, tapioca, etc., are useless, because indigestible, for children before they have cut their teeth.

The gastric juice, which is the principal ingredient for digestion, consists chiefly of the solution of a substance which has been called pepsin, and is remarkable from the fact that it contains nearly two per cent of nitrogen, a larger amount than any other substance in the body. The gastric juice behaves, chemically, like a very strong acid, dissolving zinc and iron under evolution of hydrogen; and its digestive power is impeded by the presence of any alkaline salt, while it is increased by the presence of fat.

The interior mucous membrane of the stomach, in which this gastric juice performs its functions, is reticulated; and at the bottom of each compartment are the mouths of the so-called follicles which, when seen under the microscope, resembles the fingers of a glove; and every stomach contains perhaps a million of them, each performing its absorbent function, as the polype extracts the nutritious parts of the food which he envelopes with the bag of which he consists, rejecting afterward the undigested portion. A human stomach may thus be considered as a colony of polypæ, which do not labor for their own sole benefit, but (under the control of the vitality of the individual) for the good of all, and of the body which they are destined to maintain.

THICK CYLINDERS.

A cylinder exposed to internal strain, if composed of elastic material, is stretched before rupture. The inner portion of the cylinder is stretched more than the outer; and the amounts of extension of the inner and outer portions will vary as their lengths. For instance: if the outer circumference of a cylinder is three times as great as the inner circumference, and, by the application of pressure, the inner circumference is stretched one thirtieth of its length, the outer circumference will be stretched one ninetieth of its length. It is easy to see, then, that all parts of a cylinder do not bear equal portions of the strain, and that the interior may be stretched to the point of rupture without an excessive strain being put upon the outer portion. It is found that the resistances of the different portions of a cylinder, subjected to internal pressure, vary inversely as the squares of their distances from the center; and an application of this principle will give the following rule for determining the rupturing strain per square inch: Multiply the tenacity of the material in pounds per square inch by the thickness of the cylinder in inches, and divide the product by the sum of the thickness and the internal radius in inches.

This rule may be thus expressed: $P = \frac{T \times t}{r + t}$, where P is the rupturing pressure per square inch, T, the tenacity of the material, t, the thickness, and r, the internal radius. Where the thickness is small in comparison with the internal diameter, $\frac{T \times t}{r + t}$ is nearly equal to $\frac{T \times t}{r}$, which is the formula usually employed to find the bursting strain of a thin cylinder, such as a boiler. This will give a good idea of the distinction between thin and thick cylinders.

In our columns of "Answers to Correspondents" in this issue will be found a question relating to thick cylinders. The dimensions given are: T=16,000, t=5, r=4; and by an application of the rule, we find the rupturing pressure per square inch to be $\frac{16,000 \times 5}{4 + 5} = 8,888.9$ lbs. By increasing the thickness of this cylinder, the strength is increased very slowly in comparison; and it is a very common practice, in constructing thick cylinders, to place bands on the outside, to compensate for the small resistance to rupture offered by this portion.

PNEUMATIC FOUNDATIONS.

Colonel James B. Eads, well known to our readers as the engineer of the St. Louis bridge and other important structures, addresses a letter to *Engineering*, in which he takes issue with Colonel Roebling regarding some statements relative to the pneumatic foundations of the East River bridge, made by the latter gentleman in a pamphlet recently published. The disputed point relates to the position of the air lock within the shaft in the caisson, it being placed at the bottom and within the air chamber, making ingress and egress much more convenient than by any previous method, rendering it unnecessary to make the shaft airtight, and, besides, having many other advantages which need not here be enumerated. The idea of this improvement is, by Colonel Roebling, ascribed to Lord Cochrane, whom he states proposed it in 1831, and also to Wm. Bush and G. Pfannmuller, who subsequently brought it forward at intervals of some ten years; but he adds: "It remained for Captain Eads, in his St. Louis caissons, to make the first practical application of the same on a really large scale in this country."

Colonel Eads, in contradicting the above, asserts that Colonel Roebling appropriates his plans without acknowledgment, and then leads the public to suppose that they are the

same as introduced by Pfannmuller nineteen years ago. He claims the origination of the idea, and not its mere application, and hence considers that Colonel Roebling does him an injustice in not giving him the credit to which he is justly entitled.

THE PREPARATION OF GELATIN.

In the ordinary manner of making light-colored gelatin, thin skins, sinews, cartilages, and bones are employed, which must be treated with muriatic acid and lime before being dissolved. These have furnished a good article, but at a high price. The expense of this process therefore induced F. Henze of Berlin to thoroughly investigate the subject of its manufacture in the hope of producing an equally good article at a lower price. The material employed was the brown, or almost black, glue of very poor quality, which is a by-product in a Berlin neatfoot oil manufactory, and which sells for \$5 per hundredweight. This substance does not swell up in cold water like glue, but forms a gummy mass, dissolving as a thick, sirupy liquid, not very adhesive but resembling that of which printers' rollers are made. It is now used only in making cardboard and as a dressing for very dark-colored fabrics.

In preparing this glue, the feet are first freed from hoofs and the more solid bones of the leg, which are used for turning into buttons and ornaments, and washed. They are then exposed for three hours to the action of superheated steam under a pressure of 2 atmospheres in a closed vessel; and after standing quietly half an hour, the liquid is drawn off. After skimming off the supernatant grease, the strong ammoniacal glue solution is strained and evaporated on a steam bath, and then furnishes the before mentioned blackish glue. When perfectly dry, it is very brittle and easily rubbed off between the fingers. Attempts to bleach it have yielded unfavorable results. It shows that it is already decomposed and is no longer gluten, or contains only very little of it. A large quantity of sulphurous acid partially bleaches it, but to employ this on a large scale would involve many technical difficulties. The fragile apparatus for making sulphurous acid would soon be broken in the hands of the workmen. Sulphite of soda could be dissolved in a very dilute glue solution, and then muriatic acid added to decompose this salt, if the quantity of the sulphite of soda required were not too large; but 50 kilogrammes of glue would require at least 2,500 grammes sulphite of soda and 2,250 grammes muriatic acid. The salts formed, which are sulphate of soda and chloride of sodium, as also the free acid, would in no case increase the quantity of glue, but on the contrary would render it utterly useless for many purposes in the arts. The process of bleaching with mineral acids would also destroy the iron evaporating pans, so that this method must be given up entirely.

All attempts at giving to the glue, when finished, the color desired having failed, no other course remained but to ascertain the cause of its becoming so dark-colored. The presence of sulphur and of considerable quantities of ammoniacal salts in the glue solution was too striking to escape notice very long. They could only have been caused by allowing the steam to act too long and too violently, whereby not only were the cartilages and gristle converted into glue, but the hair too had been dissolved, and thus caused the dark color. In order to reduce the decomposition of the glue and formation of ammonia to a minimum, the process may be varied in such a manner that, instead of drawing off the contents of the digester once at the end of three hours, they shall be drawn off hourly. On standing a little, the grease rises to the top and can be skimmed off, and then a quantity of fresh wood charcoal mixed with 25 per cent bone black is put into the liquid and left over night for the purpose of absorbing ammonia and other impurities. The following morning it is heated to the temperature at which gelatin melts, about 70° to 85° Fahr., strained and evaporated to the desired consistency. The amount of charcoal necessary is about 4 per cent of the quantity of glue in solution. The odor given off by evaporation after it has been purified with charcoal is quite pleasant and resembles that of *bouillon* soup, while that given off by the former method is one of the most disagreeable smells that ever polluted the atmosphere.

Glue prepared in this way answers all the requirements of a first class article. Even in thick layers the color is a pale wine yellow, and it possesses a high degree of elasticity. It has neither smell nor taste; and being always prepared from fresh material, it can be employed for all the purposes of so-called gelatin.

THE SPECTROSCOPE SIMPLIFIED.

Professor C. A. Young of Dartmouth College has recently made some interesting experiments in substituting fine ruled metallic plate in place of the prisms in a solar spectroscopy designed for the observation of the solar prominences through the C line. The grating was ruled on spectrum metal by Mr. Rutherford of this city, the lines being $\frac{1}{1000}$ of an inch apart and the ruled surface covering something over a square inch. Professor Young says: "Combining this with the collimator and telescope of a common chemical spectroscopy, we get an instrument furnishing a spectrum of the first order, in which the D lines are about twice as widely separated as by the flint glass prism of 60° belonging to the original instrument. In the neighborhood of C, the dispersion is nearly the same as would be given by four prisms." The outline of the chromosphere and the forms of the prominences were as well seen, both in spectra of the first and third order, as with the ordinary instrument. The spectra are somewhat fainter but their appearance is not injured.

President Morton of the Stevens Institute, informs us that

he has also tested a similar ruled plate with like satisfactory results. He suggests that, the ruled plates may be duplicated by electrotyping, and thus readily furnished by opticians at a price far below the expense of a train of prisms. If so, the production of spectroscopes at a very low price may be expected, and all who desire may possess them.

THE CHICAGO INTER-STATE INDUSTRIAL EXPOSITION.

New York is to have the yearly American Institute Fair, and, sometime in the future, a perpetual Industrial Exposition; Philadelphia is absorbed in the prospect of the grandeur of the coming Centennial; Boston, probably, would announce a gigantic show, had not her triple affliction, in the shape of the Gilmore Jubilee and the two big fires, exhausted her energies; Cincinnati is to repeat the great Fair of last year; Louisville, doubtless, also; and even little Newark, not to be behind, is busy endeavoring to eclipse the admirable exhibition of her manufactures inaugurated in 1872. We have been waiting to hear from Chicago, and our expectation is at last gratified. Rebuilt from her ashes, the "Garden City of the West" proposes to "celebrate" the second anniversary of her scorching by a grand Inter-State Industrial Exposition, which the *Land Owner* says is to be the "crowning glory" of that momentous occasion.

The building, which will be of a very ornate design, will occupy a portion of the lake front at the foot of Adams and Jackson streets, and will be 800 feet long by 200 feet wide. The main walls will be 24 feet high and composed of brick and glass, and the center will be surmounted by a dome 160 feet high by 50 feet in diameter. There is to be a grand art gallery, between which and the center of the building a large fountain will be placed. With the exception of the brick used in the walls, the entire superstructure will be built of glass and iron. It is the intention to have the edifice completed by September 1, so that a large force of workmen is employed and the work is being pushed forward as rapidly as possible.

In regard to the Exposition itself, the programme will soon be issued, and it may be sufficient to state at present that the plan embraces a representation of the products of every branch of art, including liberal and fine arts; the processes and products of every species of manufacture, together with collections, models, drawings, etc., illustrative of the sciences. No more comprehensive scheme could be devised, except that it does not include live stock, nor such operations and processes relating to agriculture as require to be conducted and shown in the open air. It is intended to be a reflex, not only of practical art and manufactures as they are found in this country, but, to a large extent, of those of Chicago, as shown in her trade and commerce.

Mr. Potter Palmer is president of the company managing the enterprise, and a large number of the leading citizens of Chicago are included among the officers and stock holders.

FREIGHT BUSINESS OF NEW YORK CITY ACROSS THE NORTH RIVER.

The amount of produce and general merchandise constantly being moved to and from New York city is so great that any statement of the business, by simply giving totals, can hardly be taken in by those unaccustomed to the vastness of the commercial transactions of the present day. The money represented, in the moving merchandise which constitutes the basis of the commerce of New York with foreign countries alone, is briefly told in the statement that the declared value of the imports and exports at the port of New York is upward of eight hundred millions of dollars annually; but in this estimate, of course, the vast amount of freight which is annually handled in supplying the wants of home consumers as furnished by home producers is left entirely out of the question; and this, it is safe to say, is in bulk, as it is probably in value, far greater than the traffic directly connected with the export trade.

Aside from the highly important arteries of communication which connect New York by rail with the north directly and thence west over the Hudson river at Albany, and those which perform the same work as between the commercial metropolis and the New England States, as well as the great extent of water transportation up the North river and thence through the Erie and other canals, the shipping in the Sound and to the south, along the Jersey shore or through the canals in that State, Delaware, Maryland, Pennsylvania, and southern New York—apart, we say, from all these facilities, all of which make it most convenient to land goods on New York piers and at the doors of its warehouses: there are the more important lines of railways, stretching west and south in every direction over the country and all having their proper termini on the west shore of the North river, whence their goods must be re-handled for shipment over the river, or the cars towed over on floats built for that purpose. This not only involves delay, but the expense for transportation over so small a portion of the route is great, vastly beyond comparison with that on any other portion of the distance reached.

The principal railroad lines which are situated to deliver their freight naturally on the Jersey shore are the Erie, the Pennsylvania railroad—which runs the Camden and Amboy and the New Jersey railroad—the New Jersey Central, and the Morris and Essex railroads. The total amount of freight delivered daily, as well as that taken westward, varies greatly, as many as fifteen hundred cars coming in on some days, with as many going out; while at other times there will not be more than one third of this business. As these roads have connections all through the South even to Texas and through the west to San Francisco, it is obvious that the freight which they carry must include almost every

kind of merchandise known; it is, also, equally apparent that, where there is competing water transportation, by canal or river, the more bulky and less costly articles will take the cheaper way, thereby reducing the amount of freight deliverable or taken by these channels when the canals and rivers are open to navigation; and so nearly the entire coal production of the country is brought forward to tide water or taken to its principal destinations inland by water.

For the vast amount of freight coming and going from New York by rail, however, the methods of its handling and shipment over the river have changed very little for some years past, except in the increased accommodations which the rapid growth of the business has called for. The Erie railroad company does not now, as formerly, run any cars to New York city, the whole amount of its freight being re-shipped, on canal boats, barges, and lighters, to the delivering points in New York. The number of cattle daily received by this road is very great, and it has extensive cattle yards at Weehawken, about four miles above its main depot at Jersey city, with a track running there, whence the cattle may either be taken by the cattle barges or be driven by droves across by the ferry landing at 42d street, New York. As might be expected the cost of transportation over the river forms a considerable item in the running expenses of the road, not including the extra handling, which must increase the amount by at least fifty per cent, being reported at \$184,514 for the year 1869; though from this sum must be deducted the profits of the Pavonia ferry, the gross earnings of which for the same period were \$34,523.

On the barges now used by the Erie company 8,000 barrels, or 80 car loads, of flour can be transported at once. On some days 200 car loads of flour alone have been delivered by this road at Jersey City. For other kinds of freight the facilities would be comparative both as to bulk and weight. For a car load of cut meats, such as hams, shoulders, bacon, etc., 36 packages is the rule, or fifty barrels of whisky, or about 1,000 sides of leather, etc.

On the Pennsylvania railroad, which runs the Camden and Amboy and the New Jersey railroads, nearly all the freight, and all of that brought by fast express lines running over the road, is delivered in New York without breaking bulk. The cars are run on what are called car floats, carrying eight to ten cars each—four or five on a side—and these are towed over to the depot on the New York side, and taken back in the same way. These car floats are simply large, square built, flat boats, and not very expensive; but as the business of this line and its connections is very heavy, and it also includes the Delaware and Raritan canal, quite an extensive fleet is needed for its business, which includes four freight steamers, fourteen towing steamers, six freight barges, ten car floats, twenty schooners, twenty-one coal barges, and seventy-seven canal boats.

The New Jersey Central and the Morris and Essex railroads, also large carriers of freight to and from the New York market, do not run any cars over the river, although there are several fast freight lines running over the former road under special contracts, which have their cars floated over the river by the same means as the Pennsylvania road, so that they do not break bulk until reaching New York city. The bulk of the carrying, however, on these roads, between New York and the Jersey shore, is by means of canal boats, lighters, barges, and freight steamers.

It might be supposed that no small proportion of the freight delivered and taken by these roads would be accommodated or supplied from the large number of ocean steamers which now have their landings on the Jersey shore, thus saving the expense of handling and shipping over the river; but this is true only to a very small extent. A very considerable proportion of their outward bound freight, especially in the summer season, is furnished direct by canal or steamboat lines from the interior, and substantially all that they bring here is first taken to stores in New York city, or to the bonded warehouses, whence it is subsequently withdrawn to the stores. That which is imported in bond for the interior might thus go forward, but the amount is too small to render necessary any special accommodations for it.

The total cost of passenger and freight ferriage for the use of railroads having their termini on the west bank of the Hudson can only be estimated, as these ferries also serve for the accommodation of a local business, though established and run mainly for their several railroads. There are eight passenger ferries, with boats running on each at intervals varying from ten to twenty minutes. Estimating the number of boats necessary to carry on this business, or counting the number of passengers at a fixed price each, we think we are quite within the mark in considering the cost of passenger and freight ferriage over the North River at fully two and a half million dollars annually.

THE AMERICAN INSTITUTE FAIR.

We call the attention of our readers to the advertisement in another column, announcing the opening of the forty-second Annual Fair of the American Institute, at the building of the association, on Third avenue, between 63d and 64th streets, in this city, on the 10th of September next. It will be noticed that a change has been made in the management of the exhibition, and that the usual communications are to be addressed to the general superintendent, Mr. Charles W. Hull.

We take the present opportunity to urge upon inventors and manufacturers, intending to contribute, to lose no time in preparing their exhibits, securing space and completing the necessary preliminary arrangements. There is no excuse for the state of chaos which has marked the opening days of the Fairs of the past four or five years. Timely notice has this season been given, and if exhibitors do not take advan-

tage of it they must ascribe the unfinished condition, lessened advantages, and consequent temporary lack of public interest in the exposition mainly to their own neglect.

A New Fire Escape.

A new extension ladder for enabling firemen and others to enter and escape from burning buildings was recently tested in the City Hall Park in this city. A ladder is set on a four wheel truck and is composed of sections ranging from eight to twelve feet in length, and stands independently of any building. The sections are mortised together and fastened with bolts and pins in a horizontal position. When secured they are raised perpendicularly by cog wheels and ropes, and the track is made steady by suspended weights that may be increased at will. Two of these aerial ladders were experimented upon, the longest one of which reached 125 feet, was about three feet wide at the base and tapered to eighteen inches at the top. The rungs were a foot apart, and side fastenings were arranged to form a rail when the sections were united. It took seven and a half minutes to place the apparatus in working position. By means of a block and fall on one of the sections, a fireman was hoisted in a canvas bag to the roof of the City Hall, and afterwards a lead of hose was carried up, strapped to the joints, and a stream thrown from the summit of the ladder. The tests were quite successful, though rather abruptly terminated by one of the firemen falling and sustaining severe injuries. The invention is the property of Mrs. Scott Uda, an American lady, the wife of an Italian gentleman, and was first introduced in Milan, Italy.

SCIENTIFIC AND PRACTICAL INFORMATION.

NEW STEERING DEVICE FOR WAR VESSELS.

Mr. N. Scott Russell proposes to place the tiller or yoke under the water and connect it through tubes to the steering apparatus. The advantages to be gained by this arrangement are complete protection of the tiller from shot, the tiller can be made of any length, and the afterpart of the vessel need not be armored, thus lightening the ends and leaving a great weight to be disposed in thickening the armor over the vital parts of the ship, or increasing the amount of coal to be carried.

NICKEL.

Within the past three years, more especially since the discovery of practical methods for electroplating with nickel, the demand for this metal has greatly increased, and its price has advanced. It has risen from \$1 to \$3.75 per lb., and its expense has become so great that a substitute for it in the arts is now sought. A good substitute, it is stated, may be found in the metal manganese. Dr. Percy, in a letter to the *London Times*, states that 20 years ago he made an alloy in which manganese was used in place of nickel, and the resemblance of the alloy to the ordinary German silver was perfect. Copper 75 per cent, manganese 25 per cent, makes an alloy resembling German silver, and better in its qualities. By the improved process of Hugo Tamm, heretofore described in the *SCIENTIFIC AMERICAN*, manganese may be much more cheaply produced than nickel.

EXPERIMENTS ON THE RESPIRATION OF FISHES.

M. Quirquand arrives at the following conclusions: 1st. The quantity of oxygen absorbed is proportional to the unit of time. 2d. The relative power of respiratory labor in fishes diminishes with the weight. 3. The species has but little influence on the activity of respiration. 4. Carps of two pounds weight breathe from seven to nine times less than man, for the same period and unit of weight of living substance. 5. Fishes have a cutaneous respiration, as recognized by Humboldt and Provencal, but it is feeble.

THERMO-DIFFUSION.

M. Jedderson says, in *Poggendorff's Annalen*, that if a porous body be made in the form of a diaphragm and each face be exposed to a different temperature, a current of gas is immediately formed from the colder to the hotter side. The author considers this phenomenon as entirely differing from ordinary diffusion, and proposes to distinguish it by the name heading this paragraph.

NEW WOOD CARVING PROCESS.

M. Lanteigne, says *Annales Industrielles*, has invented a machine for producing wood carvings at the rate of a yard a second, and at a cost of about one per cent of those executed by hand labor. The operation consists simply in passing the wood between cylinders forming matrices. The material, it is stated, is not deformed, and greater density is given to it by the pressure, while the sculpture is as delicate as that made by the chisel. The process can be used for producing cornices, furniture decoration, and similar ornamental work.

TRANSMISSION OF PHTHISIS PULMONALIS THROUGH DIGESTION

M. Colin says that, after experimenting upon some thirty animals, he has determined very clearly that the idea that *phthisis pulmonalis* can be transmitted through using the flesh of animals affected with tubercular diseases is erroneous. Such maladies are never inoculable through the digestive organs, and hence the employment of the meat of phthisic animals does not offer the danger generally supposed.

PURIFICATION OF HYDROCHLORIC ACID.

M. Engel introduces, in 100 quarts of hydrochloric acid, 60 to 75 grains of hypophosphite of potash dissolved in a little water. After an hour or two the liquid becomes yellow and then brown, and a precipitate is deposited more or less abundant according to the degree of impurity of the acid. At the end of about forty-eight hours, the deposit ceases and the clear liquid above is decanted off and distilled. The acid thus obtained is completely free from arsenic.

SILKWORKS.

We continue, from our paper of August 17, 1872, the series of illustrations of silkworms which feed upon the oak, and which are now being acclimated in the United States. Our illustrations and description are from the fourth Annual Report of Charles V. Riley, State Entomologist of Missouri.

THE YAMA-MAI SILKWORM.—*Attacus* [*Antheraea*] *Yama-mai*, Guér-Mén. (*Lepidoptera*, *Bombycidae*.)

This worm is a native of the northern parts of Japan. It feeds on a species of oak known botanically as *Quercus serrata*. Its silk is produced in large quantities in its native country, and already forms an article of export. It has been found more difficult to acclimatize than the alanthus worm, and but indifferent success has attended its culture. Yet there are striking exceptions, and in Austria it has been successfully reared in considerable quantities for several years. It is, withal, so valuable an insect that further trial is fully justified. In America it has been experimented with only since 1868.

Mr. W. V. Andrews, of New York, who has taken great interest in the introduction of foreign silkworms, gives me the encouraging information that, in 1871, nearly 800 cocoons were obtained from about 1,600 eggs, in the vicinity of New York.

Yama-mai undoubtedly belongs to the same natural genus as *Polyphemus*, which it closely resembles in habit and appearance. Its culture may be carried on in the same manner as that of *cynthia*, and it will suffice here to point out such of its peculiarities as will guide in its management.



Fig. 3.—THE YAMA-MAI SILKWORM.

The egg is rather larger (Fig. 2 shows it of natural size and magnified) than that of *Polyphemus*, less flattened, and of a pale straw color with a pinkish tint. It appears brown from being more or less thickly coated with a brown tenacious gum, which may be washed off by any alkaline fluid. The eggs should be kept over winter in a temperature never higher than 40° Fah. When hatching they should be moistened or kept in a moist atmosphere. As in the case of our American tent caterpillar, the young larva is fully developed within a month after the deposition of the egg, and passes the winter in a curled-up, quiescent state within the egg shell.

The worm thrives best in an atmosphere that is cool, moist, and shady, and the heat, if it can be controlled, should not exceed 80° Fah. It is a lazy slothful creature, and often rests for hours in the position given in Fig. 3. As we learn from Mr. F. O. Adams, who has made an interesting report on the culture of this species, the color of the more mature worms so thoroughly corresponds with that of the leaf on which they naturally feed, that they can with difficulty be detected while clinging, motionless, to the branches and leaf stems. They are of a beautiful clear green, with generally two all-very spots each side on the fifth and sixth joints, and a pale yellow line running along the sides. This line, with the position which the worm sometimes assumes, strengthens the resemblance to the leaf, and I reproduce a rough outline (Fig. 4) from Mr. Adams' Report, which will well convey this resemblance to the reader's mind—the worm being outlined at a.

The life of the worm lasts from 50 to 80 days, and it feeds on all kinds of oak, but prefers those of the white oak group. Dr. Alexander Wallace, of Colchester, England, to whom I am indebted for specimens of the moth, and who has extensively experimented with it, found that the worm would feed also on beech, apple, quince, white thorn, Neapolitan medlar (*photinia glabra*), and chestnut.

The cocoon (Fig. 1) is large, heavy, and handsome, and requires a full week for its completion. It is formed within a single leaf or within several drawn together and attached to a twig. It is oval and usually of a bright golden yellow color on the outside, though nearly white inside. Those raised out of doors are more green, while those raised indoors are more yellow, and white specimens have already been produced. The silk is strong and valuable; it bleaches well, and may then be dyed; fewer threads are required to make a strand than in that of *mori*, and it unwinds with perfect facility by the ordinary process. It shows its affinity to that of our *Polyphemus* by the gum which surrounds it containing a chalky or calcareous substance which may be noticed upon tearing or rubbing the cocoon.

The moth (Fig. 2, male) is magnificent in point of size and color. The front wings are broadly falcate, and more so in the male than in the female. The collar and broad costal

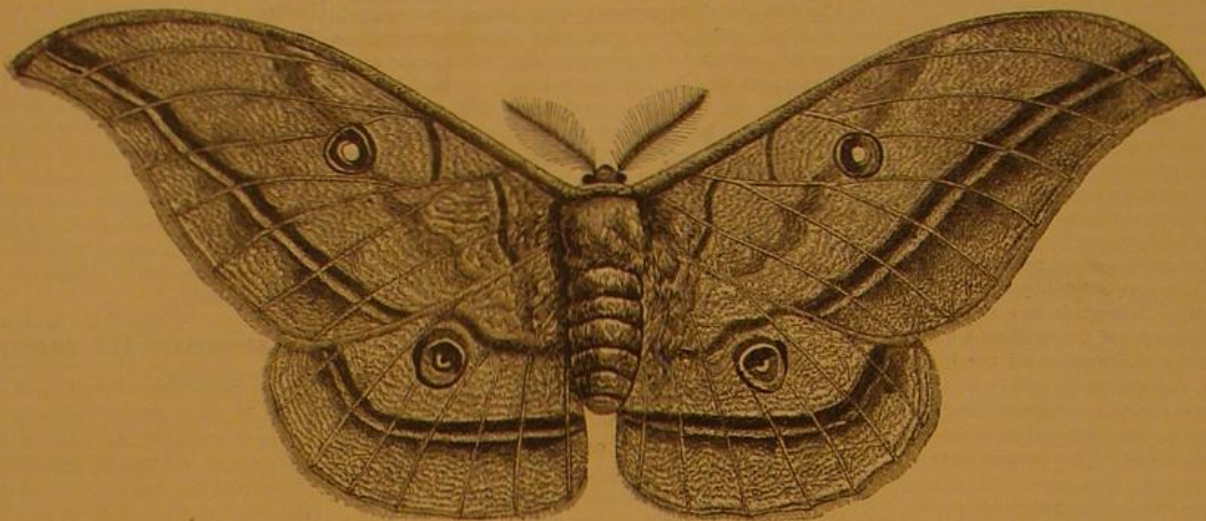


Fig. 2.—THE YAMA-MAI MOTH, MALE.

margin are always of an ash gray. The eye spots are surrounded with more or less pink and yellow, white and black, the black always being on the outside. The broad lines across the wings are either wavy and slate colored, with an inner wavy coincident shade, or more straight with a whitish outer shade, relieved by a darker and more reddish posterior shade. The posterior margins are either paler than the general surface, or ornamented with a dark wavy line. The median shade across the front wings is either very distinct and scalloped, or obsolete; and there is either one or two such shades on the hind wings. The species varies, in fact, very much in the detail of ornamentation, and in general color, being either yellow, brown, grayish, or olivaceous, and some specimens much resembling certain forms of our *Polyphemus*.

According to the testimony of those who have had most experience with this species in Europe, coition invariably takes place at night, and lasts but a comparatively brief time. As the moths issue very irregularly and the males are apt to appear many days before the females, and as it has been further ascertained that unless they emerge within a day or so



Fig. 4.—RESEMBLANCE OF THE WORM, α, TO THE LEAF.

of each other, the sexes show little affinity, it is best to retard the male cocoons. This can be done by first separating them by weighing, and keeping the male cocoons in a cooler place than those of the female.

From the foregoing it is evident that, while *yama-mai* is

the most valuable silk producer next to *mori*, it is nevertheless very difficult to rear. It cannot well endure a heat beyond 80° Fah., and will doubtless thrive best in the more northern States, for it will bear a moderate amount of cold, even below freezing point, for brief periods, with impunity. It is invariably single brooded, and runs a longer course of life than any of the other species treated of. The hatching of the eggs must be retarded till the first oak leaves (the buds of the post oak are among the earliest to swell, but some species of the black oak group, especially the laurel-leaved oak, leaf out first) put forth; and moisture, which is prejudicial to the mulberry silkworm, is grateful to this one at all times. I have already said that the embryo larva is fully formed soon after the egg is deposited. Now all our eggs, so far, have been obtained indirectly from Japan via Europe, and in the transit they must necessarily be subjected to too much dampness and confinement, too great changes from heat to cold, and the reverse, and the vitality of the young worm thus impaired. Mr. Andrews believes that to this fact must be attributed much of our failure in this country, and I fully concur with him. In this country which, compared with Europe, is so rich in oaks and in the large silk-producing insects so closely allied to *yama-mai*, and which is so varied in climate, we certainly ought to meet with better success than our European friends; and until we procure eggs more directly, or obtain them from insects reared in this country, so as to preserve them in uniform and favorable conditions, it cannot be said that we have taken the proper steps towards acclimating it.



Fig. 1.—COCOON OF THE YAMA-MAI SILKWORM.

A Common Sense Decision.

Chancery proceedings were lately begun in London by the proprietors of a weekly newspaper entitled *The Iron Trade Circular* (Byland's) to stop the publication of another journal entitled *Griffiths' Iron Trade Circular*. The Vice Chancellor delivered the following judgment: This is a motion for an injunction against the defendant to restrain him from continuing to publish a paper under the name of *The Iron Trade Circular*, and the motion is made on the ground that the plaintiffs are the proprietors, and have been so for eight years past or thereabout, of a publication, published every Saturday, which is entitled *The Iron Trade Circular* (Byland's). Now, the doctrines of the Court upon this matter are very plain. When a name has been used and appropriated, whether it be the name of a newspaper or a book, or a mark on an article produced for the purposes of trade, the person who first uses or appropriates the name or mark is entitled to prevent any other person using the same mark or name. Therefore (by way of illustration), nobody could be permitted by the laws of this country to start a newspaper in London to be called *The Times*, because that is already appropriated and has long been appropriated by the proprietors of that well known paper. So with regard to the *Saturday Review*, which is also a well known name; nobody, therefore, could be permitted to bring out a new publication to be published weekly called the *Saturday Review*, because that name is already the property of other persons. Judgment for the plaintiff.

EFFECT OF STREET GAS ON TREES.—Experiments have been lately made, in the Botanical Garden at Berlin, as to the effects of ordinary gas on vegetation. Gas was conducted through pipes to the roots of various trees continuously for several months. The principal conclusion arrived at was that 25 cubic feet of gas, daily diffused through 576 cubic feet of earth, is sufficient to kill trees of any species, and the more quickly the more compact the upper layer of soil.

IMPROVED PLOW.

The principal advantage claimed for the invention represented in the accompanying engravings consists in the arrangement of the plow stock, which is so constructed as to be readily connected with any desired form of blade. For use on cotton and other farms where varying patterns of plowshares are necessary for different purposes, the economical value of this device is obvious. The farmer in purchasing this plow need only procure in addition thereto a suitable selection of blades, with one of which he is at once furnished in the efficient form of turning plow which constitutes a portion of the complete implement.

In Fig. 1 the blade and standard are shown connected, and in Fig. 2 the same are represented separate in order to represent the mode of attachment. The beam and handles are of the usual description. The standard, A, consists of a single bar of iron made into a loop with two diverging arms. One of the latter is bent forward edgewise, and both together act as braces. In securing them, the forward arm passes through and the rear arm is bolted to the side of the beam. Two or more holes in either branch allow of the adjustment of the angle of beam and standard to suit plow blades of different curves.

The cast turning plow is made with a shoulder, B, on the under surface of the mold board, and its under face rests on the front side of the loop of the standard, a projection, C, fitting in said loop. The object of the shoulder is to give the backward inclination to the mold board, and the purpose of the projection, C, is to assist a bolt, D, in uniting the mold board and standard immovably when needed for service. This modification of the mold board enables cast plows of any pattern or size to be adjusted to the standard, the latter of course varying in size, according to the power to be applied. A saddle with its under surface, modified as the mold board just described, is to be used when a wrought mold board turning plow is to be employed. In this case the saddle, on which is a land side, is introduced between the mold board and standard, and the same bolt passes through and secures all parts.

Among the additional advantages claimed for this device are that it is universal in its uses, is an efficient turning plow, and an excellent standard for a subsoiler. It can also be made at as low a price as any other good plow. The inventor is a farmer and has thoroughly tested the plow on his farm for a period of two years with uniformly good results.

Three patents cover the improvement, the latest of which is dated Oct. 29, 1872. For further particulars regarding sale of rights, interest, etc., address the inventor, Dr. F. M. McMeekin, Orange Spring, Marion county, Fla., or Bent, Goodnow & Co., 84 Washington street, Boston, Mass.

IRON SHIP CONSTRUCTION.

The progress of iron ship construction in this country has, of late, advanced so rapidly as to engender a reasonable hope that the time is not far distant when American-built vessels

from the Delaware shall be as eagerly sought for, and, indeed, rival in the employment of the commerce of the world, the far famed productions of the shipyards of the Clyde. With every resource of material, machinery, and skilled labor abundantly at our command, there seems no obstacle to the speedy furtherance of an industry than which none bids fairer largely to augment our national prosperity; and if the owners of our merchant marine will, by their substantial encouragement, foster the enterprising spirit now manifested by many leading firms, there remains little doubt but that

form, which may exist, being set right. The holes are next punched and a final trial of the curve finishes the work.

KEEL, STEM, STERN POST, AND BEAMS.

While the frames are being prepared, the keel is proceeded with and temporarily put together on blocks alongside the dock or slip where the ship is to be built. After it is set up, the frame stations are painted upon it, when it is taken apart and again put up permanently and riveted in proper position. The stem of an iron ship is generally a prolongation of the keel; the iron stern at present in use in ordinary iron vessels is simply a curved solid bar of uniform section, or nearly so, generally forming the contour of the bow. In war vessels, the first thing to be accomplished is to give to such a stem the support of all the bow, bottom plating, and armor plating, to deliver a horizontal blow, and for this purpose all such plating is let into the substance of the stem, abutting squarely against the fore side of a rabbet. The stems of all the English iron-clad frigates are formed of the best scrap iron under the steam hammer. They were bent on beveling slabs used for forming ship frames as above described, a coke fire being made around a length of about eight feet at a time. When the heat was sufficient the fire was removed, and the bending effected by means of wedge sets, tackles and crabs, and other like appliances. The operation was repeated until the whole length was brought to the required shape.

The sternposts of iron ships admit of the same variety as keels and stems. Solid bar posts are now used, being scarfed or welded to the keel in the same manner as the stem is secured.

Fig. 1.

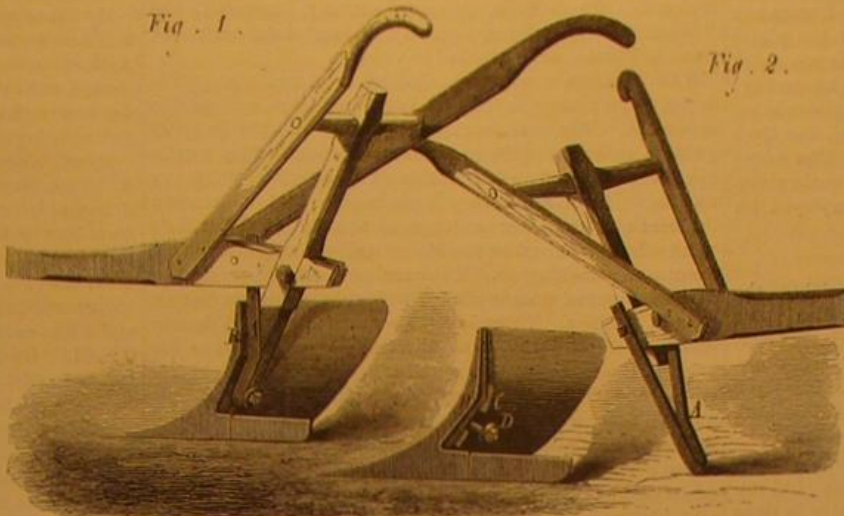


Fig. 2.

THE UNIVERSAL STANDARD PLOW.

our now dilapidated commerce will soon regain if not exceed the proud proportions which it had attained before the outbreak of the war.

In the following description, though necessarily brief and general in detail, it is proposed to give an outline of the method of proceeding with the work of building iron ships. We are indebted for the facts and illustrations to a new volume, recently published by Messrs. John Wiley & Son, of this city, entitled "An Outline of Ship Building." The book, we may here remark, is a thorough and careful exposition of the whole theory and practice of the subject to which it is devoted, and emanates from the pen of Assistant Naval Constructor Theo. D. Wilson, U.S.N., an officer of well known experience and ability.

PREPARATORY WORK.

As soon as the drawings have been completed, a model of the ship, on a scale of half an inch to a foot, is prepared, on which the general arrangement of the edges and butts of the plating, the directions of longitudinal work, deck lines, etc., are marked. Simultaneously, the laying down of the ship is proceeded with, that is, the different parts of the vessel are delineated in their full size upon the mold loft floor. This completed, the lines, to which the angle iron frames are to be bent, are transferred to boards prepared for the purpose and razed in. There are two of the latter, each being large enough to take the midship section, the fore body being transferred to one and the after body to the other. In order to show these lines more clearly the upper surface of the "shrive" or shriving boards, as they are termed,

is covered with a composition of lamp black size and water. Beside the lines to the outside of the frame, the position of the plate edges, diagonals, level lines, heights of floors, beam ends, etc., are also marked upon the boards, which are then removed to a place near the furnace in which the angle irons are heated.

BENDING THE ANGLE IRONS for the frame is the first operation. The leveling blocks or bending slabs on which this is done are made of cast iron, the upper surface being straight and out of winding, and perforated with holes placed at intervals of about six inches. The line to which the frame is to be bent is transferred from the blackboard to the slab by means of a soft iron bar, known as a "set" iron, which is bent to the line on the board, has the beveling spots, etc., marked upon it, and is then removed to the slab on which the curve is drawn and the spots are marked. After the bending and beveling are completed, the angle iron is allowed to cool, and is then taken to the blackboard and tried to its curve, any unfairness or alteration of

The form of beam now commonly employed, especially for upper deck beams, is known as the Butterley patent welded beam. Up to 12 inches in depth, it is rolled in one piece; above this dimension, the bulb half is rolled separately from the upper or T half, and the two are welded together along the neutral axis of the beams. While the frames and keel of the ship are in progress, beam molds, with the spring and length marked upon them, are given to the workmen to guide them in making the beams. The processes of bending and straightening the latter are performed by means of screw presses worked by hand or hydraulic power, the metal being cold. In forming the beam knees the ends are the only parts put into the fire, and the plan adopted in nearly all instances is to split the beam arm for a short distance, turn the lower part down, and weld a piece of plate iron in.

FRAMING.

When the keel has been fixed in position on the permanent blocks, the frame amidships is first put up, and the work is continued fore and aft simultaneously. Stages are then made around the ship at different heights for the purpose of proceeding with the plating, the latter operation being commenced as soon as the frames are regulated and secured in place.

In the meantime the floor plates, shown in the engraving Fig. 1, on the inside of the vessel nearest the keel are prepared, and holes made in their upper edges for the reversed bars. The riveting up of the latter and the floor proceeds simultaneously, as, indeed, now does all the work connected with the construction of the ship.

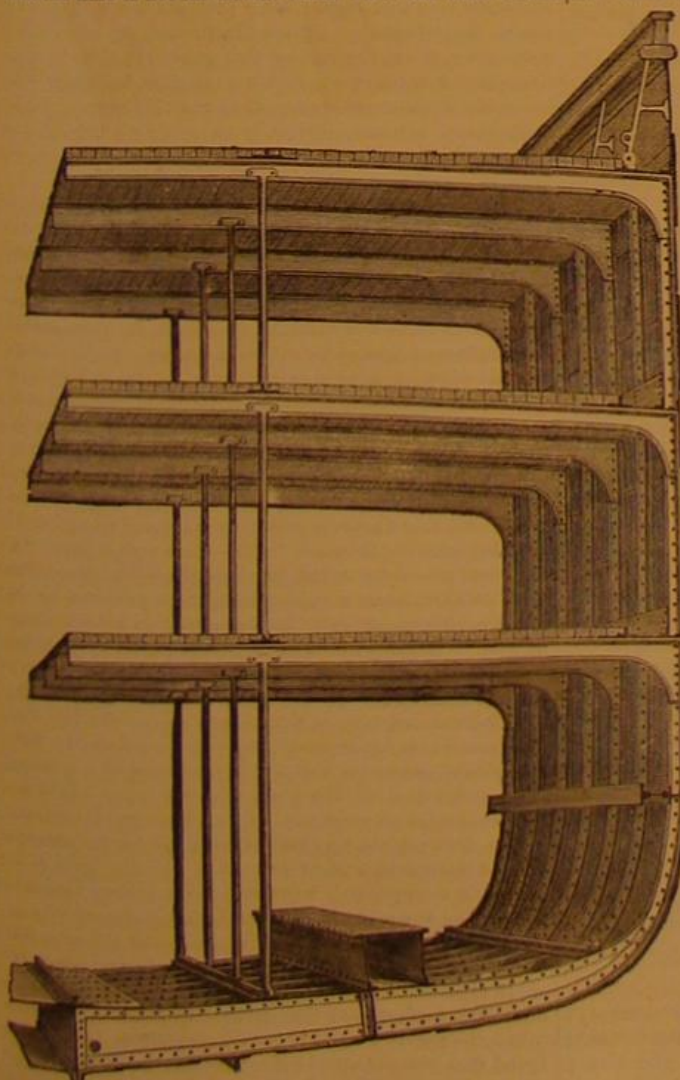


FIG. 1.—SECTION OF IRON VESSEL, BUILT ON THE TRANSVERSE SYSTEM.

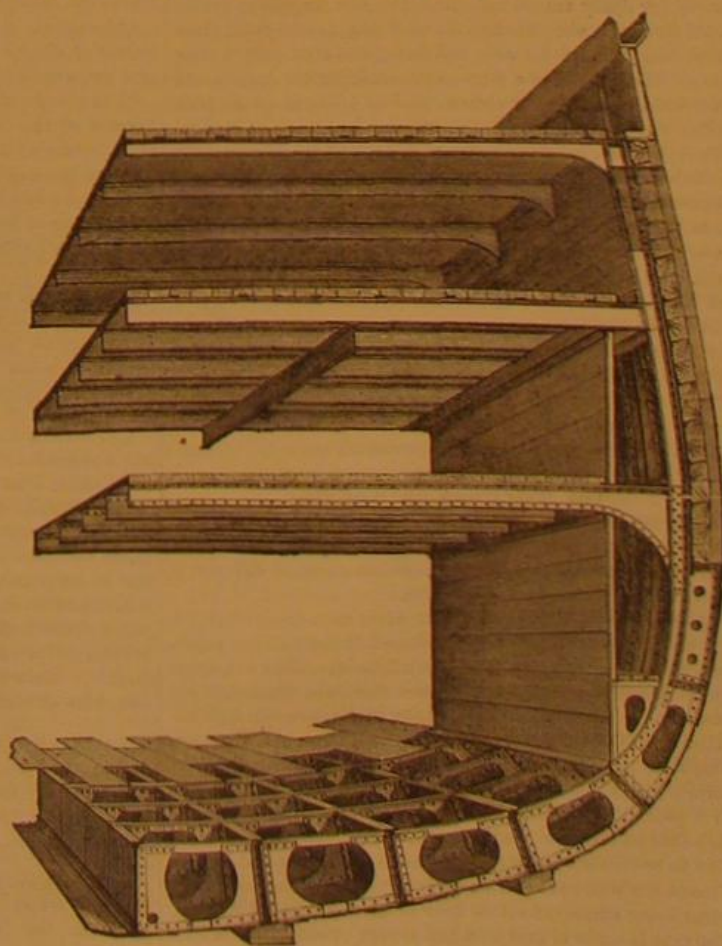


FIG. 2.—SECTION OF IRON VESSEL, BUILT ON BRACKET PLATE SYSTEM.

PLATING.

A strake is a breadth of plank, or, in iron vessels, plating wrought from one end of the ship to the other. According to the plan now in general use, each alternate strake is worked directly on the frames and the intermediate strakes form an outer layer, each of which overlaps the edges of the two adjoining strakes. This will be rendered clear by a glance at the section of the exterior plating, as shown in Fig. 1. The lowest strake is generally an inside strake and is first put on, the work being continued upward. After holes have been punched each plate is curved by passing it through rolls, and is then put in place and temporarily secured. Pieces filling up the space between the frames and outside strakes, called "liners," are fitted after the plates are prepared and fixed. While the plating is thus proceeded with, the work on the interior of the ship is also advancing; the riveting of the reversed angle irons and floor plates being completed, the beams being got in and fastened, the deck and hold stringers being fitted, fastened, etc. The edges and butts of bottom plating are generally double chain riveted, but in some cases treble chain riveting is employed for butt fastenings.

FINAL OPERATIONS.

The deck planking is of wood, almost invariably, the planks being usually secured by a screw bolt driven down from above with a nut underneath the iron deck. Watertight bulk heads, in iron vessels, are always placed transversely, and in some cases longitudinal divisions are employed in addition. In many steam ships the longitudinal bulk heads enclosing the coal bunkers are made watertight.

After working about three fourths of the outside plating, men are set to work closing up the joints, reaming out unfair holes, etc., preparatory to riveting. The latter is done by piece work, a set of riveters being two riveters, a holder up, and two boys to carry the rivets. Care is taken that the holes are well filled and the points of the rivets flush with the surface of the plates. When this work has advanced to some extent, caulking of the butts and edges commences, the closeness of the joints being first tested by trying to insert a thin steel blade at various points. Lastly the painter follows, and the vessel receives coatings of red lead which prevent oxidation of the finished portions.

BRACKET PLATE SYSTEM OF FRAMING.

In Fig. 2 is represented a section of H. B. M. frigate Bellerophon, showing a system of framing universally used in the construction of heavy armored vessels in Europe. It has been recently introduced in this country and has been first employed in the torpedo boat now in process of construction from the designs of Admiral Porter at the Brooklyn navy yard. The difference in the mode of construction is apparent by a comparison of the two illustrations.

Prevention of Artisans' Diseases.

In a recent lecture by Dr. Mapother, on the subject of the prevention of artisans' diseases, he said that the special diseases which ill regulated trades induce may be placed under three classes: 1. Those due to the entrance of dust into the lungs; 2. Those due to slow poisoning; 3. Those which constrained positions or overwork in close rooms engender. Stone cutters suffer from lung affections by inhaling minute particles of stone, which irritate the lungs and excite inflammation. The working of flax is also very detrimental, giving rise constantly to asthmatic complaints. At paper works the teasing of the shoddy, and at marine stores the picking of rags, create a most stifling and hurtful dust. The remedy for dusty trades was, first, to use a respirator which would filter the air. He had devised one some years since which was found to be very effectual, and cost only a few pence. It consisted of a wire gauze covering the mouth and nose, lined by a layer of cotton wool a quarter of an inch thick. Other remedies were ventilation by means of McKinnel's tube; the action of steam fans; and the peremptory exclusion from all labor requiring vigorous muscular and breathing efforts, of persons under eighteen, whose organs up to that age are not strong enough to resist ill-usage. Having referred to the diseases which occur among those who work with lead, copper, mercury, phosphorus, and arsenic, and the chemical and mechanical appliances for their prevention, he alluded next to the case of seamstresses. Weakness of sight, from over-use of the eyes, with badly arranged light, and indigestion, from bad and hasty meals and long sitting in a close room, are diseases which have been commonly observed among needle workers, who number in Dublin between seven and eight thousand.

The Telegraph in Austria.

G. B. Prescott Esq., the electrician of the Western Union Telegraph Company, says, in the *Journal of the Telegraph*, that in Austria a telegraph system constructed differently from any on the continent is found.

In France, Belgium, and North Germany, cross arms are not used, the insulators being fastened directly to the poles, but in Austria the cross arms again appear. They consist of round sticks of wood, of about three inches in diameter, apparently the natural timber with the bark taken off, and unpainted. When many wires are carried, two poles are used, which are joined together at the top and separated at the bottom about five feet, thus forming what the English call an A pole. The cross arms are alternately fastened upon each side of the pole, as they are in England, a preferable plan to ours, where they are all placed on the same side. In Vienna the wires are carried on iron poles, no underground wires being employed either here or in any part of Austria. The pole is made of cast iron, and is very ornamental. It consists of an iron column about twenty feet in height and one

foot diameter. The lower end is screwed to a stone base. At the top of the column a horizontal arm extends about two feet on either side, and from the ends there extend two vertical shafts fifteen feet in height, thus constituting an iron column with two branches, resembling a candlestick holding two candles. The two upper shafts support eight iron cross arms, and each cross arm carries eleven wires, so that each pole carries eighty-eight wires. The poles are about one hundred and thirty feet apart. The Government has only one office in Vienna for transmission of despatches, but it has eleven offices at which messages are taken in, and from which they are sent to the transmitting office by messengers. There is a private company, however, the "Wiener Privat Telegraphen," which has about sixty stations in Vienna and forty in the vicinity.

The Austrian territory is divided into two telegraphic zones. The charge to the first is 40 kreutzers, and to the second, 60. The male operators receive from 600 to 1,000 gulden or florins (\$300 to \$500) per annum. The female operators from 250 to 350 florins (from \$125 to \$175) per annum. In addition they both receive half a kreutzer (quarter of a cent) per message as a commission for their work when employed on the Morse, and three quarters of a kreutzer on the Hughes. The number of employees to do a given amount of work is always strikingly greater in Europe than in America. There is none of that hurry and bustle which we see at home. The Director General comes to his office at 12 or 1, and gets through at 3. In the offices, everywhere and at all times, everybody smokes. In Vienna they are building a splendid telegraph office. The walls and roof are already up, and they are now at work upon the interior. The building is five stories, and is built of stone, resembling the Nova Scotia freestone but of a better quality, and highly ornamented. In front there is a sculptured figure of Time and a group representing the telegraph. The building will cost 800,000 florins, or \$400,000. It is square, and has an inner court also square, and admits light from four sides, without and within. The operating room is on the top floor, and occupies three sides of the building. On the opposite side of the street they are erecting a splendid exchange and, adjoining it, a new post office. These are to be connected with the telegraph by a pneumatic tube, and a pneumatic tube will also convey the messages to the operating room from the receiving office.

Preparation of Chlorates for use in Calico Printing.

It has heretofore been customary, in preparing the various chlorates, to first decompose the chlorate of potash with tartaric acid. The cost of the latter, however, made them more expensive than the chlorate of potash from which they were made. Schlumberger now uses the sulphate of alumina for decomposing the potash salt, thus forming chlorate of alumina and alum, and from the former the other salts may be obtained, not in a state of purity, to be sure, but sufficiently so for printing. Ammonia, lime, baryta, soda, and even aniline, are able to decompose the chlorate of alumina, and combine with the chloric acid to form chlorates.

Chlorate of ammonia is obtained by precipitating the alumina with ammonia or carbonate of ammonia, and filtering. The solution will contain chlorate of ammonia with a little sulphate of potash and sulphate of ammonia, so that we find that Schlumberger's chlorate of alumina must contain also some alum.

Chlorate of lime is obtained by precipitating the alumina with milk of lime; and since sulphate of lime, which is formed at the same time, is almost insoluble, it settles and leaves the chlorate of lime purer than the ammonia salt.

Chlorate of baryta is made in a similar manner, and is the purest of all, for caustic baryta precipitates all the sulphuric acid present in the alum.

Chlorate of aniline contains also very little of the sulphate because of the insolubility of sulphate of aniline, and only the chlorate of aniline and a little sulphate of potash remain in the solution.

This preparation of chlorate of aniline without tartaric acid, seems to be very important in an economical point of view, since aniline black is now prepared from chlorate of aniline.

The chlorate of alumina is very acid and dissolves considerable hydrated alumina; hence its formula is uncertain. It also dissolves magnesia, and in this way a mixture of chlorate of alumina and chlorate of magnesia is obtained which is useful in printing with camwood.

CAT'S TAIL PAPER.—Among the novelties at the late Lyons exhibition were certain products obtained by M. Dupont, of Nismes, from the reed mace or cat's tail, a plant which is very abundant in marshy districts, and which has been utilized for mats, chair bottoms, baskets, etc. M. Dupont prepares the fiber by first boiling the cut and dried leaves several hours in an alkaline solution, then pressing them between rollers and washing. A specimen of yellowish, very fibrous paper made from the plant was exhibited. The fiber is yellowish, but it can be easily bleached, and takes dye colors readily. Some specimens of ropes and cords from this fiber were also exhibited.

TRAGACANTH MUCILAGE.—Take of powdered tragacanth, 1 dram; glycerin, 6 drams; water, enough to make in all 10 ounces. Rub the tragacanth in a mortar with the glycerin and then add the water. This will produce a mucilage of once of excellent quality.

HOW TO CLEAN BONES.—Soda ash, 1 lb.; lime (burned) $\frac{1}{2}$ lb.; hot water, 3 quarts. Mix, and soak the bones for 24 hours in the liquid; wash them thoroughly and bleach them.

Correspondence.

The Diurnal Variation of the Magnetic Needle.
To the Editor of the Scientific American:

The diurnal variation of the magnetic needle has always been a perplexity to land surveyors. I cannot ascertain, from any authority I have ever consulted, what allowance per hour to make for it. I can only learn that the needle changes from east to west about fourteen minutes between 8 o'clock A. M. and 2 o'clock P. M. To supply this deficiency of the text books, I have experimented through three days with the following results:

My experiments were made with a surveyor's transit, with a five inch needle, read with the aid of a magnifying glass. As the following table shows, there is a great and unreliable lack of uniformity in the hourly change, both in the different hours of the same day, and between the same hours of different days.

By reference to the table, it will be seen that from 8 to 9 A. M. on May 16 the change was eastward, while, during the same hour on the 17th, it was westward. On the 16th, from 9 to 10 A. M. the change was westward, while during the same hour on the 17th the change was eastward. On 17th, between 3 and 4 P. M., the needle made a sudden change westward, after it had commenced to return east; and a like occurrence took place on the 16th, between 5 and 6 P. M. On the 15th, the needle began to return east between 1 and 2 o'clock P. M. On the 16th, it did not begin to return till between 2 and 3 P. M.; and on the 17th, it began returning to the east between 1 and 2 as on the 15th. There were no local causes to make the difference in the changes during the same hours. The weather was throughout the three days alternately sunshine and clouds, warm at noon and cool at morning and evening.

A. M.	May 15th.	May 16th.	May 17th.
8 to 9 o'clock	West	East 1/2 in 67 minutes.	West 1/2 in 54 minutes.
9 to 10 "	—	West 1/2 in 12 1/2 "	West 1/2 in 12 1/2 "
10 to 11 "	—	West 1/2 in 12 1/2 "	West 1/2 in 13 "
11 to 12 "	West 1/2 in 12 1/2 minutes	West 1/2 in 75 "	West 1/2 in 60 "
12 to 1 "	West 1/2 in 18 "	West 1/2 in 19 "	West 1/2 in 36 "
1 to 2 "	West 1/2 in 40 "	West 1/2 in 40 "	West 1/2 in 54 "
2 to 3 "	East 1/2 in 12 "	East 1/2 in 50 "	East 1/2 in 54 "
3 to 4 "	East 1/2 in 39 1/4 "	East 1/2 in 30 "	East 1/2 in 23 "
4 to 5 "	East 1/2 in 10 1/2 "	East 1/2 in 9 1/2 "	East 1/2 in 40 "
5 to 6 "	East 1/2 in 17 "	East 1/2 in 15 "	East 1/2 in 49 "
6 to 7 "	—	—	East 1/2 in 11 "

Are there any reliably recorded observations to guide a surveyor in the hourly change of variation?
Rockville, Ind. JNO. T. CAMPBELL.

The Effect of Electricity upon Metals.

To the Editor of the Scientific American:

The deterioration of metals is of interest as an economic question, as well as a fit subject for scientific research. As the health and longevity of human life have been promoted by intelligent effort, so also has it been deemed possible to resist the destructive influences which attack the metals that enter so largely into every department of industry. Of the various agencies sought to antagonize the oxidation of metals, especially iron and copper, none presents more interesting phases than electricity. Almost in the infancy of electrical discoveries, it was ascertained that galvanic action, in some unexplained manner, exerted a protective influence upon one metal at the expense of another when both were plunged in the same solution, effectually checking all oxidation of the protected metal, even under circumstances that would ordinarily suffice to rapidly destroy it.

A saline solution attacks iron or copper; but if a piece of zinc be attached to either, it is preserved, while the zinc is consumed. It was upon this principle that Sir Humphrey Davy based his plan for the protection of iron and copper-bottomed vessels from the action of sea water, a plan, however, which has not been found practicable for reasons which do not affect metals under other conditions. Napier considers the application of zinc to iron a barrier to corrosion: "Not only as a coating but from its more electro positive character, it protects it by a galvanic influence." Upon this subject, Faraday asserts that "zincd iron would no doubt resist the action of sea water so long as the surface was covered with zinc, or even when partially denuded of that metal; but zinc dissolves rapidly in sea water, and after it is gone the iron would follow." The same writer says: "As to voltaic protection, it has often struck me that the cast iron piles for lighthouses or beacons might be protected by zinc in the same manner that Davy proposed to protect copper by iron." Faraday's hint has been acted upon by the British Government, and perhaps by others, in the protection of the iron cables with which the buoys are moored in the English Channel and various British sea ports. M. Van Beck observed that a copper vessel, filled with sea water for forty-seven days, connected voltaically, by means of a platinum wire, with a plate of iron plunged in the same liquid, was preserved from all oxidation. De La Rive says: "A metal, copper, for example, may be protected against the corrosion exerted upon it by an acid or a saline solution, such as sea water, by associating it voltaically with a more oxidizable metal, such as zinc." M. Schönbein demonstrated, by a numerous series of experiments, that iron and copper oxidize in air, in water, and in a saline solution, as well when they are in contact with zinc as when they are not so, if there is no electric current; but that as soon as there is one established, the negative metal is no longer oxidized. Dr. Schorn found that iron plunged in nitric acid becomes negative to untreated iron, and acquires a singular property enabling it

to resist the action of the strongest acid; commenting upon which, the editor of the SCIENTIFIC AMERICAN (March 16, 1872) ascribes the result of the experiment to electrical action and anticipates that "investigation may give us some new light on the subject of electrolysis."

Having thus based the statement of this protective principle upon the highest authorities, I will enter into the consideration of a phenomenon as valuable in the practical arts as it is instructive to the student and scientist: yet, unfortunately, as a distinguished writer has aptly expressed it, the subject "has occupied the attention of practical men for a long time; it is one of high importance; nevertheless there seems yet to be a great deficiency in our knowledge of the extent of this influence, and how and when it is effective." The object of this article is not to attempt an explanation of the unknown or to develop a new theory, but rather to invite attention to a principle in Nature which may be made of practical utility in many ways when better understood.

One new feature, not mentioned in any of the text books, has been developed by a single experiment which any of the readers of the SCIENTIFIC AMERICAN can try. It has been found that instead of making the metal to be protected one of the elements of the voltaic combination, it may be made simply the conductor of a current generated by an independent battery. Immerse a sheet of copper in a saline solution, and, instead of attaching zinc to the copper, connect the latter by wires to the poles of an ordinary galvanic battery; the result is that, so long as the electric current is maintained through the copper, the solution in which it is plunged is inert and will not attack it. This only corroborates, more forcibly than ever, the conclusions of the SCIENTIFIC AMERICAN and the other authorities quoted, that these phenomena are attributable purely to galvanic action; and it widens the field for future investigation.

J. L. WAITE.

St. Louis, Mo.

Estimating the Power Transmitted by Belts.

To the Editor of the Scientific American:

On page 257 of the current volume of the SCIENTIFIC AMERICAN, you give two rules for estimating the power transmitted by belts. Not long since, some experiments were made, in a large woolen manufactory, to determine the amount of power consumed in working the machinery in several of the departments of the factory. Selected from a large amount of data obtained, the following, relevant to the subject under discussion, will, I trust, be found of interest to very many of your readers; and the importance of your hints in relation to the employment of a dynamometer ought to be placed, by it, beyond question:

From a 46 inch pulley, an ordinary horizontal 8 inch belt drives a counter line about 40 feet long, by a 20 inch smooth iron pulley; and from pulleys on this line, the picking machinery and fans for drying wool were driven. The 8 inch belt having been thrown off, a similar 8 inch one was employed to drive from the 46 inch pulley in nearly a vertical direction to the 24 inch leather-covered pulley of the dynamometer, about 6 feet distant from center to center. From the driver on the dynamometer (also leather-covered) a 6 inch new double belt ran on a 20 inch iron pulley, about 12 feet distant, on the counter line before mentioned, rising at about an angle of 30°. The new belt was put on with clamps and was considered tight. It transmitted, without difficulty, 13.9 horse power at a speed of 1,130 feet per minute. Adding 2.19 horse power, the belt slipped so that speed could not be obtained. Three inches were then taken out, the belt becoming quite taut, not more so, however, than is quite usual on woodworking machinery. It would then transmit 17.27 horse power without any appearance of slip whatever. By the formula given, the 8 inch belt would be rated at 3.875 horse power. By actual test it was found equal to more than four times the estimate. An 8 inch belt could not be made to drive from the dynamometer on to the 20 inch smooth iron pulley on the counter line. By the same formula, a 6 inch belt would be rated at 2.53 horse power, and a double belt at 3.8 horse power (adding one half for a double belt). The common millwright's rule in this instance is much nearer the truth, and that estimate, 8.23 horse power, is less than one half the power actually transmitted.

The best possible conditions under which a belt can be used is when running horizontally, with the draft on the under side of the pulleys, and, of course, the slack or sag of the belt on top; thus wrapping a little more of the circumference of both pulleys when at work. On the contrary, a vertical belt, if of considerable length, is always in difficulty without a tightener.

A. M. SWAIN.

North Chelmsford, Mass.

A Hailstorm at St. Louis, Mo.

To the Editor of the Scientific American:

A severe hail and rain storm took place here on May 19, 1873. All day the weather had been sultry, and at about 3.30 P. M. the thermometer registered 85° Fah. Just then, it began to rain, and soon the hail came pelting down thickly and fast, with an occasional heavy dash of rain. In eight minutes the thermometer fell 24°, and, in twenty-five minutes after the thermometer was at the maximum of 85°, it fell to its minimum, 57°. The storm came from the southwest, and was a thunderstorm, with hail and rain. The wind was from the southwest when the storm began, but suddenly changed around to the northwest and then to the northeast. Many of the hailstones were of extraordinary size; one weighed over half a pound when it fell, for it weighed 6½ ounces ¾ hours after the storm was over. At the time it was weighed, it measured ¾ inches wide by 1½ inches thick.

St. Louis, Mo.

GEORGE W. ALLEN.

The Concentration of the Sun's Heat upon the Earth's Surface.

To the Editor of the Scientific American:

On page 309 of your current volume is illustrated a theory on the above named subject, in which it is claimed that the atmosphere acts as a concavo-convex lens, by which the sun's rays are concentrated upon the surface of the earth. To my mind, this cause is quite insufficient to produce the great difference of temperature between the higher and lower strata of air, and for these reasons: The extent of the atmosphere above the earth's surface (supposed to be 50 miles) on all sides, viewed in its ratio to the earth's size, is as 1 to 80; hence the earth can obtain no more rays of solar heat with its atmosphere than it would if $\frac{1}{80}$ were added to its diameter and it had no atmosphere; and this would be quite insignificant. If the depth of the atmosphere bore anything like the proportion to the earth's size as it does in the illustration to the article, the case would be quite different. If the writer will draw his figure in true proportions, he will see at once that the heat rays have so very short a distance to traverse, after being refracted, before they reach the earth's surface that their convergence is imperceptible. I see no more mystery in the accumulation of heat on the surface of the earth than I do in the accumulation of snow-flakes there. While in mid-air they are not arrested, and this is precisely the case with the rays of heat; they accumulate only where they are arrested by some more or less solid substance.

The low temperature of lofty mountains has sometimes been attributed to the rarity of the atmosphere through which the rays pass, by which the heat fails to be intensified, as it is supposed to be in some mysterious way when passing through denser air; but I think a more probable cause is simply that, so very small is the area of space where the rays are lodged, being surrounded by so vast a body of cold air continually floating upon it from all sides, the heat is carried away as fast as it is received; but on lower ground, where the rays are being retained for thousands of miles on the same plane, the heated air simply moves from one locality to another, the mass remaining nearly of the same temperature. The clear atmosphere is evidently not perceptibly warmed by the passage of the sun's rays through it, but rather from its contact with the earth and solid substances on its surface where the rays are arrested; and thus, as this heated air rises constantly, mingling with cooler air above, there is secured the most beautiful system of circulation which even the Infinite Wisdom could devise.

Milford, Mass.

E. BROWN.

Horse Power.

To the Editor of the Scientific American:

Seeing a communication on page 320 of your current volume, on the power of horses, I am reminded of some notes which I took of the work of a pair of horses cutting wood at a railroad station. They weighed 2,000 pounds, 1,000 each, and worked on an endless bed power machine, such as is used in New England for threshing grain. The bed was raised so as to incline 3½ inches to the foot, and ran at the rate of 105 feet per minute, making a rise of 28½ feet per minute, which of course is equal to 2,000 pounds falling 28½ feet a minute, which would make 57,000 foot pounds per minute, including friction, which in that class of machinery would be enough to make it up to 66,000 pounds, the standard of two horse power. This amount of power would cut, with the ordinary sawing arrangement, 15 cords of mixed wood (hard and soft, 4 feet long), 2 cuts, in 10 hours and do it day after day.

The horses were not harnessed, but merely tied by a halter, so that it was actual weight that drove the saw. It was so good an illustration of the power of a falling weight that, being very much interested in such matters, I took down the figures, thinking that they might be of use or interest at some time, as a criterion to judge from in working or using the power of the horse.

W. A. J.

Boiler Explosion at Syracuse, N. Y.

To the Editor of the Scientific American:

I wish to remark upon the cause of a disastrous explosion which occurred in our city on May 5, 1873:

The boiler was a portable one, of about 10 horse power. It was about 10 feet long and of 30 inches diameter. It had 24 three inch flues, and a furnace 3 feet 3 inches x 2 feet 1 inch, with a water bottom. The inside sheets of the furnace were $\frac{1}{8}$ of an inch thick, of an excellent quality of iron. The entire outside firebox and shell were of $\frac{1}{2}$ inch iron, of a poor lamellar crystalline structure; the quality, however, was no worse than is usually used for the outsides of such boilers. The stay bolts in the furnace, crown sheets, etc., were insufficiently riveted over on the inside, which was the only defect of workmanship which appeared to exist.

But the safety valve was much too small, and the manner of weighting it was bad. The diameter of the opening was but 1 $\frac{1}{8}$ inches, and the valve was held down by a lever and spring balance, the nut of which I found screwed down 3½ inches upon the stem. It is well known, among railroad men at least, how the steam pressure used to run up in the boilers with the old style of spring balance; the only way to reduce such excess was to slack off the thumb nuts. It is easy to imagine that a boiler, short of water, the engine standing still, will rapidly get up steam; and there was an immense fire in the large furnace of this boiler, of tar barrel staves, left to itself and to the mercy of a safety valve as described above. Of course, the engineer is not to blame, as (being green) he knew no better; but what can I say of his employers? The cause of explosion was an excessive

pressure of steam, from over firing and the center of the crown sheet being dry and overheated. The effect of these combined causes was a reversal of the arch of crown sheet, which was then the cause of the destruction of the other portions of the boiler.

It is seldom that the causes of explosions are as visible as they were in this case, and in one which occurred at the Geddes rolling mill some time since. OPERA MUNDI.

Diving Bells.

To the Editor of the Scientific American:

It has occurred to me, while reading in your current volume an account of a submarine observatory and photographic gallery, invented by M. D. Toselli, that, instead of the top chamber for containing respirable air (which the operator will consume in a short time), he should take with him the materials used for evolving oxygen gas; he could then stay under water for a longer time.

Oxygen gas is generally obtained from substances by heat; but if *aqua regia* be poured on black oxide of manganese the gas is evolved without any other aid.

QUINTIS.

Philadelphia, Pa.

A NEW PREVENTIVE FOR SLIPPING BELTS.

We doubt if any more prolific source of loss of power in its transmission from motor to work exists than through the medium of slipping belts; nor, as a moment's consideration will show, is there any ordinary mechanical defect more destructive to that system of careful economy which should be the rule in every well regulated workshop. It is of little use to maintain and run a powerful engine, if the very power which represents the cost of so much labor and so much fuel is to be wasted before it can be applied to useful purposes. Suppose, for example, a pulley makes 100 revolutions per minute. Experiments conducted in England in 1863 proved that, when the power is transmitted by belting, there are, out of this number of revolutions, two slipped. Clearly, then, but 98 per cent of the power is forwarded to the work; and if there be numerous intermediate gearings, a still proportionally less fraction of the original efficient labor of the engine becomes utilized. In a case of which we were recently informed, fully 8 per cent of the power was thus totally lost. For a 200 horse power engine, 8 per cent means 16 horse power thrown away, or at a low estimate 32 pounds of fuel per hour burned without producing any other result than wearing out the belt and heating the pulley.

There are, of course, means for obviating slip to a certain degree. Probably those most commonly employed are the reprehensible habit of covering the periphery of the wheel with oil, resin, or adhesive matter, or of tightening the band, thereby bringing heavy pressure to bear upon the journals, increasing the friction and expediting the wear of the belt. Better than either of these is a plan which has lately come under our notice, which consists in covering the pulley with a flat band of elastic rubber and cloth made about one inch per foot shorter than the circumference, and with its inside face unvulcanized. This is stretched around the wheel and cemented fast. It is plain at once that, by this means, friction between belt and pulley must be materially increased, but to what extent the following results of experiment will best show. The tests made in our presence were conducted on an special apparatus consisting of two 12 inch pulleys on a shaft in bearings so that it could freely revolve. Upon one wheel the inventor (Mr. John W. Sutton, room 2, 95 Liberty street, this city) had placed his cover; the other had a plain smooth face. Over the plain wheel was passed a four inch belt, one end of which was secured to the floor: to the other extremity (the slack side of the band) were hung adjustable weights. Upon the covered pulley a two inch belt was placed, which also carried a weight at one end but at the other was attached to a hand lever. On suspending 29 pounds to the small band, and some 60 pounds to the large one, it was found, on applying a pressure to the lever, that the smooth wheel was caused to slip with great readiness. Without augmenting the weight on the small band, that bearing upon the smooth wheel was increased to 108 pounds, in spite of which the latter was easily and by the same means made to slip. Above this limit, however, the power of the covered wheel did not extend, and on the addition of more weight it also began to yield. The result may therefore be summed up in the fact that the friction of 29 pounds opposing the pressure of a hand lever on a 2 inch belt, aided by the pulley cover, was sufficient to overcome the friction of 108 pounds acting on a four inch belt, opposing a solid support, but applied to a smooth though otherwise similar pulley.

A second test was made with a smaller apparatus having an 8 inch pulley and a 1 inch belt. The result was gained by the aid of a lever and steel yard suitably arranged. With the pulley smooth the scale marked 3½ pounds, when the belt slipped freely. When, however, the cover was applied to the surface of the same wheel, the pointer indicated 19 pounds, or some 5 times the resistance. It would seem from the above that the claim of the inventor, that his device will transmit 100 per cent more power than the smooth pulley and consequently do twice the work before the belt will slip, is well founded, as such estimates are manifestly much below those obtained by actual trial.

So simple and effective an invention as this is worthy of the attention of machinists generally. It is readily and quickly applied, and in point of expense is inconsiderable in comparison with the economy which its employment must produce. We are informed that it is durable. The examples now in use for fourteen months exhibit no appreciable sign of wear.

TANITE EMERY GRINDER WITH ADJUSTABLE TABLE.

The accompanying illustration shows a machine designed to run emery wheels for accurate facing or grinding on surfaces. The principal difficulty encountered in performing this operation has been to so hold the work that the metal being ground should press evenly at all parts cut by the wheel, and yet not bear so heavily as to generate too much frictional heat, which frequently causes injury to both the metal and the emery wheel. The Tanite emery wheel here shown is 16 inches in diameter by 3 inches face, and is run on a steel arbor 2 inches in diameter. The journal boxes are each 9 inches long. The table is 29 inches by 8 inches, and is faced with an accurately ground steel plate, in which is an opening over the top of the emery wheel. If so desired, this plate can be of sufficient size to cover the whole surface of the table. The adjustment is effected by turning the hand wheels, which are on the same rod, and are shown at either end of the table. Motion is transmitted through the worm and crown gear close under the table to two inch and a half screws, working in the two vertical sleeves similarly located. This adjustment is very accurate and, if desired, very slight, even to the $\frac{1}{16}$ of an inch. The vertical screws are hidden from view by the sleeves, which work on the principle of the tail stock to a lathe. The support through which the sleeve operates is fastened to the frame of the grinder at each end by a bolt and nut, and is leveled and adjusted by four set screws.

It is well known that all makers of solid emery wheels manufacture their products with the same general gradations of coarseness and fineness, dependent on the size of grain emery used. In addition, however, to the varied qualities produced by these differences, the Tanite Company's wheels possess others, dependent on their special processes for tempering the wheels. Thus, if two wheels are made of the same sized emery, and one is for edge and the other is for surface work, they are so varied in temper as to fit each for its special use. This difference in temper is seldom understood by the users of wheels, who, supposing all to be alike, except in point of coarseness, subject all to similar treatment, and thus, through misusing the goods, fail to obtain proper results.

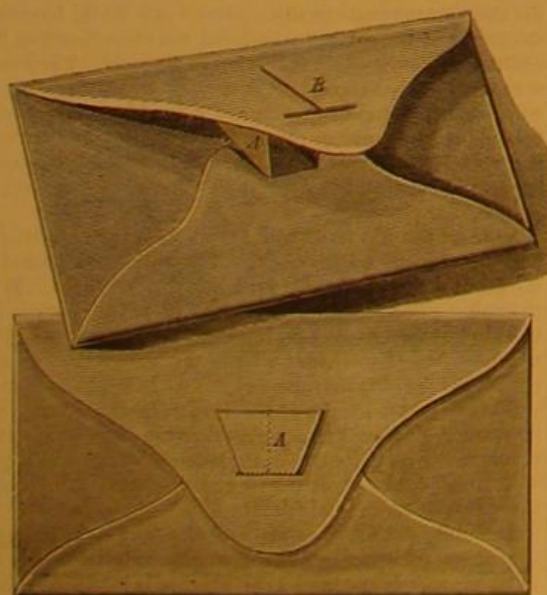
The machine now illustrated is specially designed to prevent this misemployment of wheels tempered for surface operation, which are so constituted that a too heavy or an unequal pressure results in rapid wear of the wheel and small product of work.

The adjustments of this machine are claimed to be such that the least steady and most heavy handed workman cannot fail to bring wheel and metal together in light and even contact. It is unnecessary for us to point out to machinists generally that this use of wide-faced wheels, properly tempered and so mounted that they cannot be recklessly used up or worn out of shape, is an important step toward making solid emery wheels as successful for grinding large flat surfaces truly as they now are for general edging, spruing and rough grinding. The varied uses of this machine are obvious and will readily suggest themselves.

For further information address the Tanite Company, of Stroudsburg, Monroe Co., Pa., as per advertisement on last page.

LOCK ENVELOPE.

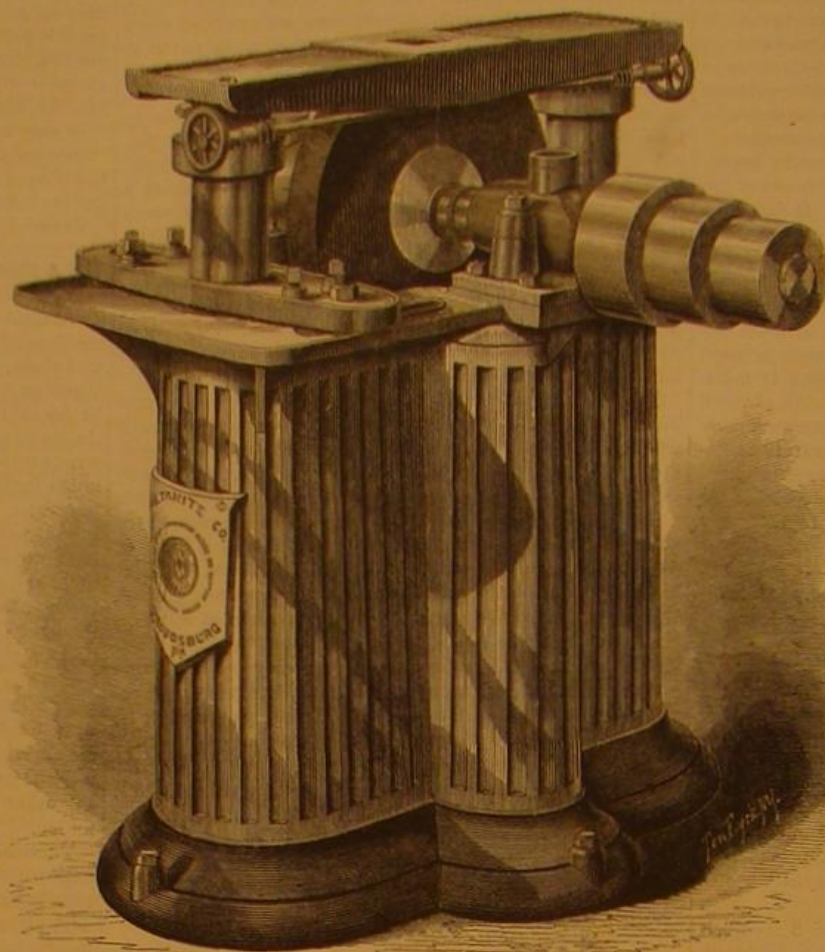
There are few who, at some period, have not experienced the annoyance of receiving or sending letters, the envelopes



of which have, through a careless handling or other causes, sprung open in their transit. In the course of a voluminous correspondence, such as is carried by express companies and

large business houses, improper sealing of missives is very apt to occur, and through such oversight important inclosures are often defaced or irretrievably lost.

In the invention which we herewith illustrate, this difficulty is guarded against, and the letter securely contained, even if the masticage fail to adhere, by a very simple locking arrangement of the envelope. On the lower fold of the back of the latter is made a dovetail-shaped slip, A, as shown, and in the upper fold are cut two slits, as shown at B. To lock the envelope, the corners of the slip are bent inwards,



No. 4 TANITE EMERY GRINDER WITH ADJUSTABLE TABLE.

as in the upper figure, and the latter is then easily pushed through the opening in the upper fold. The horizontal portion of the cut then admits of the slip being spread out flat, when, its back being gummed and moistened, it adheres to the envelope.

The efficacy of this device is obvious from the fact that, even in case the paste does not stick, it is impossible for the dovetail to come out of the slit unless it be deliberately folded and pushed through. For circulars and other documents generally forwarded unsealed, this envelope is also well suited.

For further information address the inventor, Mr. J. D. McNulty, No. 127 South 9th (corner 4th) street, Williamsburgh, L. I.

Perfumery and the Sense of Smell.

It may be doubted whether anything is really known regarding the actual composition and nature of the substance of most of the pleasing odors. We know perfectly well, says Mr. James Paton, the bodies which yield odors, and chemists can tell with absolute precision what is their chemical structure; but although they can further tell the conditions essential to the sensation of smell, the subtle essence which gives rise to it appears to be too ethereal for human detection or manipulation. A grain of musk will perfume millions of cubic feet of atmospheric air and still it continues apparently a grain of musk. The following minute quantities of different substances spread out on the surface of smell cause a distinct sensation:

Phosphoreted hydrogen, $\frac{1}{30000}$ grain; sulphureted hydrogen, $\frac{1}{30000}$ grain; bromine, $\frac{1}{100000}$ grain; oil of resin, $\frac{1}{13000000}$ grain. A still smaller quantity of musk than the last given smells strongly, but the actual measure has not been ascertained.

It is assured that, for the perception of an odor, it is necessary that the body to be smelt must be in a gaseous condition, just as it is required that, before we experience a taste, the substance must be dissolved; and for the sensation of touch, a resisting solid is necessary. Odorous gases are such as are readily and energetically acted on by oxygen, and the presence of oxygen is therefore a necessary condition of smell. Such gases as mix freely without uniting with oxygen—as hydrogen and nitrogen—are inodorous. In order also to experience the sensation of smell it is necessary that the odoriferous particles impinge with some violence upon the surface of the sensitive membrane in the nose which corresponds with the olfactory nerve; therefore, when we wish to experience a strong sensation of smell we sniff strongly, and when a disagreeable odor is to be avoided, we hold our breath, and breathe out when we think we are beyond its influence.

Manufacture of Carmine.

This is one of Nature's most gorgeous products in the way of color. That lovely, rich shade of red is solely produced from a decoction of the cochineal bug. Wherever the *Dactylopusia* is indigenous, there this little insect is to be found in myriads, feeding on the plant and imbuing its own blood with the glorious red of the flower. Only the females are used for making carmine; but as there are 300 females to one male, there is not much difficulty in picking out that solitary representative of the ruling sex. Woman's rights have full sway in this particular branch of the insect kingdom. The excellence and purity of this color and vermillions—in fact, of all colors—depend on careful and thorough washing in water. Some vermillions are washed as often as sixteen times before the pigment is sent to the drying rooms. In the manufacture of some of the finer colors, too, milk, eggs, or cheese are used with the chemicals as purifiers. The most surprising thing, says a correspondent of the *New York Times*, describing the Plymouth Color Works at Bergen Point, N. J., is to see the water that is drawn off from the huge tanks of color after it has been well stirred and washed. The tanks being lined with fine muslin, not a particle of color escapes, and the water is pure and clear as drinking water. Lakes of different shades are made from carmine combined with a chemical body, which cheapens the color and makes it of any desired hue. Rose pink and cheap lakes are made from a decoction of a red wood which is found in Brazil. Pure carmine is very expensive, costing in bulk at wholesale \$8 a pound.

IMPROVED SPINDLE STEP.

The object of this invention is an improved construction of the steps of mill spindles or other vertical shafts, whereby they are made adjustable to compensate for the wear of the bearing surfaces.

The illustrations show, Fig. 1, a perspective view with a portion broken away, and Fig. 2, a vertical cross section. In the base, A, of iron is formed a recess, the walls of which are screw-threaded to receive a correspondingly formed guide or bearing, B. The latter is constructed with an inverted conical opening to inclose the toe of the spindle, C, the end of which extends through and rests upon the upper of two or more hardened steel disks, D, placed in a suitable cavity at the bottom of the recess. The top of the guide forms a collar, E, which is beveled off around the interior to receive oil for lubricating the spindle. The passages, F, in the base also serve to conduct lubricating material to the spindle toe. G is a lock nut screwed upon the guide between the collar and the base. In the engravings, Fig. 1 shows the guide let into the base to the full extent and locked in position by the nut, G, screwed down to bear upon the upper surface of the latter. As the guide becomes worn by the rotation of the spindle, it is unscrewed and moved up, Fig. 2, to the requisite height to fit the toe snugly and prevent the spindle from vibrating or running out of true; thus, in short, compensating for the wear. The nut, G, is then again screwed down to lock the parts in place. By using a number of disks, D, one, two, or more can be removed as the spindle drops down, thus adjusting the step regularly to supply the deficiency by wear. The invention appears durable and simple

Fig. 1

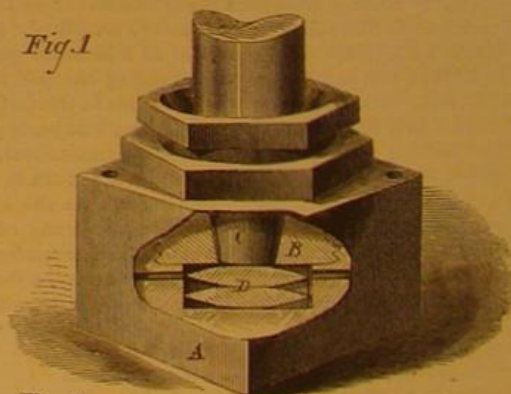
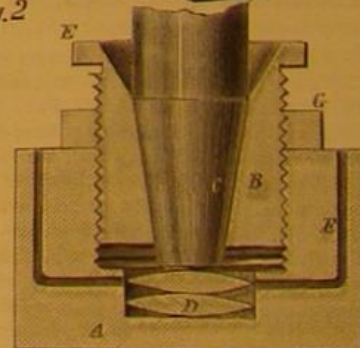


Fig. 2



Its efficiency will doubtless be proved by actual employment. Patented April 1, 1873. For further information address the inventor, J. J. Henry, 236 Lexington st., Baltimore, Md.

CAR AND PASSENGER ELEVATOR.

Our illustration represents a proposed method of securing rapid transit between Hoboken (opposite New York city, in New Jersey, east of the Palisades), and Jersey City Heights, North Bergen, Bonnyville, and other localities in Hudson county, in that State. The topography of the route is very irregular, necessitating circuitous roads to avoid high eminences, and rendering a direct path by ordinary means impracticable. The present system is now being carried out by the Hudson County Elevating Company, an association incorporated "to erect elevators, driven by steam or other power, at the base of Jersey City Heights or Palisades, at such points as said Company may select, for the easy elevation of street cars, teams, passengers, etc."

The mechanism of the invention was devised by Edwin L. Brady, civil engineer, of Jersey City. The lifting cars will be constructed entirely of iron, with strong angle iron frameworks, all centering upon a huge ring bolt at the top of the car, to which wire cables are attached. To the latter steam power is applied, which it is estimated will accomplish the lift of 200 feet in about one and a quarter minutes. Safety idlers, moving on independent cylinders, are arranged, and a system of check pawls, attached to each of the eight iron columns, are also provided to guard against any danger of accident. Each column will be twenty-four inches in diameter and, with the exception of the two upper sections which are of wood, constructed entirely of iron. They will be securely adjusted by iron truss braces, and strongly keyed to the rocky sides of the cliff.

At the base of the elevator two large buildings are to be erected, in order to afford means of utilizing the surplus steam power. Ample room will be provided for elevating cars and teams and for the transportation of one hundred foot passengers at once. Galleries will be added to the upper portions of the structure, from which a fine view of the surroundings will be obtained. The work now in progress, it is estimated, will be completed by the first of July next.

Should the plan be found feasible for elevating horse cars, teams, and passengers, it is not unlikely that the railroads extending westward may adopt a similar plan for taking their passengers over the hill instead of through Bergen tunnel, which the Erie, and the Delaware, Lackawanna, and Western railroads now have to traverse.

The Planet between Mercury and the Sun.

At a recent meeting of the Manchester Literary and Philosophical Society, Mr. Joseph Sidebotham, F.R.A.S., said: "As there is again some speculation as to the existence of an intra-mercurial planet, and every little fact bearing on the subject may be of value, I have referred to my diary, and find that on Monday, March 12, 1849, our late member, Mr. G. C. Lowe, and I saw a small circular black spot cross a portion of the sun's disk. We were trying the mounting and adjustment of a seven inch reflector we had been making, and used an ink box between the eye piece and the plane speculum. At first we thought this small black spot was

upon the eye piece, but soon found it was on the sun's disk, and we watched its progress across the disk for nearly half an hour. The only note in my diary is the fact of the spot being seen; no time is mentioned; but if I remember rightly, it was about 4 o'clock in the afternoon."

Nickel Plated Speculum.

In a letter which Mr. Sidebotham had received from Professor Hamilton L. Smith, of Hobart College, Geneva, N. Y., the writer suggests the use of iron or bell metal specula coated with nickel, for reflecting telescopes. He says: "I ground and prepared a bell metal speculum, which I coated with nickel, and this, when polished, proved to be more reflective (at least I thought so) than speculum metal. The two objects which I sought were, first, to have a polished surface unattackable by sulphuretted hydrogen (this, for example, is not injured by packing with lucifer matches), and, secondly, for large specula, doing the most of the work by the turning tool and lathe. I really think a large, say three feet, mirror,

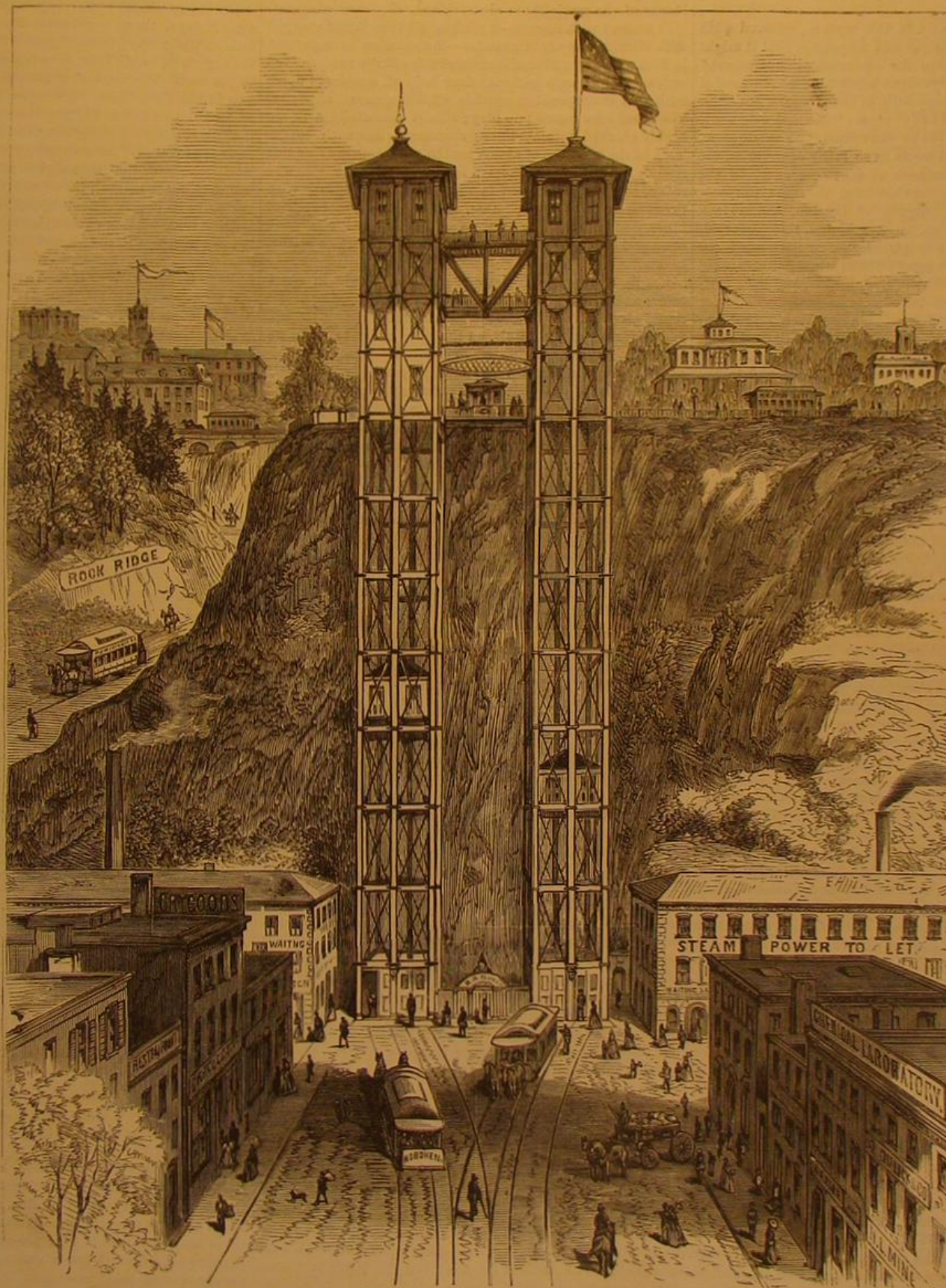
hazel or yellowish color, leaving the pupil brown. The fore feet, or hands, have the fingers formed very like the human hand, while the thumb or toe, corresponding to the human thumb, is quite short and is large and round. The joints are protected and covered by a formation resembling armor, and the body and tail seem at first glance to be free from scales, though a closer examination shows the scales to be small and smooth. The reptile has not yet been identified as belonging to any species heretofore known, as it does not appear in Cuvier. It is the intention of Dr. Woodward to kill it and prepare the skeleton for mounting; but it has been suggested that a cast be taken, before killing, for exhibition in the collection of the Smithsonian Institute.

The Salt Deposits of Western Ontario, Canada.

The superficial area of the Ontario salt deposits is comparatively small, and the whole salt bearing district may be included within the counties of Huron and Bruce. Mr. John Gibson, B. A., in a paper in the *American Journal of Science and Arts*, gives some interesting facts regarding the principal wells, eight of which he has recently examined. The Ainleyville well was sunk 1,244 feet, and then abandoned. The position of the boring marked the north-eastern margin of the ancient salt lake, and the geological horizon of the salt was passed without the least evidence of its occurrence. The Kindred well reached a depth of 957 feet, and the Goderich company's boring struck the salt rock at exactly 1,000 feet below the surface. From this depth was obtained, by pumping, a saturated brine from which large quantities of salt continue to be manufactured. The salt bearing stratum lies immediately at the base of the Onondaga formation, and is at once recognized by the presence of saliferous and gypsiferous magnesian marls, lying as a general rule above the salt bed. The Dominion well was sunk 1,113 feet, and the brine pumped up constantly marks 87° salinometer, with a temperature of 63° Fah. Hawley well extends 967 feet, and the Clinton well 1,136 feet. From the Stapleton well, 1,220 feet in depth, brines of great purity are yielded. It may be mentioned that the prevalence of vast quantities of gypsum and salt in a mixed state naturally suggests the utility of a shaft by which not only could pure rock salt be obtained, but also the combined gypsum and salt for agricultural purposes. The drilling done in Coleman and Gowinlock's well is said to be unprecedented, both for speed and absence of mishaps. Actual boring commenced on the 10th of March, 1870, and the salt-bearing stratum was reached on the eve of the 22d of the same month at a depth of 1,035 feet. After passing through 100 feet of pure rock salt, without the least evidence of change, the boring was abandoned.

In no other portion of the American continent has there been discovered a deposit of salt so magnificently great. The supply is practically illimitable and may favorably compare with the production of the salt mines of Droitwich, in central England, or with that of the solid salt hills of Cordova.

The residues from molasses are used in France for the manufacture of carbonate of potash.



THE CAR AND PASSENGER ELEVATOR IN JERSEY CITY.

coated with nickel, but cast of iron, and finished mostly in the lathe, while it would not cost the tenth of a similar sized one of speculum metal, would be almost equal to silvered of glass the same size, and vastly more enduring as to polish."

Iguana or Tree Lizard.

The largest specimen of the iguana or tree lizard of South America that has ever been seen in this country was lately received, in good health, at the Army Medical Museum, Washington. The reptile is almost entirely black, or a dark chocolate brown, is thirty inches long, and on the top of the head has a large round protuberance like a swelling, while on each side of the head, near its base, appears a similar immense ball. The eye is prominent, very bright, and is of a bright

Anæsthetics.

This is a term derived from the Greek word *anæsthesia*, meaning those agents which, like nitrous oxide, ether, and chloroform, produce insensibility to pain.

That there are two sides to every question is very forcibly illustrated in the attempt to place the honors of the discovery of anæsthetics where they rightfully belong. In a recent scientific lecture, on this subject, delivered here by Dr. Sims, he awards the credit of first using anæsthetics, for the relief of human sufferers under disease or surgery, to Dr. Wells, of Hartford, Conn. The *Evening Post*, of this city, in commenting upon the statements of Dr. Sims, says:

"The difficulty with Dr. Wells' claim is that, though he experimented with anæsthesias, with nitrous oxide gas, perhaps with ether, he never established their use. The real question at issue is, not who discovered the possibility of producing insensibility under surgical operations, but who established the possibility with a known agent and brought it into practical use.

Sir Humphrey Davy, early in this century, relieved pain by the use of nitrous oxide gas, and suggested that it might "be used with advantage during surgical operations." Pliny, and some Greek physicians after him, recommended the use of certain herbs, especially of mandragora, for their soporific power; and, said one of them: "Medical men use it for those who are to be cut or cauterized." The Chinese, who preceded the western world in so many discoveries, are supposed to have used anæsthesia at a remote age. In the middle ages, other agents were used for the same purpose. In 1823 Mr. Hickman, a surgeon of London, and in 1832 Dauriol, a French physician, used gas, and, they asserted, successfully. Other French physicians, recommended and performed operations with some success when patients were under the influence of alcoholic intoxication, and later mesmerism was suggested and tried in some cases. Thus for many centuries, alleviation from pain has been sought for; discoveries have been made, and perhaps some limited practical application of them maintained; but the man had not yet appeared who had made it clear to surgeons and to the world at large that any of the known agents were so safe and so available that they could be brought into common use.

Neither Jackson, Morton nor Wells, then, was the discoverer of anæsthetic agents, any more than Fulton discovered steam, or Morse, electricity. The question is: Which of them first successfully applied such an agent and established its general use? Unquestionably Wells tried, as others, scattered along through the centuries, had tried before and failed. He pulled a few teeth, but either he wanted the energy or the confidence to persevere; Jackson understood the properties of ether, gave some instructions to Morton; perhaps he even recommended ether to Morton as the agent he was in search of, but he did not establish its use; there is even evidence that he doubted if it could be used without danger, to produce insensibility. But it was Morton who had the energy and perseverance to insist upon trial after trial till the virtue of the remedy was established to the satisfaction of the world at large. It is the first step that costs and counts, and that step was Morton's.

In reply to this, Dr. G. Q. Colton very emphatically upsets the theory of the Wells abandonment. "We have," he says, "the sworn testimony, of about forty of the most respectable citizens of Hartford, that during the years of 1845 and 1846 Wells extracted teeth for them without pain, using the gas as the anæsthetic. He was in constant use of the gas for about eighteen months, when his health gave way, and he went to Europe. Even in Europe he did not abandon his discovery, for he presented his claims to the Academy of Sciences in Paris, and that institution, in recognition of the services, conferred on him the title of M. D.

As soon as Wells returned to this country he resumed the use of the gas, and continued it until his death, which occurred on the 24th of January, 1858.

But he met the most determined and bitter opposition from all quarters. It was at that time too much to believe that the inhalation of so little gas or vapor would destroy the pain of a surgical operation! Dr. Wells did all that a man could do, while he lived, to prove to the world the value of his discovery. Should he be deprived of the honor of the discovery because the public were incredulous and repudiated his claims?

Wells died before the merits of the gas were generally recognized. After his death Dr. Morton set up the claim that nitrous oxide was not an anæsthetic, and therefore that Wells had discovered nothing. No one had used the gas to produce anæsthesia save Wells, and Morton was enabled to gain a general assent to the position he took, namely, that, nitrous oxide not being an anæsthetic, therefore he, Morton, was the discoverer of anæsthesia! If at that time and during the lifetime of Mr. Wells the gas had proved to be what it really is, and what I have demonstrated it to be, the best and safest anæsthetic known, we never should have heard of Morton as the discoverer of anæsthesia.

When I revived the use of the gas in 1863, I had this general incredulity respecting its powers to contend with. I was met on all sides by the assertion that Wells had tried the gas and it had proved a failure. I expended eight thousand dollars the first year in advertising, advocating, and defending it; and in all this time did not realize a dollar of profit from my business. Is it any wonder that poor Wells, who had no money to spend, should encounter opposition and discouragement in its first introduction?

It should be remembered that Wells' first experiment—for which I gave him the gas—was on the 11th of December, 1844, and that the first experiment by Morton was on the

30th of September, 1846; also that Morton was stimulated to this experiment by information derived from Wells and newspaper notices of Wells' operations.

In view of all these facts," says Dr. Colton, "how can any one hesitate to award the honor of the discovery of anæsthesia to Dr. Wells?"

The A B C Process.—London Filth transformed into Shining Gold.

The process of precipitating by sulphate of alumina the valuable constituents of sewage, and utilizing at the same time the purifying power of charcoal and clay, is that to which, says the *Journal of Science*, we decidedly give the preference, as by this means the water is practically purified fit to be discharged into a running stream, and the deposit is retained in a form entirely inoffensive and capable of being turned into a dry and portable manure. This process has been before the world for some years as the A B C process, being derived from the initial letters of the principal constituents of the precipitant: alum, blood, clay and charcoal.

In contact with sewage—a slightly alkaline liquid charged with nitrogenous organic matter—the alumina is separated in flocks, and, by virtue of its remarkable affinity for dissolved organic matter, each particle seizes hold of, and drags down with it, a corresponding particle of nitrogenous impurity. The blood here comes into play; this is essentially a liquid highly charged with albumen; albumen is instantly coagulated in the presence of alum; and in the same way as this ready coagulability of albumen is utilized in fining wine and coffee, so it is made use of in this process by joining with the alumina in its precipitation, uniting it in a network of fibers, and giving it, as it were, arms wherewith to seize upon and drag out of solution still more putrescible constituents.

But the precipitated hydrate of alumina is light in character; and although it would ultimately settle, leaving a clear liquid above it, the slightest agitation causes it to float up, and thus renders it difficult, on the large scale, to drain off the mud. Here the action of the clay is apparent. This substance has a curious physical property; when finely ground up with water, it forms a creamy emulsion, which takes many days to settle. But when this creamy liquid meets with sulphate of alumina, the clay coagulates like albumen, and settles down in heavy granular flakes. Now in the A B C process these three precipitations—that of the alumina, that of the albumen, and that of the clay—take place simultaneously, and in each other's presence; they become closely locked together in a triple alliance; the heavy character of the clay particles gives density to the mass, and causes it to settle rapidly, and remain in a compact form at the bottom of the tank.

There still remains the probability, if not the certainty, of foul gases being present, while the water, though clear, may nevertheless be colored. These residual impurities are attacked by the charcoal; the powerful affinity of animal charcoal for organic coloring matter corrects the one evil, while the well known absorptive action exerted by vegetable charcoal on the gaseous products of putrefaction corrects the other.

The method of applying the ingredients is extremely simple. The clay and charcoal are incorporated in a grinding mill, with the aid of sufficient water to form a thin paste. This paste flows into a tank, and is constantly agitated until it is required to be mixed with the sewage. By the side of the mixing room is a smaller room, through which passes a channel or trough. At one end of this channel there rushes in the London sewage, and with it an unmistakable odor. The B C mixture, or thin water paste of clay and charcoal, is admitted to the trough by a pipe from the store tank; the sewage in its passage past this pipe carries with it the mixture, and the two, after well mixing, proceed on their way past a second pipe connected with a tank containing a supply of sulphate of alumina dissolved in water. All that is now requisite is to allow the sewage, B C mixture, and alum to flow in inodorous company to the settling tanks. The channel leading to the tanks has its course interrupted by numerous ledges, which serve to cause the more perfect intermixture of the sewage and the disinfectants. The first tank in which the sludge is allowed to settle contains the principal portion of the precipitate. The clear water is allowed to flow off continuously from the first tank into a second tank; and the remainder of the mud is deposited in this and in the other tanks into which it flows. From the last tank the water is conducted to the river, appearing as a clear, inodorous and tasteless effluent. When sufficient sludge has been collected in the first tank, the treated sewage is shut off from this and permitted to flow into another tank, which then forms the first of the series. As much of the water as possible is then run off from the mud, and the latter is drawn into the acidifying tanks, where a small quantity of sulphuric acid is added to prevent the loss of any ammonia. From the acidifying tanks the semi-dry mud is pumped into the drying presses, whence it issues in a cake. This semi-solid mud is then further dried by a most ingenious application of heat in revolving iron cylinders. The wet mud is passed in at one end, and dry manure, in the form of an inodorous and inoffensive powder, falls from the other end, at the rate of 5 tons in ten hours, at the expenditure of a few hundred-weights of coal.

If space enough be available, the mud may be simply pumped, from the bottom of the settling tanks, into large open air stanks, where it dries under the influence of the sun and air. Not the slightest offensive odor is apparent during any stage of this drying.

The dry mud in powder, forming excellent manure, is removed from the sheds, and packed into bags for transport.

Crossness is situated on a projecting part of the southern shore of the Thames, between the Plumstead and Erith marshes, and is the southern outfall of the London drainage. The quantity of sewage now daily discharging at Crossness is 50,000,000 gallons. Large as this quantity may appear, the enormous engines employed in pumping the sewage are fully equal to the task, for they are capable of lifting 230 tons in a minute, or nearly double the average flow. The transformation of such a mighty mass of filth into heaps of shining gold is a feat worthy of the days of the alchemist, or rather of the days of modern chemistry. Of this quantity of sewage, the works of the Native Guano Company are capable of dealing in the twenty-four hours with 500,000 gallons, drawn from the cross-cut or culvert through which the sewage runs into the principal reservoir. This quantity amounts to 1 per cent of the whole delivery. Thither the sewage flows into the sump of a pump worked by a 15 horse power steam engine, whence it flows into contact with the A B C constituents as we have described.

During an official trial, lately completed, extending over eighty days, there were used 80 tons of dry A B C materials, while the "native guano" obtained amounted, in the dry state, to 131 tons, showing an increase of more than 63 per cent. The amount of sewage treated during this time was 11,672,000 gallons. Therefore 1 ton of dry native guano was obtained from 89,100 gallons of the Crossness sewage.

With scarcely an exception, the farmers are unanimous in their approval of "native guano;" many of them, shrewd, intelligent men, well acquainted with the various artificial manures in the market, have tried "native guano" with intelligence on different fields against other manures, and were assured that, putting equal values per acre, it was superior to most manures in the market.

SANITARY NOTES.—MILK AND ITS ADULTERATIONS.

It is proposed in this paper, drawn from the report of Dr. A. H. Nichols and Professor J. F. Babcock, to consider briefly the various methods which are resorted to for the purpose of adulterating milk, and the means which have been afforded to us by chemistry for their detection.

THE COMPOSITION OF MILK.

Genuine milk is composed of water holding, either in suspension or solution, fat globules, casein or cheesy matter, sugar, and various mineral matters or salts. It is a physiological fact that the quantity and quality of milk may vary, not only in different cows, but in the same cow, this variation depending upon: 1. The breed of the cow from which it is obtained. Alderneys, for example, give milk containing a large proportion of cream, and hence forming a very nutritious food for infants; while Durhams produce a fluid richer in casein and, on this account, especially adapted to the manufacture of cheese. 2. On the number of calves born, and time since calving. Less milk is given with the first calf than with the subsequent ones; and for a week or ten days after every birth a yellow, thick, stringy substance, called colostrum, is secreted, which is unfit for use. 3. On the character of the food furnished to the animal. When fed principally on carrots, there is a slight diminution in the amount of casein and butter and an increase in the quantity of sugar. This is still more marked when beet root is made the chief article of diet. If the food consists of the refuse of distilleries, the animals often become diseased, and the milk given is manifestly unfit for consumption. The yield of milk is most abundant in spring. In dry seasons the quantity secreted is less, but the quality is richer. An unpleasant taste and odor is said to be imparted to milk by an exclusive diet of turnips or oil cake, and the same is also the case when the cows feed upon wild garlic or other weeds and leaves of plants where the pasturage is bad. 4. On the cleanliness and ventilation of stables, and care bestowed upon the animals. It often happens that milk, of high specific gravity and yielding a large per cent of cream, becomes so thoroughly impregnated with the vitiated air of the stable as to be decidedly repulsive to the taste. 5. On the time of milking. The afternoon milk is richer, on the average, by one fourth than that obtained in the morning, and the last portion of a milking is much the richest and is often reserved for cream.

METHODS OF EXAMINATION.

The hydrometer alone affords an imperfect test of the richness of a specimen, for many reasons, prominent among which is that the specific gravity of impoverished milk may be fraudulently lowered or raised by the admixture of various ingredients, principally water and salt. The ordinary specific gravity of milk at 50° Fah. ranges between 1.029 and 1.037, and it is no secret to milkmen that this specific gravity is not much changed if four per cent of water be added for every one per cent of cream abstracted. The lactometer is simply a long tube graduated into a hundred parts, and intended to indicate the percentage of cream which has spontaneously separated from the milk and risen to the surface within a given time. This quantity generally measures from 8 to 20 per cent, and, in certain breeds of cows, may amount to even 50 per cent. The instrument furnishes no knowledge of other constituents, such as casein and sugar. The lactoscope determines the richness of milk by measuring its opacity, on the principle that, while the fat globules are opaque, the liquid in which they float is nearly transparent. It is considered to present no material advantage over the lactometer. The microscope enables the eye to estimate the number of fat globules a specimen contains, as well as abnormal constituents, infusoria or fungi which may be present.

ADULTERATING SUBSTANCES AND HOW THEY ARE DETECTED.

These are principally water, flour or starch, gum arabic or

dextrin, cerebral matter, chalk or whiting, turmeric or annatto, gum tragacanth, carbonate of magnesia, arrowroot, sugar, emulsions of almonds or hempseed, carbonate of soda, eggs and salt. We shall consider them in their order.

Water lessens the specific gravity, and may be detected by measuring the density of either the milk, the skimmed milk or the serum. If a few drops of acetic acid be added to the milk, the fatty matter and casein will be coagulated, and may be removed, leaving the serum. The effect upon this substance by the addition of water is shown by the following:

Serum containing percentages of water.	Specific gravity.
Pure serum.....	1.029
Water 10 per cent.....	1.025
20 ".....	1.023
30 ".....	1.020
40 ".....	1.017
50 ".....	1.014

The quantity of water may also be estimated indirectly by determining quantitatively the amount of the solid constituents or of the milk sugar present.

Flour or starch is easily recognized by adding a few drops of the tincture of iodine to the whey. If this produces the characteristic blue color, it indicates that some amylaceous substance has been added. Starch can also be found by the microscope.

Gum arabic or dextrin is detected by the action of a small quantity of alcohol upon the whey. A dull abundant white precipitate falls, which may be proved to be gum by its properties, and which differs essentially from the light bluish or diaphanous flakes which alcohol produces in pure milk.

Cerebral matter is usually some villous mixture of the brains of sheep, employed to counteract the blue tinge of impoverished milk. It is rarely used; and if present, generally sinks to the bottom of the vessel. It may be made out by the microscope.

Chalk or whiting is sometimes employed to neutralize the acidity of soured milk. Chalk is insoluble in milk, and hence will form a sediment, the character of which may be detected by the effervescence caused by a drop of acid.

Turmeric or annatto is used to give a rich cream color. Evaporate a portion of the sample to about one eighth its original bulk, and add a small quantity of caustic potash. If the yellow color becomes brownish, turmeric is present; if bright red, annatto.

Gum tragacanth, carbonate of magnesia and arrowroot add consistency and counteract the blue color of the milk. To detect the former, let the fluid stand for some hours and observe if any gelatinous deposit is formed. If so, wash it with water and test with a few drops of the tincture of iodine, when a blue color will be produced, due to the starch contained in the tragacanth. Arrowroot is detected by means of the microscope, by which instrument the round particles of carbonate of magnesia can also be made out. The latter will be found to disappear upon the addition of a drop of acid.

Sugar, in the form of caramel or brown sugar, is used to add to the color and develop the flavor of impoverished milk. Its presence is ascertained by mixing a little yeast with the serum of the sample and exposing the mixture to a temperature of between 70° and 80° Fah. An abundant and rapid disengagement of gas will take place in the course of two or three hours, forming a sure sign, as pure milk cannot ferment in so short a time.

Emulsions of almonds or hempseed are inexpensive substances, and impart an unpleasant flavor to the milk. The addition of a few drops of amygdaline to an ounce of milk containing milk of almonds will cause a development of the odor of bitter almonds.

Carbonate of soda is added to prevent milk from quickly turning sour. When this substance is present, there is a slight increase in the quantity of the cinerated ash, which will be found to effervesce upon the addition of an acid.

Eggs, the admixture of which is one of the most harmless adulterations, are recognized by diaphanous clots formed in boiling the milk. When present in small quantity, the serum of the milk must be boiled, and the flocculi formed compared with the effect of boiling upon serum known to be pure.

Salt is understood to be used quite extensively to increase the specific gravity and develop the flavor of the milk. Its presence cannot be detected by the ordinary observer, but is made manifest to the chemist by the weight and taste of the ash.

ADULTERATION IN LARGE CITIES.

The report from which we draw our facts states that in large cities adulteration of milk is carried to an extent, the fearful nature of which is best evidenced by the mortality among children, of which it forms the principal nourishment. In 1868, the last year of which the records were published, 487 deaths of cholera infantum occurred in Boston, while, in an equal population outside the city, but 100 took place. The cause is attributed to the impure milk, which the country children were not obliged to live upon.

It is stated that, in crowded localities, adulteration is the rule, and the fact is admitted by milkmen generally. It is estimated that the daily supply of milk for the city of Boston, for the year ending March, 1872, was 24,069 gallons, which, for the entire year, would amount to 8,763,285 gallons, the cost of which, to consumers, may be reckoned at \$2,979,517. If we assume the average amount of water, fraudulently added, to be but twelve per cent, and this is putting it at a low figure, the amount expended by the citizens during this year for water, apart from the legitimate water rates, amounted to the sum of \$357,542.

To indicate more accurately the full amount of the fraudulent gains in this trade, there should be added to this sum

the value of the cream poured off from the top of the cans, and sold by the milkmen at a price varying from twenty-five to fifty cents a quart.

Ship Canal in Scotland.

The Caledonian Canal, which, with Loch Ness and other lakes, cuts across Scotland from northeast to southwest, for a distance of sixty miles, between Inverness and Fort William, affords easy passage to ships drawing not more than eighteen feet. The necessity for such a canal is not very great. It serves only to avoid the somewhat dangerous voyage around the northern extremity of the country. But what seems an unwise policy diminishes its usefulness to the smallest possible degree. The tolls are so high that commerce avoids it almost entirely. Steamers, which combine their own motive power with good passenger accommodation, monopolize the usefulness of the canal and pay tolls sufficient to defray the labor of working the locks. Main taining the canal is thus a large government charge for a very small result. A small toll would serve the country and the interest of the government to greater advantage.

A NEW DIETETIC.—Dr. Goodman, writing to the *British Medical Journal*, says that artificial fibrin is an admirable dietetic substance, being unparalleled for lightness and digestibility, and a great delicacy besides. It is obtained by exposing albuminous material to the action of cold water for a time, the hen's egg, from its great abundance, being the most suitable source of the albumen. When the contents of an egg are immersed in cold water for twelve hours or thereabouts, they undergo a chemico-molecular change, becoming solid and insoluble; a change indicated by the opaque and snowy whiteness of the white. The action of heat to the boiling point is now brought into the process, and the fibrin is then ready for use. In cases of deficient nutrition and rejection of food, Dr. Goodman says this artificial fibrin is of the greatest service, as the weakest stomach is able to retain it, and its use appears to promote the appetite for food.

A COLOSSAL BEER CASK.—The great Hungarian cask, which is capable of containing 2,000 ciders (or 25,000 gallons) of beer and which has been sent for show to the great exhibition at Vienna, is made entirely of wood grown in Hungary, and is said to be a perfect marvel in workmanship.

PROGRESS OF THE HOOSAC TUNNEL IN MAY, 1873.—Headings advanced from east end westward, 155 feet; from west end eastward, 120 feet. Advance during May, 275 feet. Total lengths opened to June 1st, 23,367 feet. Rock remaining to be penetrated, 1,664 feet; being 96 feet less than one third of a mile.

J. A. B. says: "I have taken the *SCIENTIFIC AMERICAN* ever since I commenced to learn my trade, and it is not too much to say that that journal has had a great deal to do with the raising of my salary from \$500 a year to \$1,700."

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. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Roe, 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 cannot 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 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 collect 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, New York, 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.

Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate. Address MUNN & Co., stating particulars.

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.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is \$10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

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.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, for full particulars.

Design Patents.

Foreign designers and manufacturers, who send goods to this country may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 35,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens to all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

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 the former, 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 assignee 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.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Canadian Patents.

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 \$30) 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, N. Y., who will give prompt attention to the business and furnish full instruction.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office \$1.

A copy of the claims of any patent issued since 1836 will be furnished for \$1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent. Address MUNN & Co., Patent Solicitors, 37 Park Row, New York city.

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an honest opinion. For such consultations, opinions and advice, no charge is made. Write plain, do not use pencil, nor pale ink; be brief.

All business committed to our care, and all consultations, are kept secret and strictly confidential.

In all matters pertaining to patents, such as conducting interferences, procuring extensions, drawing assignments, examinations into the validity of patents, etc., special care and attention is given. For information, and for pamphlets of instruction and advice

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37 Park Row, New York.

OFFICE IN WASHINGTON—Corner F and 7th streets, opposite Patent Office.

Recent American and Foreign Patents.

Improved Supplementary Wheels for Car Trucks.

Smith Spelman, Brooklyn, N. Y.—This invention has for its object to diminish the friction and consequent wear of car wheels in passing around curves. The invention consists in applying supplementary wheels to run loose on the axle of the ordinary flanged wheels. It is especially applicable on street railways, a wide flat rail being provided for the supplementary wheels to run on.

Improved Washing Machine.

Clarence L. Rose, Roseville, Ill.—This invention is to furnish a washing machine which turns, rubs, and presses the clothes, thus washing them leanly in a short time, with comparatively small exertion in handling. The invention consists in the double action of the beater by the motion of the oscillating tub, producing rubbing and pressing at the same time, the beater carrying the clothes against the rubber and pressing them against it and the bottom of the tub.

Improved Hay Carrier.

Eugene B. Tanner, Attica, Ohio.—The object of this invention is to furnish to farmers and others a simple apparatus for hoisting, carrying, and depositing rapidly hay bales to the desired place in the barn, raving time and labor thereby. The invention consists of lever and guide pieces, in connection with a pulley having a weighted catch lever for suspending the load till ready to be dropped. Suitable guide strings and pulleys facilitate the rapid action of the conveying apparatus.

Improved Stop Mechanism for Looms.

Thomas Islerwood and William Nuttall, Westbury, N. Y.—This invention consists of two or more wires, with devices for presenting them behind the web thread at the middle of the loom, or thereabout, after the shuttle passes, to insure the action of the web fork or feeler for throwing off the shipper lever when the web is present. It also consists of a novel arrangement of means for presenting the feeler to the web in a suitable position in advance of the cloth, and then moving it away, so as not to interfere with the beating up of the web by the reed. The arrangement of the stopping mechanism at the middle of the lay saves the necessity of employing one near each edge of the warp. It often happens in looms carrying several shuttles that the web breaks, so that the ends are long enough to raise the latches, owing to the cutting or overstraining of them in particular places by the boxes in which the shuttles are changed.

Improved Skate.

Wendell Straker, Taylorville, Ohio.—This invention relates to an improved construction of skates with a view to rendering them more durable, and their attachment to the feet more convenient, secure, and comfortable, enabling the repair or renewal of the runners to be more easily effected than heretofore. The runners are secured in a groove in an iron which is secured to wooden soled boots or shoes, and said iron is detachable from the wooden sole by a peculiar but simple device. The runner is also readily detached from the iron.

Improved Lock Fastening for Mail Pouches, etc.

Brice X. B. Jr., Huntington, Pa.—This invention relates to modes of conveniently applying locks to pouches, satchels, carpet bags, and analogous articles; and it consists in employing two hinged sliding clamps, and in providing the adjacent end of each with a corresponding eye through both of which the padlock is passed and then locked. It also consists in an apertured plate sliding in a recess on top of a plate to hold firmly the name, address or destination of the owner of the pouch, satchel or carpet bag.

Improved Sewing Machine.

George Webster, Jr., and John Fraser Webster, Hamilton City, Province of Ontario, Canada.—This invention consists in a new mode of applying the feed bar mechanism; in a peculiar relative construction of the shuttle carrier and feed bar to enable the former to raise the latter at every forward motion; and in a very simple and convenient mode of regulating the length of stitch.

Improved Fence.

Austin Orris, Ellington, Iowa.—The invention relates to that class of fences which are placed across streams liable to be flooded with water at one season of the year and obstructed with ice at another. The invention consists in a jointed post which will enable the panel to stand erect in the grazing season, and to be thrown down with its top up the stream in the season of ice.

Improved Cement.

Dr. John E. Park, Seguin, Texas.—This invention relates to a new hydraulic cement, and to a process of burning the same to develop its highest cementitious qualities. The cement is composed of 1 part lime with 30 to 40 per cent of clay (alumina and silica), and 5 to 10 of fine sand (silica), and 5 per cent of soda (carbonate, muriate or caustic), or potash. The principal feature of the process is determining the degree of calcination by means of the color of the material at various stages of the burning; and without the exact degree of calcination, thus determined, the cement will not be of the required quality.

Improved Steam Engine Valve.

Alexander Bauman, London, England.—This invention consists in cutting off the steam from the main cylinder before its piston has reached its throw by detached leading valves, one at each end of the main cylinder and an intermediate one, all moved by the pressure of the steam that fills the main cylinder at or near the completion of each stroke. The piston valves cut off the exhaust of the main cylinder before the end of each stroke, thereby forming therein a steam cushion which checks the momentum of the main piston and receives it with a yielding resistance like a spring, thus making high speeds much safer. It is also economical, because the steam cushion stores up power which is exerted in the reaction to send the piston back.

Clevis Bar, Hook, Whiffletree, and Whiffletree Staple.

Robert Gibbs, Spring Hill, Mo.—This invention consists, first, in a peculiar mode of constructing and combining the clevis bar with its brace; second, in a peculiar construction of double hook for clevis bars or whiffletrees; third, in a novel mode of swiveling the shank of a clevis hook in the clevis bar and combining it with a laterally adjustable front plate; fourth, in a new way of applying a hook staple to a swingle tree in connection with a perforated plate.

Improved Turpentine Scraper.

John G. Cobb, Shoe Hill, N. C.—This invention relates to turpentine scrapers which are used to detach the resinous substance that exudes from the tree, and consists in a double edged reversible scraper. This obviates entirely the employment of two implements to complete the operation.

Improved Carriage Protector.

George Bruce Brown, Newburgh, N. Y.—This invention consists in a plate provided with a subjacent and projecting strip of rubber applied in the rear of a carriage wheel and attached to the carriage spring by a curved arm and bifurcated holding piece.

Improved Sleigh and Sled Runner.

Jacob W. Karn and Eugene W. Karn, Watkins, N. Y.—This invention relates to the construction of sleigh runners, and consists in making the top rail bottom, runner, and intermediate supports of a single rod of metal.

Improved Wash Boiler.

Joseph Adams, Newark, Ohio.—This invention relates to the construction of parts which make up a wash boiler, and consists in a false bottom convex on top and provided with adjacent channel ways, the latter receiving the water from the former and delivering it to the steam generating chamber; also in a two part end-closed and side-perforated pipe, through which the hot water is forced in jets upon the clothes; and also in a perforated clothes shelf that fits over the pipes of the false bottom.

Improved Belt Hook.

Greenleaf Wilson, P. O. Box 1150, Lowell, Mass.—These hooks act on the same principle as pegging on the sole of a boot, the teeth taking the place of pegs. The belt is not weakened by punching holes; and, the teeth taking hold in so many places, the strain comes uniformly on the ends of the belt, which prevents tearing out the ends. The hook is particularly adapted for rubber belts. The inventor manufactures different sizes and supplies them by the quantity, at low rates.

Improved Machine for Cutting Hoop Locks.

John McCreary, Havenswood, W. Va.—The invention consists in arranging a series of knives in a reciprocating holder, one above another, and each one projecting further out than the subject one, so as to cut out successive shavings from the shank. It also consists in an intermittent and laterally moving gage, that is automatically adjusted to each successive knife as the latter approaches the blank. It also consists in arranging knives on the knife holder, for the purpose of placing the gage in its proper relative position to each knife as it comes to its work. It also consists in providing the grooved uprights of the sliding tool holder with a separate and detachable cap, so as to permit an easy access to the said holder. It consists in a peculiar construction of cutter shanks, so that they may be readily applied and supported in grooves of holder.

Improved School Desk.

John Wallace Childs, Kansas City, Mo.—The invention consists in a peculiar mode of constructing the hinge joint of desk lids, and analogous articles, so that the desk lid is easily held by gravity in an inclined position for use, and lifted before it is allowed to fold against the back.

Improved Curtain Cord Fastener.

Charles Gammel, Utica, N. Y.—This invention has for its object to furnish an improved pulley for the cords of window shade rollers. A plate, designed to be secured to the window casing, is cast with a socket or hollow rib to receive a rod. The upper end or head of the rod is slotted to receive a pulley, around which is passed the endless cord by which the shade is raised and lowered. The rod is made considerably longer than the length of the plate, and has a hand nut screwed upon its lower end, so that, by simply turning the nut on or off, the tension of the shade cord may be adjusted as required. In the side of the rod is formed a groove, into which is inserted a pin so as to be entirely out of sight.

Improved Sofa.

William R. Conger, Newark, N. J.—The invention consists in the improvement of sofa bedsteads. The back is hinged to the frame of the seat, so that it will turn over and hang down. In this manner the lounge may be used as a double lounge whenever such use of it is desired. The back may also be fastened in an inclined position. To the front side of the lounge is attached an adjustable side or shield. When the lounge is in ordinary use, the shield is dropped down in front so as to be entirely out of the way. When it is desired to use the lounge as a bed, the front is turned up and fastened in any desired position. The head may be raised and adjusted to suit the occupant of the lounge.

Improved Telegraph Cut-out and Switch.

Robert Henning, Ottawa, Ill., assignor to himself and J. D. Caton, of same place.—The object of this invention is to substitute, for the different separate instruments used at present in telegraph offices as cut-outs and ground switches, a combination instrument which not only offers all the advantages of the former, but, by its simple construction, is clearly understood, easily operated, and furnished at less expense. The invention consists, mainly, in the combination of a cut-out and ground switch by means of two parallel metallic plates, connected with the line and local wires, which connection may be interrupted or established by the adjustable button or circuit closer and a metallic peg, which may connect either wire, or both, to the ground.

Improved Copy Holder.

Stephen French and Rufus D. Chase, Orange, Mass.—The invention consists of a board, supported in any way in an oblique position suitably for reading "copy." Near its upper edge is a pair of rolls with elastic surfaces arranged suitably for drawing a half sheet of paper along the table from bottom to top, one of said rolls being provided with a thumb bit at one or both ends for turning it. Just below the rollers is a slotted plate, arranged so that the paper, containing the matter to be copied, will be drawn under it and hidden from view, except a line or two which may be seen through the slot, and thereby be clearly indicated to the eye of the copyist, so that no time will be lost in following the copy in the right connection.

Improved Shank Laster.

Richard B. Perkins, Almond, N. Y.—The object of this invention is to construct a shank laster, which may be adjusted to different sizes of boots, holding the shanks firmly, and allowing the use of both hands in pegging. The invention consists of a curved main piece, with plucers, guard, and regulator pivoted to the end thereof. The curved lever is placed under the knee, the pressure on guard and plucers stretching firmly the shank leather for pegging.

Improved Cooking Vessel.

Laurence P. Bodkin and John S. Bodkin, Brooklyn, N. Y.—This invention has for its object to improve the construction of boilers, sauce pans, and other cooking vessels, in such a way that the liquid contents may be poured off and the solid contents retained. Upon the edge of the forward side of the boiler is formed a lip, inclining upward and outward, to serve as a spout in pouring out the liquid contents of said boiler, to guide them into the receiving vessel and prevent them from trickling down the outer side of boiler. Upon the inner side of the edge of the forward side of the boiler is formed a grate, the bars of which are connected with each other at their inner ends, and at their outer ends are formed solid with the body of the vessel. The bars of the grate are made triangular in form, and are so arranged as to form the least possible obstruction to the outflowing liquid.

Improved Railroad Switch.

John E. Adams, Sacramento, Cal.—The object of this invention is to construct a switch connection which avoids the disadvantages resulting from the expansion and contraction of the switch rail at different temperatures, causing either a too close contact, so as to prevent the working of the rail, or a too wide opening, so that the battering of the ends of the rails necessitates their replacement. The invention consists in the arrangement of an inverted rail under the switch rail, connected and pivoted to it at one end, and the extension of the lower inverted rail under a rest plate to the track rails, to which the same is also rigidly connected, producing an expansion and contraction in such a manner that the switch rail is always equidistant from the track rails, and no interruption of the working of the switch or battering of the rails is possible.

Improved Folding Bedstead.

Alfred G. Bayles and John W. H. Carroll, New York city, and George D. Miner, Williamsburgh, N. Y.—This invention has for its object to improve the construction of the folding bed described in letters patent No. 133,137, issued to the said Alfred G. Bayles, November 19, 1872, so as to make it simpler in construction, and make it more nearly resemble a table or other similar article of furniture. The invention consists in an improved folding bed, formed of the two parts hinged to each other. One part has a molding around its top so that when the said part of the bed body is turned back the molding may swing out and serve as legs to support the weight, the cross bar of the molding supporting the weight, the hinges being simply intended to pivot the molding in place. The spaces in which the parts of the mattress rest are made of such a depth that the edges of three of the sides of the parts of the body of the bed may project sufficiently above the mattress to give space for the bed clothes. An end board is fitted into the open space formed by recessing the adjacent edges of the hinged sides of the parts when the bed is closed, so as to closely cover said opening. The edge of the part of the body opposite the hinges may be provided with a board, which, when the bed is closed, overlaps the other part and, when the bed is opened, serves as a head board to the bed.

Improved Feed Water Heater for Steam Boilers.

Sidney T. Taylor, Baltimore, Md.—This invention consists in a new arrangement of a cone and induction and eduction exhaust-steam pipes or tubes, with a perforated circular water discharge pipe, within a case or cylinder, whereby a very thorough absorption of heat by the water, and corresponding condensation of the steam, is assured. It also consists in providing a well at the bottom of the aforesaid case and arranging a piston and valve therein, so that the water accumulating in the case may be entirely removed.

Improved Sash Cord Guide.

William Shaw, Brooklyn, N. Y.—The case has flat surfaces in which is journaled the rod or pulley shaft, and the rollers or pulleys have end chambers combined with sets of loose balls placed in said end chambers, so as to take the pressure of the rollers and lessen the friction.

Improved Soldering Apparatus.

William D. Brooks, Baltimore, Md.—This invention relates to means for avoiding the necessity of changing the circle of blow pipes at every change in the size of cans to be soldered, and consists in a novel and peculiar mode of attaching the burner pipes to their supply chamber.

Improved Butter Worker.

Warren N. Golden, Coldwater, Mich.—This invention consists in butter workers having paddles with peculiarly shaped end curve and flat surface; and in the combination with two butter workers and one butter holder of a circular rack and pinions, arranged so that all the former may be simultaneously operated from a single crank arm.

Improved Harvester.

Wm. K. Halrigh, Plumville, Pa.—This invention consists in making the shaft that drives the cutter pinions in three sections, easily applicable to and removable from each other, and in making the seat to slide back and forward at the will of the driver.

Improved Veneer Cutting Machine.

John W. Leslie and George R. Smith, Cairo, Ill.—This invention consists in the employment of a pressure roller so small that the curvature of the periphery will admit of the application of the pressure exactly opposite the edge of the cutter, with two secondary pressure rollers setting upon it to make up the capacity for pressure, in which it is considerably reduced by being made so small. The object is to lessen the checking of the wood, which is considerable in the machines using only one roller, because the size necessary for strength makes the curvature so large that the point of contact with the wood must be considerably in front of the cutting edge.

Improved Extension Settee.

Cornelius Beatty, Elizabeth, N. J.—The object of this invention is to so construct settees or "lounges" that they may be readily converted into beds for sleeping purposes; and it consists in the mode of extending the settee by sectional extension side pieces hinged thereto and provided with legs, the same being so constructed and arranged as to be folded back around the settee and fastened together.

Improved Sewing Machine.

Cyrus Lewis and Joseph Southall, Howard, Ill.—The invention consists in means for facilitating the application of glass to bearing surfaces. The vertical wall of the shuttle race and the bottom are of glass. The glass race is supported by a metal plate to which it is fastened by detachable clips at the ends. A groove or a slot is made in the part for the needle. The glass race is bedded thereon, on its metal supports, in cement, shellac, or other elastic substance calculated to back it throughout, take up the shock, and prevent fracture.

Improved Compound Explosive Projectile.

Frank A. Markley, Waynesborough, Va.—The object of this invention is improvement in the class of shells or explosive projectiles which are formed of several detachable parts; and the improvement consists in the construction of the projectile whereby the several auxiliary shells or chambers are connected to the main cylinder. On the ignition of the fuse connection, the powder charge in the main chamber explodes, and throws the quarter shells in different directions. The fuse of each shell will take fire from the first explosion and ignite the powder charges of the auxiliary shells, scattering their fragments again with powerful effect.

Improved Water Wheel.

Alissa B. Reniff, Bingham's Mills, N. Y.—This invention has for its object to furnish an improved water wheel. Around the body of the wheel is formed the inner rim. The inner edges of the buckets are secured to this inner rim, and to their outer edges is secured an outer rim. The buckets are so arranged that their upper edges are about upon a tangent with the rear side of the shaft. They also incline to the rearward, and their inner side edges pass to the rearward faster than their outer side edges, and are made longer, so that their bottom edges may be horizontal. The inner rim is made deeper than the outer rim which, in connection with the form of buckets, causes the wheel to discharge freely. The wheel when at work in connection with the spent water causes a suction, which renders the use of a suction pipe wholly unnecessary. The size of the buckets and their number may be varied according as more or less power is required. The body of the scroll or stationary wheel is made convex upon its upper side and horizontal upon its lower side. The lower edges of the chutes are arranged about upon a tangent with the forward side of the shaft, and are inclined in the opposite direction from the buckets. This construction of the stationary wheel allows the water to pass readily and freely into the chutes, and enables the wheel to be run effectively with a very low head of water.

Improved Wheel Cultivator.

John H. Randolph, Jr., Bayou Goula, La.—The invention consists in the improvement of cultivators. The tongue of the machine is attached to the cross bars of the horizontal frame and strengthened by inclined braces. To the rear cross bar of the frame are attached a pair of vertical standards, placed at such a distance apart as to receive one of the drive wheels between them. The drive wheels are placed upon shafts and carry the same with them in their revolution. The shafts revolve in bearings, while their inner ends project through keepers on long bearings attached to a standard, so that the latter may be raised and lowered without disturbing the shafts. Upon the forward edge of the standards are rack teeth into which gear the teeth of a segmental toothed wheel, the hubs of which are placed upon shafts to which are rigidly attached the lower ends of the levers. Flows or scrapers are attached to the lower ends of the standards, and are so formed as to move the soil inward or toward the plants. By means of blades actuated by radial arms suitably arranged, the soil is thrown toward the plants, said blades operating upon the soil somewhat as the blades of a propellerscrew operate upon the water. The blades may be used in connection with the plows, or either may be used without the other, and both may be adjusted to work at any desired depth in the soil.

Improved Swaging Machine.

Henry M. Crippen, Bartlett, assignor of one half his right to James C. Wilson, Plymouth, Ohio.—The object of this invention is to furnish a machine for the use of carriage smiths and metal workers generally, by means of which the time and labor required for forging the various light irons required in the prosecution of their business may be greatly diminished and the work performed in a superior manner. The bed plate of the machine is elevated on an iron frame and supports a stand. Vertical rods are held in the jaws of this stand, upon which are spiral springs. The bar which carries the upper swages rests upon the top of the spiral springs. The rods, with the bar connected, play freely up and down in the jaws. The down action is produced by means of a treadle. The back or upward motion is produced by the recoil of the spiral springs. The die plate has on its face grooves which correspond with the grooves in the faces of the hammer dies, and is moved and adjusted on the bed laterally to suit the operator, and may be secured in any desired position.

Improved Paddle Wheel.

James C. Chaffee, Titusville, Pa.—The shaft is connected with the driving power by cranks to which are attached hubs made with pairs of parallel flanges to receive the inner ends of the paddles. To said ends are secured the paddles bent in the middle, flanged on their outer ends, and bolted to disks. Upon the outer edges of the disks are formed flaring rims to protect the buckets from obstructions in the water. This construction, the paddles being set opposite to each other, makes the boat more steady and renders the wheels less liable to clog than wheels constructed in the ordinary way.

Improved Harvester.

Wm. K. Halrigh, Plumville, Pa.—This invention consists in combining an adjustable reel with a set of pulleys and cords so that the said cords and belts will always be automatically tightened or loosened whenever the reel is changed; in a pivoted reciprocating rake that is held upright on the off-stroke but tipped over by a spring ready for the on-stroke; in a wire frame gatherer attached to a detachable guide frame; and finally, in operating the rake by a shaft having two reversed and crossing spiral slots.

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ond hand. E. Lyon, 470 Grand Street, New York.

Notes & Queries.

J. H. P. asks for a good recipe for blacking
or painting a portable boiler, so that it would retain its
gloss.

G. F. C. asks where a description of the
electro-plating process of Messrs. Jacobs and Klein may
be found.

E. A. J. asks: With an area of steam pipe
of 1 square inch, and a pressure of 50 lbs. per sq. in., if
the steam flowed into a vacuum, with what force would
it strike a disk suddenly slid over the opening?

B. F. J. asks: What is the striking power
of the largest hammer used in Burden's horseshoe
works; also of the largest one in use anywhere else?
(Perhaps some of our readers who have seen the ham-
mer mentioned will forward some information on the
subject. The largest hammer in the world is supposed to
be the 100 ton hammer at Krupp's steel works in
Prussia.—Ans.)

W. B. asks for a recipe for cement which
can be applied around the joint of a tin box, which will
keep oil from coming out during transportation. When
the box and contents reach the destination, the cement
is to be removed. "I do not wish to solder the cover on,
but merely to keep the oil from oozing out."

J. N. H. asks: Will a turbine wheel give as
good results for power as an overshot, the amount of
water being from 100 to 300 inches in volume, and the
fall 20 feet? Both wheels are proportioned to that
amount. A man was desirous of putting in a turbine
wheel; but a millwright said it would do well enough in
the spring for a month or two when water was plenti-
ful, but in low water it would not do the work that an
overshot would. [The question proposed by our corre-
spondent is one of great interest, and we would be glad
to hear from those of our readers who have informa-
tion on the matter. Some turbine wheels have given an
efficiency of more than 85 per cent, but there is gener-
ally a great falling off at "part gate."—Ans.]

R. will find full directions for kalsomining
on p. 350, vol. 24.—J. C. S. will find a rule by which he
can obtain the required width of belt on p. 257, vol. 23.

J. H. B. asks: Can glass be made into solid
balls of from 3/4 inches to 5 inches diameter, and what
would be the cost of common glass in that shape per
ball? I am informed that it cannot be done, as the glass
would crack in hardening. Answer: Those who have
worked in glass houses say there would be no danger of
the glass cracking if annealed. We cannot tell the
price.

E. S. asks: What will remove iron rust
from carpenter's tools? Answer: Very dilute sulphuric
acid will dissolve rust from iron or steel. It must then
be carefully washed, thoroughly dried and oiled. Paraf-
fin will protect iron from rust.

B. W. F. asks (1) for a recipe for making
"Pharaoh's serpents." 2. How are a number of clocks
kept regulated by means of galvanic connections? 3. How
can I make a cheap electric alarm bell? I have
batteries and an electro magnet. Answers: 1. See an-
swer to C. R., in another column of this issue. 2. A
series of electric clocks are run by having first a stand-
ard clock so arranged as to make and break the electric
circuit at each oscillation of the pendulum. When
contact is made, an impulse of electricity is sent through
the wires connecting the clock with the indicators.
These indicators in their most simple form are merely
ordinary clocks, marking seconds, with the driving me-
chanism and pendulum omitted. In place of the pendu-
lum there is an electro-magnet so connected with a bar
of iron that every time the circuit is made the bar of
iron is attracted and pushes the second wheel forward
one tooth. As soon as the circuit is broken, a spring re-
tracts the bar of iron, and it is ready for another beat.
Perhaps an easier method for converting an ordinary
clock into a copying clock or indicator, if you are not
a clock maker or brass founder, is that described in Holte
& Gillett's "Cambridge Physics." It is to simply discon-
nect the driving power (spring or weight) and remove
the pendulum ball. In place of the latter, attach to the
pendulum rod a coil of insulated wire, and attach to the
sides of the clock case two permanent magnets in a hori-
zontal position with their south poles toward the ends
of the coil. When a current passes through the coil one
end acquires north magnetism, and is attracted by the
magnet near it, the other end becomes south and is re-
pelled. The regulating clock now reverses the direction
of the current and the pendulum coil is carried to the
opposite side. 3. You may attach a small electro-mag-
net to a spring, so as to prevent the clock work from
ringing the alarm bell; when the current is broken the
spring is released and the bell rings; or the bell can be
rung by electricity.

C. A. asks what kind of varnish is used for
the process of etching designs in glass plates. The use
of the varnish is to prevent the action of the hydrofluor-
ic acid upon the parts of the plate which are not to be
etched. Answer: A very good etching varnish is made
by dissolving wax in turpentine; but for a sma. plate of
glass, it is better to warm it gently and apply the wax
which melts and flows evenly over the surface, as the
turpentine varnish sometimes remains sticky and soft.
Engravers etching ground can be used on either glass or
copper. It is made of 2 oz. white wax, 1/4 oz. black
pitch, and 1/4 oz. Burgundy pitch, melted at a moderate
heat; then stir in 2 oz. powdered asphaltum and boil.

Pour the mass into water and work into balls, which are
tied up in smooth worn silk and applied to the plate
warm, when it oozes through the silk. A dabber of soft
wool covered with silk is used to smooth it perfectly.

A lady asks if camphor put up with furs
causes them to fade. Answer: Persons who have used
camphor for a long time do not notice any change of
color, even where the gum is in direct contact with the
fur.

W. A. S. says: Herewith enclosed please
find a section of lead pipe, cut from a piece eleven feet
long; the whole length is perforated like the sample sent.
We are somewhat puzzled as to the cause of decay. The
pipe was put down, six feet below the surface of the
ground, nine years ago, as a conductor of pure water
from the main pipe into a building. The soil is dry,
sandy and pebbly. Attention was first called to it by
the leakage, through the stoppage of water in the build-
ing. Believing that it would be interesting and in-
structive, we ask your opinion. Answer: The specimen
appears to have been gnawed by some animal, but it
may have been corroded by some mineral acid in the
soil, which attacked the lead. Such cases are not com-
mon.

W. H. P. says: I have been using the fol-
lowing arrangement for over a month, and I find it to
surpass anything of the kind in use. The object is to
pump water into a boiler without diminishing or stop-
ping the making of steam. Set the check valve on the
center of the boiler, thence run a pipe (inside the boiler)
to the front end, elbow it and run it to the back end,
and to within an inch of the bottom; so that, as a natu-
ral consequence, by the time the water passes through
that length of pipe in the steam, it will be as hot as it
would be when it gets to the water in the boiler. Please
give me your opinion. Answer: If the water is heated
by the steam in the boiler, it must, of course, absorb heat
from the steam, so that our correspondent's ar-
rangement, while it is efficient, may not be economical.

J. B. F. asks: What is the most suitable
engine for driving a street car, that is, the one that
would do the work with the least steam? What is the
weight of the engine and the amount of steam required
to run one of the dummies now in use? Answer: It
would require too much space to answer our corre-
spondent's inquiries in full. By consulting back numbers
of our paper he will gain considerable information on
the subject. Opinions differ as to the best form of en-
gine for street cars. We have seen an account of a
steam car containing an engine of 5 horse power, and
consuming coal at the rate of one ton every thousand
miles of continuous run.

D. C. says: A low pressure engine has a
condenser, and I notice that it does not carry so much
steam as a high pressure; what is the reason? If I were
to put a condenser on a high pressure engine, would it
be called a low pressure or a condensing engine? An-
swer: In common parlance, a low pressure engine is one
that has a condenser, and a high pressure engine ex-
hausts into the air. Modern condensing engines fre-
quently carry as high pressures as non-condensing en-
gines; and the names condensing and non-condensing
are the most appropriate. A condenser and air pump
can be attached to any non-condensing engine, and it
then becomes what is commonly known as a low pres-
sure engine. In this case, the initial pressure of the
steam can be reduced—or the valve may be beatered so as
to cut off the steam at an earlier point of the stroke;
and the engine will then develop the same power as
before.

C. A. B. says: A hydrostatic press having a
cylinder whose internal diameter is 8 inches and exter-
nal diameter 18 inches (thickness of metal 5 inches), the
tensile strength of the material being 16,000 pounds per
square inch: what pressure per square inch will it take
to burst the cylinder? I find so much difference between
Rankine and Molesworth that I ask you to give an ex-
planation. Answer: The bursting pressure per square
inch will be nearly 9,000 pounds. The rule given in
Molesworth is derived from experiment, and is applied
to thin cylinders and pipes of cast iron, under given con-
ditions. See article on thick cylinders on page 284.

J. E. P. says: Suppose that a steam pump
shows 50 lbs. steam on boiler with throttle wide open,
and say 100 lbs. water pressure, throwing 150 feet through
1 1/2 inch nozzle. If I connect another engine of the same
capacity with the same amount of steam and water pres-
sure, with the throttle wide open, to the same line of
hose, using the same nozzle, will the two combined in-
crease the pressure on the hose or throw a greater dis-
tance than the single engine by itself? Answer: The
effect of connecting the second engine will be to force
more water through the hose in a given time. The pres-
sure per square inch on the hose will be increased, and
the water will probably be thrown farther.

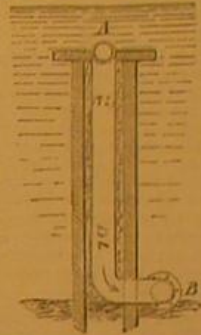
Y. M. says: 1. With a cylinder 1 1/2 inches
bore x 3 inches stroke and a slide valve, would a shaft
1/2 inch diameter be stiff enough for the fly wheel and
crank, or should it be 3/4 inch? 2. The boiler is 18 inches
long x 10 inches diameter, and is to have two doors 2 1/2
inches diameter through it. The fire is under the boiler,
from which place it goes to the back end, and returns
through one flue and then through the other to the
smoke stack. Would a boiler of that size be large
enough to run an engine of the size mentioned at 150
revolutions? The boiler is made of copper three thirty-
seconds of an inch thick. It is to be fired with shavings,
etc. 3. How many pounds pressure ought it to stand
per square inch, and how many pounds would it require
to run it at the speed mentioned, to drive a lathe 6 in-
ches swing, turning 12 inches long, either iron or wood?
Answers: 1. A shaft, 3/4 of an inch in diameter, would
be large enough. 2. You will find remarks on the per-
formance of small boilers in previous numbers of our
journal. 3. The boiler ought to stand a pressure of 80
or 90 pounds to the square inch, and drive the lathe with
a pressure not exceeding 60 pounds.

J. E. E. says: 1. I want to set the valves
of a locomotive engine. Please give the simplest method
of placing eccentrics in the right position on axle, the
position of the reverse lever, and the lap and lead of the
valves. 2. For a four horse stationary engine, what
should be the size of the boiler, number of flues, pres-
sure per inch, number of strokes per minute, and size of
cylinder, valve seat, and valve. Answers: 1. You will
find details as to size of ports and methods of setting
slide valves in "Link and Valve Motions," by W. S. An-
chincloss. It would take too much space to give you
all the information you ask for in this column. 2. Make
the cylinder 4 inches diameter and 8 inches stroke, with
a piston speed of 200 feet per minute. The boiler should
have from 60 to 70 square feet of heating surface; and
the steam pressure should be about 20 pounds per square
inch.

F. C. B. asks: 1. How is the oxide of man-
ganese put in around the carbon plate of a Leclanché
battery? Is there any other substance with the coke?
2. How can I make nitrate of silver? Answers: 1. The

carbon plate is placed inside the porous jar, which is
then almost filled with the crushed peroxide of mangan-
ese, and sealed with melted asphaltum. A solution of
chloride of ammonium is used outside to act on the zinc.
2. Reduce a silver coin to filings, by means of an ordina-
ry file or rasp, dissolve the filings in more or less nitric
acid, according to the strength of the acid, and evapo-
rate the solution until the salt will crystallize; any ex-
cess of acid will be driven off in the process of evapora-
tion. The copper of the coin will not interfere for ordi-
nary use, but pure silver may be obtained from almost
any dentist.

F. W. says: I have a stream of water,
but no spring for feeding a hydraulic ram; and
at the point where I want to use the water the
fall has little weight, but has a depth of 7 or
8 feet. The river car-
ries in the driest season
about 800 cubic feet of
water per minute. I
propose to fix substan-
tially a cast iron pipe
to the bottom of the
river, as shown in the
engraving. The pipe
and its supports act as
a kind of dam and pre-
vent an admission of
water, except from the
surface at mouth of
pipe at A. This would
create a fall of 9 feet at
high water in the river.
The perpendicular part
of pipe has a length of



7 feet inside and a diameter of 7 inches, and 7 inches
gives an area of 38.484, which, multiplied by 9 feet fall,
shows 1,290 gall. ns per minute. According to your ar-
ticle about hydraulic rams, the 1,290 gallons falling 9 feet
would raise 200 gallons per minute to a height of 63 feet, or
one seventh the quantity descending. Forty per cent
of this would be 112 gallons. A good deal less would be
enough, if a constant stream to a reservoir on top of
bank could be had, without further aid or power. Any
water engine or the ram can be screwed to the border
at B. If the fall of said quantity of water will not
create, per se, a rise of water to the height of 63 feet in
smaller streams, which is the best way to effect it?
Answer: The pipes would simply fill up and no result
would follow in the desired direction. If there is no
available permanent fall, no water can be raised, even
with the hydraulic ram.

J. A. B. says: I noticed on page 210 of your
current volume an article on a large magneto-electric
machine, copied from *Engineering*. For some time past
I have been anxious to make an electric light, and I
thought I might possibly make a magneto-electric ma-
chine myself, large enough to show the spectrum of the
metals, etc. I noticed that, in reporting Tyndall's first
lecture in your journal of January 4, you say that he
used a small voltaic battery for his light. I wish to
have some apparatus to experiment with. Part of this
apparatus, I have already finished, such as bisulphide of
carbon prisms, clockwork for rotating colored cards,
etc. I wish to ask you: Which would you advise me to
use, a series of batteries or a magneto-electric machine?
2. Are Bunsen elements the best? 3. What would be
the smallest number to use so as to get a good light with
a Duboscq lamp? Answers: 1. A series of batteries. 2.
Bunsen's are most generally used. 3. It will depend on
the amount of light wanted, and the time it is required
to be kept up; five cells will give a good light. Thirty
No. 1 Bunsen cells will give a good light for your pur-
pose, provided you scrub the zincs with a wire brush
when you are through; the price per cell is about \$1.75;
the running expense is the zinc and acid; the zincs you
can cast yourself, using one new zinc as a pattern. Nitric
acid is about 12 1/2 cents per lb. Sulphuric acid is 3
cents per lb.

S. L. G. asks: How much power could I get
from a stream of water 1 1/2 inches in diameter, with
about twenty feet fall? I would have to carry it about
a mile in pipes to get that much fall. Would it be neces-
sary to run the pipe thus, or would it do as well thus



with wheel at the bend? Answer: An inch pipe a mile
long would discharge too little water to be of any use.
With a pipe sufficiently large to discharge the required
amount of water under a head approximating the amount
due the grade, it would make no difference which of the
proposed methods of termination was adopted.

J. C. L. says: In your answer to N. B. D.,
on page 267 of your current volume, I think you do not
get at the idea in regard to electro-magnets. He says
he has 600 feet of fine covered wire on which is too much
resistance for any ordinary local battery to overcome.
There is wire enough for a relay, or intensity magnet,
as it is sometimes called, requiring a battery of 5 or 10
Bunsen cells to have first rate effect. A local sounder
has only about 100 feet of No. 23 wire, and that is as
much as a local battery wants to do. Answer: We re-
spectfully differ. We will produce a sharp click of the
armature with an electro-magnet of No. 30 wire and of
fifty Ohms resistance, and only use a battery formed of
two copper pennies and two zincs of same size, in dilute
sulphuric acid; the same battery will produce no no-
ticeable effect on the armature of a magnet of coarse
wire of less than one Ohm resistance, but, conversely,
using five Daniell's cells. The second magnet will hold
its armature with about three times the force of the
first, both armatures being of the same size and under
the same recoil tension. N. B. D.'s magnet, if properly
made, is suitable for obtaining the most attractive force
from a very slight current of electricity; but if he wish-
es to obtain the greatest magnetic effect from an ordina-
ry local battery on short circuit, then he should use, as
you say, coarser wire and less of it. Telegraph instru-
ment makers try to follow this rule: Have the resistance
of the electro-magnet wire equal to the resistance of
the battery and the wires connected with it. N. B. D.
did not mention the particular use for which his mag-
net was intended, and for this reason we did not mention
that the fineness of the wire was a probable mistake.

B. F. W. asks: What should I use to dead-
en the sound in smut machines, where the grain is
cleaned by scouring against the sides of an upright iron
cylinder? We place a wood hoop around it, having a
space of from 3 to 5 inches between the two; with what
can we fill the space, cheaply, to produce the desired re-
sult? Answer: The sound would be deadened in the
most perfect manner by exhausting the air from the
space between the hoop and the cylinder.

A. S. R. asks: 1. If an article weighs one pound at the pole, ought it not to weigh very much less at the equator, from the greater centrifugal force at the equator caused by the daily revolution of the earth? 2. If centrifugal force, caused by the revolution of the earth, has any influence on a body on the surface of the earth, and if there is not a corresponding difference in the weight of the body at the equator and at the pole, would not the fact conflict with the general idea of the laws of gravitation? Answers: 1. The force of gravity at different points of the earth's surface is diminished by the centrifugal force in the ratio of the square of the cosine of the latitude. Hence, a body is lighter at the equator than the pole, and a body which weighs one pound at the pole will weigh about .995 of a pound at the equator. In general, it may be stated that the weight of a body at the equator and at the pole are in the ratio of 194 to 195, or that 194 pounds at the equator will be 195 pounds at the pole.

D. D. A. asks: 1. Which is the most likely to roll over or upset, a long boat or ship or a short one, supposing the width and depth of hold in both instances to be the same? 2. Which is the staunchest, or rather, which has the greatest strain on it, a long boat or ship or a short one, if in both instances they have a proportionate width and depth of hold? Answers: 1. Other things being equal, a long vessel has greater stability than a short one, or in other words, the long vessel has a stronger tendency to right itself quickly on being heeled than the short one. 2. We do not understand exactly what our correspondent means by this question. A long vessel is ordinarily more strained than a short one, and requires to be made stronger.

J. C. asks: Has stone been used in a steam boiler for a float? Answer: The device mentioned has been frequently used in a boiler, a counterpoise being placed outside. A kind of sandstone has been commonly employed.

F. A. M. asks: What is the cause and preventive of the foaming of the water in my boiler? It occurs only when the engine is in motion. The boiler is a 10 horse power upright; the feed water is very pure well water. When the engine is at rest, I can tell just where the water is, but when I start it, if the water is at the lower gage, it will often come out at the upper, and if it is at the second gage and near the third gage, it will overflow into the engine for 15 minutes after it is started. I run with about 20 lbs. of steam. No matter how soon we try the gages, after the steam is shut off from the engine the water is at rest; but the instant the throttle valve is opened, the upper gage will show water, when before only the lower gage showed it. Answer: Your boiler primes because the steam space is too small. If you can increase the pressure and keep the throttle valve but partially open, you may remedy the trouble. If, however, the water only "lifts" in the boiler, without being carried over into the cylinder, it does no harm, provided that you are careful to have enough water in the boiler so that, on stopping the engine, the flues will not be uncovered when the water level falls.

E. G. S. asks: How can I best conduct sound through 1,500 feet distance? I have been told that gas pipe is good; if so, what kind and what sized pipe is best? Answer: The ordinary speaking tube, with mouth pieces and whistles, will probably answer your purpose. Any good plumber will fit it up for you.

G. F. S. asks: 1. What are the best sized ports for a 4 inches bore steam cylinder? 2. What size in the bearings ought a solid cast iron crank shaft to be made to insure sufficient strength for the said cylinder, the bearings being 6 inches apart? 3. Does it cool the water much faster in a boiler to pump in at the top of the fire box than at the bottom of boiler? Answers: 1 and 2. Sufficient data are not given. The length of stroke, length of ports, steam pressure and number of revolutions would be required to answer the question. 3. Under ordinary circumstances, the feed should enter the boiler at a low point.

A. S. asks: 1. What is the cause of our steam pipes splitting, when the condensed steam cannot get out? They will stand the pressure of the steam. We had a two inch pipe split last Saturday, and there have been many of them split through the winter. I do not think that it is the frost. 2. What is the best and cheapest way of heating water to feed our boiler? We have thought of putting a coil of two inch pipes into the chimney and pumping through them, and we set the pump low to let the water run into it, but the pump got so hot that it would not work. 3. We have been burning sawdust in our boilers, and there is a hard crust inside the tubes; it is difficult to get it off. Is it the wet sawdust that causes it; and if so, what is the best means of cleaning it off? Answers: 1. The pipe was probably split by the concussion of the water. When steam is admitted into a cold pipe it condenses, and the rush of steam forces the water with great violence against the pipe. Put drain pipes at the lowest points. 2. It is better to force the water through the heater than to draw from the heater. If the exhaust steam from the engine passes into the chimney, the plan you propose will probably give satisfaction. 3. If the crust cannot be removed by a scraper, it may be loosened by a jet of steam. This can be readily directed by means of a small rubber tube.

J. H. D. asks: 1. If I send you a sample of boiler scale, could you tell me what the impurities of the water are; or could you tell better from a sample of the water? The water will eat holes in an inch iron gas pipe used for running it in about one year. 2. Is it possible to make a siphon work over about 21 feet, or any further than a common pump will lift water? Answers: Probably the impurities of the water could be determined by simple inspection of the scale and some remedy could doubtless be found. 2. No.

F. L. S. asks: 1. What is the difference between tannate of soda and common washing soda? 2. What quantity should I put in a boiler of 25 horse power? Our boiler is thick with scale and we have to stop and pick it off once in six months. The scale has a dark slaty appearance. Answers: 1. Washing soda is a hydrate of soda, or a compound of the oxide of sodium and water. Tannate of soda is a compound of soda and tannic acid. 2. The amount of the compound required in a boiler depends largely on the nature of the water used, and the amount of scale already deposited. Try 25 pounds in your boiler; and at the expiration of a week, clean out the loose scale. In a few weeks, you will be able to determine, by the condition of the boiler, whether to use more or less of the compound.

T. F. D. asks: 1. Will water rise higher than the level of the reservoir from which it is taken, when forced by the pressure of the water through a pipe from the bottom, the end of said pipe being higher than the main level? 2. Which is the proper way to use a reamer on cast iron for general purposes, dry or with oil? 3. Where are the terms of the first Atlantic cable to this continent? 4. Are visitors allowed to go into the printing office of any of the daily or weekly papers?

Will they be allowed to go through the SCIENTIFIC AMERICAN printing office? Answers: 1. No. 2. Dry. 3. The American terminus is at Trinity Bay, Newfoundland, and that on the other side is at Valentia Bay, in Ireland. 4. Printing and publishing rooms are private establishments; but in general, visitors are allowed, by courtesy, to inspect them.

C. N. D. says, in reply to B., who said that sulphuric ether would not dissolve rubber: Use chloroform; you will find that it will dissolve readily.

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

H. M. B.—Quite pure red hematite iron ore.
C. A.—It is flint.

COMMUNICATIONS RECEIVED.

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

On the Precession of the Equinoxes. By J. M.

On the Million Dollar Telescope. By R. H. and by V.

On the Stages of Invention. By S. H. H.

On a Coal Dust Burning Furnace. By —.

On Soap. By F. E. W.

On a Fly Destroyer. By J. C. C.

On Deep Sea Soundings. By L. de W. and by H. N. C.

On Storm Signals. By A. W.

On Retrogressive Motion of the Sun. By J. H.

On Meteors and Meteorites. By D.

On Trisection of the Angle. By P. H.

Also enquiries from the following:

W. S. G.—W. F. G.—S. C.—J. F.—J. H. M.—W. D.—J. B. H.—H. A. W.—J. H. D.—P. Q. L. R.—S. W. E.—S. J. W.—J. S. J.

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.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

May 20, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Angling fly, J. Mollaly.....	129,180
Anger handle, S. W. Hemenway.....	129,006
Augers, forming the lips of, J. Swan.....	129,091
Augers, coupling for earth, T. Uriel.....	129,092
Axle box cover, Moyal & Howell.....	129,179
Basket form, A. F. Scow.....	129,025
Bell, door, A. A. Stewart.....	129,208
Bell ringing, J. Harrison.....	129,147
Blind slats, entering, J. Church.....	129,013
Boiler alarm, milk, S. Mangold.....	129,072
Boiler feed, etc., F. A. Fischer.....	129,126
Boiler fuel thimble, J. C. Farmer.....	129,596
Boiler water alarm, etc., R. Safely.....	129,194
Boot sole plane, B. J. Tayman.....	129,034
Boot tip, detachable, M. B. Hawley.....	129,090
Boots, etc., sample holder for, J. Cross.....	129,044
Boot, attaching heels, etc., Ellis & Glidden, (r).....	5,412
Box lifter, B. H. Smith.....	129,029
Box or can for paints, etc., H. Tucker.....	129,514
Box, packing, D. L. Bartlett.....	129,106
Branding apparatus, J. W. Dodge, (r).....	5,420
Bricks, repressing, J. K. Caldwell.....	129,118
Building blocks, forming, A. Derrom.....	129,090
Building materials, elevating, J. King.....	129,116
Bureau and ironing table, W. W. Adams.....	129,101
Bustle, H. H. May, (r).....	5,416
Cake cutter, J. Webster.....	129,177
Can, C. A. Mardock.....	129,181
Can for oil, etc., metal, G. W. Banker.....	129,586
Cane, M. Osborn.....	129,720
Car coupling, R. D. Moody.....	129,446
Car coupling, E. Wiley.....	129,221
Car, reversible street, W. T. Jenks.....	129,003
Car starter, G. Felner.....	129,134
Cars, brake for coal, D. Wetzel.....	129,097
Car pipe coupling, M. Hensley, Jr.....	129,120
Carpet beater, W. H. Hankinson.....	129,118
Carriage top, G. H. Young.....	129,225
Carriage running gear, Kline & Jack.....	129,164
Caster, J. Toler.....	129,212
Casting seaboard ornaments, V. Price.....	129,023
Centrifugal machine, E. J. M. Becker.....	129,108
Chain machine, B. Hershey.....	129,151
Chair fan, rocking, O. Bruck.....	129,117
Chair, tilting, M. V. B. Howe, (r).....	5,419
Chandeller, J. Kintz.....	129,096
Chimney cow, J. H. Richardson.....	129,098
Chimney and fireplace, J. Briggs.....	129,111
Churn motor, J. B. Sweetland.....	129,208
Cigar trimmer, A. Hettlinger.....	129,132
Clay, pulverizing, G. C. Bovey.....	129,110
Clock striking works, Leeds & Thorpe.....	129,166
Cloth, stretching and drying, W. Bailey.....	129,028
Clothes line pulley, G. H. Rye.....	129,024
Clothes pressing machine, H. E. Smith.....	129,201
Clothes wringer, H. E. Smith.....	129,203
Clutch, friction, E. Allen.....	129,395
Copying press, letter, G. C. Taft, (r).....	5,417
Cornice, stucco, A. Derrom.....	129,049
Cotton worm destroyer, J. Helm.....	129,062
Coupling, union, W. B. Snow.....	129,226
Cultivator, E. M. Graham.....	129,001
Cultivator, R. Bust.....	129,193
Cultivator, rotary, R. McKisley.....	129,011
Darning machine, B. Arnold.....	129,991
Darning machine, B. Arnold.....	129,992
Dental drill, J. W. Baxter.....	129,029

Dental gillings, block for, C. H. Mack.....	129,012
Digger, post hole, A. E. Linsley.....	129,169
Doll joint, J. A. H. Ellis.....	129,180
Door check, G. E. Hittenshouse.....	129,099
Drill, seed, E. G. Matthews.....	129,074
Dyeing madder colors, F. A. Clatty.....	129,066
Drop light, center slide, C. Deats.....	129,123
Edging machine, Gronberg & Ferry.....	129,112
Eggs, etc., preserving, J. Connell, Jr.....	129,116
Elevator, J. B. Baldwin.....	129,383
Engine, compound steam, C. E. Emery.....	129,052
Engine governor, steam, E. Ware.....	129,096
Engine variable cut off, W. Wright.....	129,224
Explosive compounds, E. A. L. Roberts.....	129,193
Exhausting machine, A. Dawes.....	129,048
Feather renovator, S. G. Thunhauser.....	129,211
Filter for water coolers, C. Schneider.....	129,095
Fire arm, breech loading, T. Restell.....	129,190
Fluting machine, Madden & Dodsworth (r).....	5,415
Fruit jar, T. B. Carroll.....	129,115
Fruit jar, sealing, R. S. Manning.....	129,170
Fruit picker, H. Mowes.....	129,615
Furnace feed attachment, D. Morey.....	129,075
Gage, speed, J. W. Osborne.....	129,181
Gas, manufacture of, F. A. Sabiston.....	129,081
Gas purifier and regulator, J. A. Enos.....	129,121
Gate, farm, Westbrook & Clemmons.....	129,019
Glass coffin, J. N. & T. Wallis.....	129,095
Governor, R. W. Gardner.....	129,055
Grain blinder, S. D. Locke.....	129,008
Grain, elevating, etc., H. L. P. F., & E. D. Chase.....	129,594
Grain, ventilating, B. Dunwiddie.....	129,126
Grater, vegetable, McNett & Stockton.....	129,173
Hair curling, E. F. Crails.....	129,095
Harrow, T. M. King.....	129,005
Harvester, J. S. Davis.....	129,122
Harvester, H. J. Silverdale.....	129,196
Hat blocking machine, E. C. Falce.....	129,183
Hatchway protector, J. W. Meaker.....	129,014
Hatchways, closing, J. S. Baldwin.....	129,584
Hedge hook, E. S. Turner.....	129,215
Heeling machine, Glidden & Fairfield.....	129,058
Horses, detaching, H. Latschew.....	129,098
Horses, treating, D. Sullivan.....	129,207
Hose coupling, Wilson & Kendall.....	129,223
Jack, lifting, W. A. Brunker.....	129,041
Jelly glass, D. C. Ripley.....	129,081
Knife cleaner, T. & L. Gingsas.....	129,057
Knitting machine, W. & W. Campton.....	129,114
Ladders, elevating, A. Miller.....	129,175
Ladder, step, Oakley & Post.....	129,163
Ladder, step, Hardenbrook & Belford.....	129,004
Lamp, J. E. Ambrose (r).....	5,412
Lamp heater, W. Friel.....	129,140
Lantern, T. Smith.....	129,033
Last, L. N. C. Saville.....	129,196
Lathe for turning wood, Smiley & Small.....	129,028
Lathe for turning wood, A. R. Park.....	129,076
Lithographic press, C. C. Manrice.....	129,171
Lock for sliding doors, A. W. Crum.....	129,118
Loom stop mechanism, C. Barnes.....	129,087
Mail bag, T. J. Hardaway.....	129,011
Mantel, false, J. T. Flechearty.....	129,137
Mattress, H. E. Smith.....	129,102
Mattress, E. Parker.....	129,077
Medical compound, J. Conzelman.....	129,045
Medical compound, T. B. Owens.....	129,185
Mills, grater for elder, W. Barr.....	129,105
Mill feeder ore, C. P. Stanford.....	129,204
Music leaf turner, J. H. Gerry.....	129,141
Nut and coffee roaster, D. T. Gale.....	129,054
Oil tank, self-measuring, J. Schalk, Jr.....	129,084
Oil wells, cleaning, J. J. Looney.....	129,010
Pad, etc., metallic sweat, J. M. C. Bennett.....	129,990
Paper bag machine, H. G. Armstrong.....	129,104
Paper clip, T. Orion.....	129,019
Paper collar die, Harrington & Rollins.....	129,146
Paper cutter, rotary, H. S. Miller.....	129,176
Paper feeding machine, J. T. Ashley.....	129,393
Paper washer, E. S. Hanna (r).....	5,422
Pavements, composition for, G. L. Eagan.....	129,127
Petroleum, treating heavy, J. J. Looney.....	129,039
Photographic camera, E. P. Spahn.....	129,090
Photograph burning press, Entekin & Bramble.....	129,132
Piano lid prop stick, M. Doherty.....	129,125
Pipe stems, bending, J. Harvey.....	129,145
Pipe tongs, F. H. Merrill.....	129,174
Planter, corn, A. H. Stark.....	129,205
Planter, corn and cotton, Savage & Doty.....	129,195
Plow, L. Gibbs (r).....	5,421
Plow, G. B. Vaughan.....	129,036
Plow, wheel, L. B. Green.....	129,035
Plow, wheel, C. B. Stevens.....	129,032
Pocket openings, fastening, J. W. Davis.....	129,121
Polishing device, J. C. Morrison.....	129,178
Printing ink attachment, E. A. Howitt.....	129,135
Printing press, G. A. Hunt.....	129,156
Propellers, operating screw, J. Wilcoxon.....	129,098
Pruning shears, J. S. Crum.....	129,119
Pump, compound steam, A. J. L. Loretz.....	129,070
Pump, compound steam, A. J. L. Loretz.....	129,071
Pump, submerged force, A. T. Hafford.....	129,003
Pump, steam, W. Aldrich.....	129,108
Punch and nippers, hand, J. O. Reilly.....	129,079
Range, cooking, J. L. Piss, Jr.....	129,187
Railroad switch, C. H. White.....	129,220
Railroad switch signal, J. Cullen.....	129,106
Railroad tie, W. H. Sterling.....	129,011
Railroad water column, J. N. Poage.....	129,188
Railway links, forming, F. H. Healey.....	129,005
Railway scale platform, C. C. Warren.....	129,216
Razor stop, J. B. Lucas.....	129,011
Reamer, adjustable, A. Shedlock.....	129,057
Refrigerator, W. H. Lewis.....	129,118
Refrigerator and slide board, G. L. Packard.....	129,156
Refrigerator, etc., J. F. Schneider.....	129,107
Rolling metal, George & Durfee.....	129,000
Roofing slates, attaching, S. Farquhar.....	129,399
Safe, milk, J. P. Dale.....	129,140
Saw blanks, case for, C. I. Walker.....	129,094
Saw filing machine, C. F. Henis.....	129,149
Saw setting machine, W. H. Dolson.....	129,124
Saw sharpening machine, F. E. Frey.....	129,139
Scraper, road, L. P. Wright.....	129,099
Screw and clamp jack, Jackson & Watson.....	129,137
Screw driver, C. Law.....	129,003
Seat, folding, W. W. Parker.....	129,021
Seed dropper, E. L. Gross.....	129,113
Sewing machine, E. W. Beebe.....	129,010
Sewing machine, J. A. Davis.....	129,096
Sewing machine, L. W. Lathrop.....	129,007
Sewing machine hemmer, H. Howell (r).....	5,414
Sewing machine ruffer, etc., A. Johnston.....	129,061
Sewing machine ruffer, etc., F. Stevens.....	129,069
Shaft, vehicle, Connor & Pfisterer.....	129,117
Shafting, manufacture of, Knolly & Wentworth.....	129,165
Shag's machine, S. M. King.....	129,102
Shoe fastening, M. Boch.....	129,109
Spark arrester, E. Fontaine.....	129,033
Spark arrester, J. W. Gray.....	129,032
Spikes, extracting, Barsaloune & Graham.....	129,065

Steaming stop, electrical, H. A. Chas. Jr.....	129,080
Steaming stop, J. J. Dewey.....	129,081
Spittone, H. Toussaint.....	129,015
Spring, door, M. L. Webster.....	129,001
Station indicator, C. Barton.....	129,000
Steam condenser, J. L. Alberger.....	129,100
Strap, safety, L. H. Jones.....	129,100
Stone, artificial, W. H. Lewis.....	129,101
Stove, coal oil, J. H. Thorp (r).....	5,418
Stove, heating and cook, R. McConnell.....	129,173
Stove, heating, C. G. Thompson.....	129,095
Stove pipe damper, J. Emmeri.....	129,091
Stove pipe thimble, F. Tarrant.....	129,210
Stove polish, J. I. Danforth.....	129,074
Sugar, manufacture of, A. F. W. Paris.....	129,075
Telegraph, printing, T. A. Edison.....	129,128
Telegraph, printing, T. A. Edison.....	129,129
Thill coupling, J. H. Parkhurst.....	129,122
Thrashing machine, H. Wehler.....	129,218
Thrashing machine attachment, W. Masterton.....	129,070
Time printing machine, J. C. Hinchman.....	129,138
Time printing machine, J. C. Hinchman.....	129,134
Tongs, guttering, J. Schwartz.....	129,136
Tran, animal, G. A. Norman.....	129,102
Trunk, G. B. Jenkins.....	129,108
Umbrella stretchers, J. Shepard.....	129,068
Valve, automatic regulating, G. L. Kitson.....	129,163
Valve, balanced, F. P. Cady.....	129,092
Valve for cut-off, rotary, J. W. Strange.....	129,033
Valve, safety, G. Swenson.....	129,309
Vehicle wheel, J. Hagaman.....	129,144
Vessels, center and bidge keels for, S. P. Wilbey.....	129,222
Wagon brake shoe, H. Seltz.....	129,066
Wagon seat, J. U. Shultz.....	129,071
Washing machine, L. Beau'ten.....	129,107
Washing machine, A. Filkins.....	129,125
Washing machine, A. W. Jennings.....	129,139
Washing machine, J. Higgsbee.....	129,191
Washing machine, G. W. Waggoner.....	129,093
Washing machine, W. S. Young.....	129,100
Waterproofing canvas, etc., P. H. Morgan.....	129,017
Water wheel, Abell & Cole.....	129,079
Water wheel chute, J. Abell.....	129,078
Well, driven or bored, J. E. Morrison.....	129,018
Whip handle cap, G. A. Burr.....	129,091
Whip socket, A. Beales.....	129,036
Windmill, T. R. & A. C. Jackson.....	129,077
Wind wheel, A. Raymond.....	129,109
Window screen, W. H. Fletcher.....	129,129
Wrench, pipe, G. P. Moloney.....	129,177

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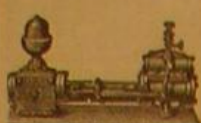


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Vol. XXVIII.—No. 26.
(NEW SERIES.)

NEW YORK, JUNE 28, 1873.

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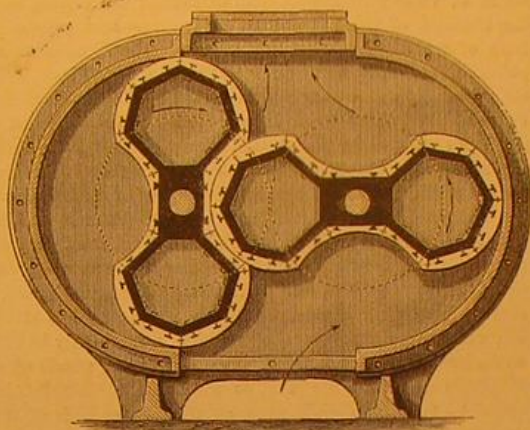
IMPROVED FORCE BLAST ROTARY BLOWER.

We present herewith a fine engraving of the interior of the setting up room of one of the best known of our Western manufactories, the works of Messrs. P. H. and F. M. Root, at Connersville, Ind., an establishment devoted to the production of the Root rotary blower. From the illustration, the reader will perceive not only the excellent internal arrangement of this extensive workshop but also be able to compare the different forms of the standard machine which there receives its finishing touches. On the wide application and manifold uses of devices having for their object the production of a continuous and powerful blast of air, it is hardly necessary here to enlarge. As a class they find employment in nearly every industry, and, contrasted with their prototypes, the hand bellows, the high speed fan, and other crude conceptions of former days, mark the progress of modern mechanical science as clearly and strongly as the steam engine or telegraph.

Ranging from the colossal apparatus, capable of delivering a current of 100,000 cubic feet of air per minute, to the almost toy-like implement constructed for the delicate operations of mechanical dentistry, the Root blower possesses, in all its various forms, certain advantages which have been the means of its successful introduction in many of the largest establishments in this country and Europe. Among these points of superiority, as claimed by the manufacturer, may be noted the facts that a positive or force blast is produced with great regularity and reliability; that fifty per cent of the power required to drive fans is saved by reason of the slow speed on which the Root blower does its work, from 100 to 200 revolutions per minute, giving a blast which requires at least 2,000 to 3,000 revolutions of the fan (a fact demonstrated, we are informed, by repeated and careful experiment); that, when applied to the cupola, more perfect and uniform combustion is produced, securing rapid melting, softer and bet-

ter castings, and a material economy in the amount of fuel consumed; and, lastly, that the machine itself is of great durability, consequent upon its substantial construction and slow motion causing much less wear upon the belting and running parts.

Fig. 2

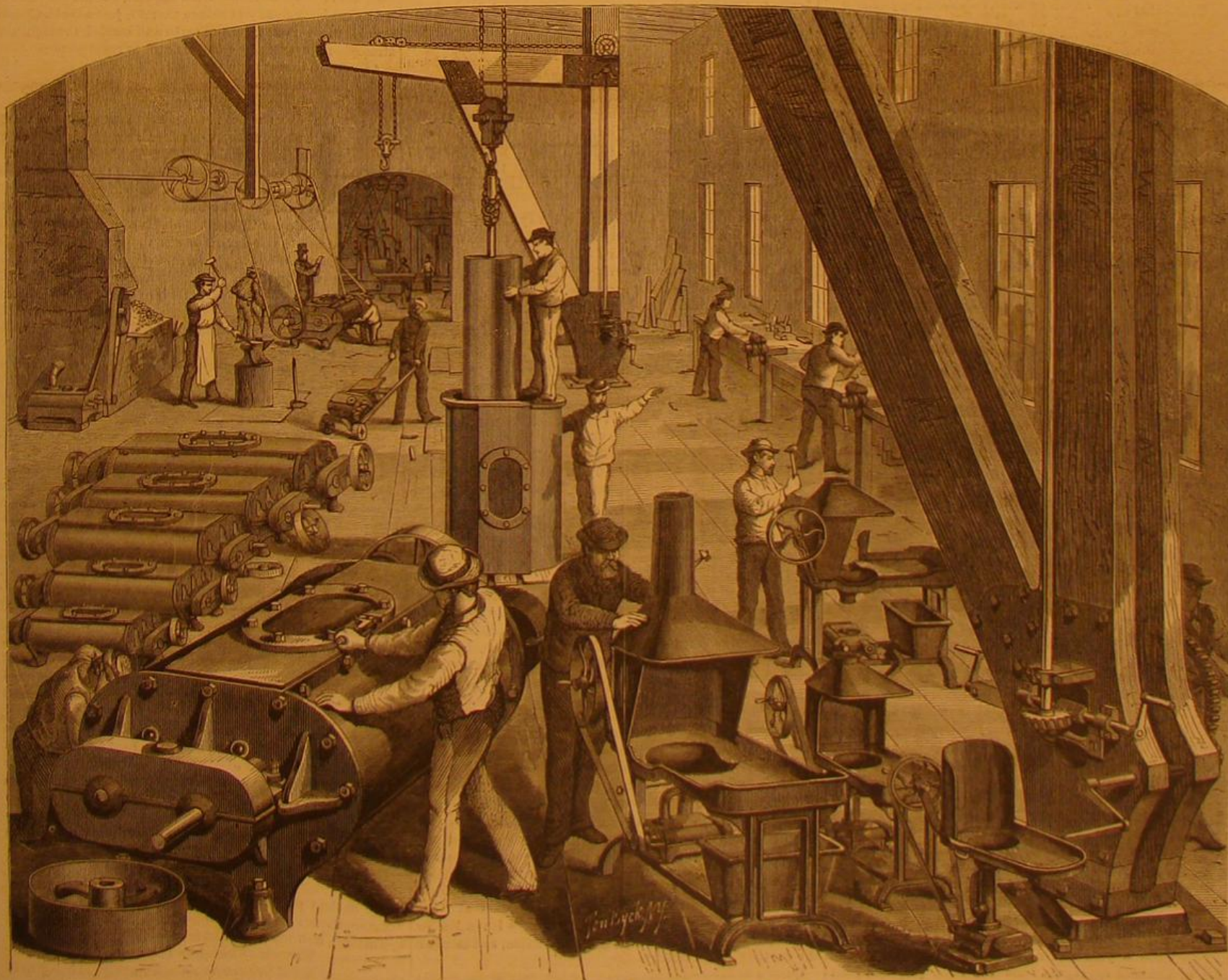


Referring to the mechanical arrangement, it should be noticed that the apparatus is built with a pulley at each end and one on each of its two shafts, being driven with one open and one cross belt. The power, instead of being transmitted from one shaft to the other through cog wheels, is applied directly to each shaft, and the stress and wear is al-

most entirely removed from the gearing, which serves only to keep the revolvers in their proper relative position. The blower, as will be seen from the sectional view, Fig. 2, does not operate on the principle of a fan, that is, by imparting momentum to the air by running at a great velocity, but by regular displacement of the air at each revolution, whether driven fast or slow; in this respect it resembles an air pump. The current entering the case is closed in by the wings of the revolvers, absolutely confined and forced forward until brought to the eduction pipe, where it is discharged. There can be no backward escapement of the air after it once enters the case, the contact being kept up at all times in the center of the blower, between the pistons or revolvers. The external case is made of cast iron, and the cylindrical parts are bored out. The head plates are faced off on a boring mill especially arranged for the purpose.

The blower is adapted to all purposes where either blast or exhaust is required, such as foundries, smith shops, or rolling mills; it is suited for the ventilation of public buildings, mines, and tunnels of any magnitude. As a gas exhauster, it has been adopted by many of the leading gas companies in the United States and, besides, has found employment in woolen, paper, and other manufactories. One of its most notable applications was that of furnishing the blast for driving the passenger car of the Beach Pneumatic Transit Company, in their experimental underground railway tunnel under Broadway, in this city. The immense blower there employed delivers, when worked at maximum speed, a volume of 100,000 cubic feet of air per minute.

The subject of our article is also largely employed abroad, and is manufactured in several of the principal industrial centers of Europe. We learn that it has been introduced in the well known steel works of Herr Krupp, at Essen, Prussia, and in the equally celebrated works of Messrs. Sir Joseph Whitworth & Co., Manchester, England, and in nearly



ROOT'S ROTARY BLOWER MANUFACTORY.

all the Bessemer steel works of Great Britain, nearly one hundred being in use in the city of Glasgow alone. In all, about one thousand are in use in England at this time, and a large number on the continent. By the aid of one of these machines Mr. W. Ireland, the noted iron founder, made a 230 ton anvil block, probably the largest casting ever made, melting the iron at the rate of thirty tons per hour, and completing the entire work in a little over eight hours.

This blower received the highest award conferred on machines of this class at the Paris Exposition of 1867. We notice that it is on exhibition in the American department at the exposition now being held in Vienna. It has also received the highest awards for three years successively at the Fair of the American Institute of this city, and also the highest premium at all the industrial expositions held in the city of Cincinnati, Ohio.

For further information address the inventors and proprietors at Connersville, Ind., or S. S. Townsend, general agent, 31 Liberty street, New York city.

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NEW YORK, SATURDAY, JUNE 28, 1873.

Contents:

(Illustrated articles are marked with an asterisk.)

Alcohol from flint and quartz.....	401
Answers to correspondents.....	411
Aquarium and fountain, parlor.....	405
Box protector.....	406
Blacking box.....	402
Blower, force blast rotary.....	409
Booming.....	404
Business and personal.....	411
Casting under compression, metal.....	407
Chair construction, new mode of.....	402
Comets, their character and source.....	420
Corundum mines of Pennsylvania, the new.....	404
Dollars are formed, how.....	402
Dyeing aniline green on wool.....	407
Electrical machine, Carré's.....	402
Electric light, the new.....	408
Evaporator, revolving.....	406
Fishing tackle.....	401
Inventions patented in England by Americans.....	408
Model, a wonderful.....	407
Paper in the Boston fire.....	405
Patent decisions, recent.....	408
Patents, official list of.....	412
Patents, recent American and foreign.....	408
Railroad shops in the world, the largest.....	405
Reward of one hundred thousand dollars, renewal of the.....	400
Rifle attachment for fowling.....	402
Rock drilling machines, trial of.....	405
Sanitary notes.....	405
Sanitary reform, necessity for.....	400
Scientific and practical information.....	401
Silver, the chloridizing process of extracting.....	404
Soldering tool.....	402
Sprinkler, combination.....	402
Straw-burning portable engine.....	404
Tallow cup, combination.....	406
Texas Pacific railroad, the.....	401
Tides, the retardation of the earth by.....	404
Time around the world.....	401
Tobacco hanger.....	402
Vacuum, a perfect.....	400

END OF ANOTHER HALF YEAR.

With this issue a number of six months' subscriptions, which commenced with the year, will end. We hope all such subscribers will renew, and it will gratify the publishers if each would send a new subscriber. It is just as easy to remit \$3 for two names for six months as half the amount for one name, and it suits the publishers much better. Remittance by postal order is the safest and best. Address MUNN & Co., 37 Park Row, New York city.

NECESSITY FOR SANITARY REFORM.

In another column of this issue will be found a continuation of our series of "Sanitary Notes," a paper on the subject of "Sewerage and Sewage," devoted mainly to a brief description of the various projects for the utilization of refuse filth, so as to transform it from a source of expenditure to one of valuable profit. In large cities the question of obtaining the fertilizing matter from the material, though in itself one of no small importance, is, owing to the vast quantities of the latter produced, subordinate to the problem of disposing of the noxious substance in such a manner that it shall not breed disease or nurture pestilence in the narrow and confined limits of thickly populated districts. It need not be pointed out that without an effective system of sewers, which not only convey away the filth but also form complete drains for every portion of the city, the removal of this waste is impossible. Here, where the main conduits are on a level below the high water mark of the rivers into which they empty, or are distorted to convey their contents (hypothetically) up hill, or where the branch sewers connect with mains set on a superior level, nothing else is to be expected than a stagnation of contents in the tubes, and in the former instance their reflux through the action of the entering tides.

Bad as such a state of affairs is, and pressing as is the invitation which it holds out to epidemic and zymotic diseases, it nevertheless obtains in New York and probably many other cities of which the growth has been proportionally rapid. Some of the daily journals, notably the *World*, have recently taken up the subject, and the information published is well calculated to arouse the citizens of the metropolis to a sense of the insidious dangers to which they are constantly exposed. The death rate from zymotic diseases alone averages 9,000 a year within the corporate limits, and the cases of sickness aggregate from the same period at least

100,000. It requires but a casual stroll through certain portions of the city to determine the reasons for this fearful mortality.

Probably the action of the tides, as above described, forcing the filth back and often out of the street culverts, is a prolific source of the miasm of the lower lying districts. It is but a few days since that, in passing through a street contiguous to the Hudson river, we ourselves observed that, after a heavy rain and at high tide, the gutters and roadway in the neighborhood of the openings were flooded over a considerable area, and to several inches deep, with a black, horrible liquid, in which, despite its disgusting odor, the street urchins were holding especial revel. For such glaring faults as this there is clearly no excuse, even if any in depreciation be admitted for the negligence to which the more hidden defects of the uptown sewers must be ascribed. Cellars are flooded, and the soil, permeated with filth, giving rise to deadly mephitic gases, makes the locality a hot bed for disease, originating that scourge of children, *cholera infantum*, and also the rheumatism, scrofula, fevers, and innumerable pulmonary complaints of adults. In the new and manufactured portion of the city, in the neighborhood of Central Park and above, the condition of matters, though less apparent, is not much better. Some years since General E. L. Viele published a map of Manhattan Island, showing the lead of the natural water courses and ponds, the beds of which, like that upon which the Tombs or city prison now stands, were quagmires and soaking bogs. This map disappeared, but was resurrected by the Citizens' Association in 1865, and from its topography the origin of the maladies prevailing in certain quarters is readily traced. Old marshes, which, in the overwhelming desire to raise grades and make streets, were filled up with sand and stone, have asserted their existence and converted the land into a sponge, absorbing the filth which flows from the faulty sewers. In the upper portion of our city, even at the present time, there are streets, raised far above the normal grade, enclosing lots on the bottom of which stagnant pools still exist; and we can recall localities which, now thickly built up, were, hardly ten years since, sites of skating ponds of considerable extent. This land, as well as whole districts indicated by General Viele's map as the former beds of water courses, is now covered with many of the finest residences in the city, the owners of which, though experiencing sickness in their families, little suspect the hidden cause to which the prevalence of disease is due.

We notice with gratification a revulsion of opinion against filling in, as a means of reclaiming ground from bogs and swamps. The health authorities of Brooklyn have already taken steps in another direction, and have appropriated funds to pump off the water from submerged land before raising the grade. This, we think, is the wisest course the Health Board can pursue. Burying a nuisance out of sight is not abating it, and merely covering up so formidable an enemy to public health renders it doubly dangerous by concealing its existence until it becomes recognized through its deadly effects. The pumping operations can be accomplished very expeditiously, while the filling up process takes a great deal of time; and the expensive nature of the latter, for material, labor, and cartage, would cost the city or the owners a much greater sum than that for which the property when filled in could be sold.

We need rapid transit, and our present system of docks is a disgrace to any civilized people; but great as are both our wants in this direction, they are exceeded by the urgent necessity which exists for a thorough overhauling and, if need be, entire alteration of our sewerage.

RENEWAL OF THE REWARD OF ONE HUNDRED THOUSAND DOLLARS.

The Legislature of the State of New York has recently renewed, for the period of one year, the offer of one hundred thousand dollars reward for improvements in canal navigation. This will be good news to scores of inventors.

The law making the offer of this large reward was originally passed in 1871, and the text thereof was given in the *SCIENTIFIC AMERICAN* of May 6 in that year. It provides for the payment of one hundred thousand dollars to the introducer of a plan, for navigating the Erie canal in this State, which shall prove on actual trial to be better and more economical than the existing method of towage by horses. The following are the chief requirements of the law:

A Board of Commissioners is appointed, consisting of George B. McClellan, Horatio Seymour, Erastus S. Prosser, David Dows, George Geddes, Van R. Richmond, Willis S. Nelson, George W. Chapman, William W. Wright, and John D. Fay, whose duty it is to practically test and examine all inventions that may be submitted to them, by which steam, caloric, electricity or any motor other than animal power can be practically and profitably applied to the propulsion of boats upon the canals. Such tests and examinations are to be confined to the season of canal navigation in the year 1873, and the Commissioners are required to demand that the competing inventions shall be tried practically upon the canals at the expense of the applicants; that the boat shall, in addition to its weight of machinery and fuel, be able to transport at least 200 tons of cargo, be able to run at a speed of not less than three miles per hour, be easily stopped and backed by its own machinery, which should be simple, economical, and durable, and readily adapted to the present canal boats. Lastly, the law requires before an award is made that "the Commissioners shall be fully satisfied that the invention or device will lessen the cost of canal transportation, and increase the capacity of the canal."

Quite a number of boats were tried last year on the canal;

and in our paper of February 15, 1873, will be found a brief description of their construction and performances.

Individuals who propose to compete for the prize should bear in mind that it is not simply the propulsion of the boat ahead that is required. It is not only the propulsion, but the steering, rapid and economical handling of the vessel when in the canal. It is easy enough to drive a canal boat in open water by steam power, faster and cheaper than by horse towage. But to do so in a narrow canal, where the stoppages are frequent, the water shallow, the delays considerable, the boats constantly passing or repassing or dashing into each other, crowding together, jamming fast, etc., is a difficult problem. Evidently the boat should be provided with a variety of appliances to meet and promptly overcome the various exigencies to which it is to be subjected. It should have power to move laterally as well as longitudinally, at the will of the commander, and should have facilities for quickly anchoring and getting under way. Inventors will do well, therefore, to turn their attention to other things besides the mere form of the propellers. These have been invented already by the hundred, and little or no advantage has been secured from any of them. A velocity of only three miles per hour is needed, and this the ordinary propelling devices will easily supply.

The dimensions and other particulars of the Erie canal are as follows: Depth, 7 feet; width at top, 70 feet; width at bottom, 56 feet; length, 345 miles; number of locks, 72. The locks are 110 feet in length over all, admitting boats 96 feet long. The width of the locks at the surface of the water is 18 feet, and at bottom 17 feet 4½ inches. The largest boats used on the canal are 96 feet long by 17 feet 8 inches beam, with a depth of 9 feet. Such boats draw 6 feet of water, and each of them carries 240 tons.

COMETS.—THEIR CHARACTER AND SOURCE.

The spectroscopic shows us that comets consist of a mass of carbon dust, so diffused as to make them bulky with little weight, and this explains at once the cause of the total absence of refraction of the light freely passing between those minute dust particles.

In regard to the question "whence these masses of dust particles came," Zöllner, whose observations and calculations we mentioned in a former article on the sun, holds that the solar eruptions throw up masses, consisting chiefly of hydrogen, ejected from the sun with a velocity of 133 miles per second. He comes to the conclusion that as twice this velocity would carry material entirely beyond the limits of solar attraction, a somewhat less velocity would throw it to distances corresponding to those of the comets. He thinks, therefore, that comets originate from the sun, and are thrown out from that body finally to return thereto, just as volcanic material is thrown out from the earth and carried through our atmosphere, eventually coming down at remote spots.

Any doubt in regard to the possibility of the existence of such enormous projectile forces is removed by the actual observations of Janssen, Lockyer, and Respighi. The latter says: "The solar surface is the seat of movements of which no terrestrial phenomenon can afford any idea; masses of matter, the volume of which is many hundred times greater than that of our earth, completely change their position and form in the space of a few minutes, showing motion of which the velocity is measured by hundreds of miles in a single second." Professor Young has observed a solar explosion of which the mean velocity, between the altitude of 100,000 and 200,000 miles above the solar surface, was 166 miles per second; as this indicates an initial velocity of 200 miles per second, it is sufficient to carry the projected matter beyond the orbit of the earth.

Schiaparelli, in the *Astronomische Nachrichten*, calls the comets "cosmical clouds." He says: "Cosmical clouds will always appear to us as comets when they pass near enough to the earth to become visible." The comparison is indeed striking; as watery clouds ascend in our atmosphere and float around the earth, so the fiery clouds from the solar surface ascend into planetary space and float around as comets. Both are raised by solar heat and are afterwards cooled.

It is possible that the hydrogen in the solar protuberances is at first so abundant that its spectrum overcomes the spectra of the other materials which it may hold, as it were, in solution; and that while being projected, it expands by its gaseous nature in the planetary space, leaving the carbon and other materials, as a mass of dust which slowly disintegrates by the disturbing influence of the solar heat, planetary attractions, and adhesion of the different particles, forming finally great numbers of small and dense masses, which will fly around the sun in the form of a belt; and when some of them at last come down upon the earth, we call them meteors. Schiaparelli further says: "Gradually the products of disintegration are distributed along the comet's orbit; and if the earth's orbit cuts this, the phenomena of shooting stars are produced."

Two interesting facts are connected with these views; one is that the position of some well determined meteor streams coincides with the orbit of a comet; the other fact is that recently chemists have extracted hydro-carbon from meteoric masses: indicating the hydrogen which the spectroscopic shows to exist in excess in the solar protuberances, and the carbon which the same instrument shows to exist in excess in the comets.

A PERFECT VACUUM.

The ancient philosophers who defended the theory that "Nature abhors a vacuum" were greatly derided by their opponents; but modern research would seem to confirm their views. There is an anecdote that Galileo, who, as our readers know, lived in the seventeenth century, on being con-

sulted by some engineers of Florence who found it impossible to raise water in a pump barrel higher than thirty-four feet, told them that Nature's abhorrence of a vacuum extended only to a height of thirty-four feet; and that beyond that height, it had no objection to an empty space. Galileo's pupil Torricelli first demonstrated, by actual experiment, the cause of water rising in a pump barrel from which air had been exhausted, and his theory was firmly established by the experiments of Pascal. Torricelli's experiment can be readily reproduced. Take a glass tube, more than thirty inches long, filled with mercury, from which the air has been expelled. Put the open end of this tube into a cup filled with the same liquid, and the mercury in the tube will fall until it has reached a height that can be balanced by the pressure of the atmosphere. The space in the tube above the mercury is called the "Torricellian vacuum," and is the most perfect vacuum that can be produced by mechanical means. By a perfect vacuum we mean empty space, and this space above the mercury is supposed to contain two substances: 1st. The vapor of mercury, which is there in virtue of the principle that evaporation takes place from the surface of all liquids, at all temperatures except that of absolute zero. 2nd. The subtle and elastic medium of ether, which is supposed to pervade all space. Many physicists have made experiments to determine the existence of this ether, but its effects are best observed in the motions of Eucke's comet, whose periods of return to its perihelion are constantly diminishing. The undulating theory of light is also based on the existence of the ether.

It becomes interesting, then, to inquire whether a perfect vacuum can be produced in any manner. Admitting the existence of the ether, which has some tension, even though it be too small to be measured by the most delicate instrument, it will be seen that the problem cannot be solved, unless we can destroy the tension of this ether. There is a theoretical temperature, at which (if it could be produced) all vapors would lose their tension. This is the point of absolute zero, at which all heat motion ceases. This is a point which can never be reached in practice, but can readily be determined, and is marked on the thermometric scale as follows: -219.2° Réaumur's scale, -273° centigrade scale, -461.2° Fahrenheit's scale.

Before closing, we will explain how a degree of exhaustion can be reached, which is almost perfect with the exception of the ether. In the use of an ordinary air pump, at each stroke a pump full of air is removed, and the remaining air expands and fills the whole space. Hence, with the most delicate machine, there will always be some tension in the receiver, unless other means are employed. Let the pump and receiver be filled with carbonic acid instead of ordinary air, and let this be exhausted by successive strokes of the pump until the tension is very slight. Then introduce potassa or caustic lime, which will absorb the rest of the carbonic acid, leaving a perfect vacuum, as far as can be ascertained by a measuring instrument or gage.

TIME AROUND THE WORLD.

We have received of late sundry queries from correspondents relative to the gain or loss of time in circumnavigating the globe. Those who have not found answers in the columns devoted to such purpose will receive a general response in the following rather amusing discussion recently carried on between two grave and learned French savants on the same rather paradoxical topic. M. Jules Verne, of the French Geographical Society, has written a book entitled a "Tour around the World in Twenty-four Hours." What the nature of the contents of the volume is, we know not; but at all events it excited M. J. Bertrand, of the Academy of Sciences, to attempt to pose M. Verne with the following conundrum: "A person, supposed to be furnished with the necessary means of transportation, leaves Paris at noon on Thursday; he travels to Brest, thence to New York, San Francisco, Jeddo, etc., returning to his starting point after twenty-four hours, that is, encircling the globe at the rate of 15° of longitude per hour. At every station, as he passes on his journey, he asks: 'What time is it?' and he is invariably answered: 'Noon.' He then inquires 'what day of the week is it?' At Brest, 'Thursday' is the reply, at New York the same; but on his return, supposing he passes Paris from the east and stops at Pontoise, a town some 19 miles to the northwest of that city, he will be answered 'Friday.' Where does the transition happen? Or when, if our traveler is a good Catholic, should he consider Friday's abstinence from meat to begin? 'It is evident,' continues the questioner, 'that the transition must be sudden, and may be considered to take place at sea or in a country where the names of week days are unknown; but,' he continues, 'suppose the parallel at which it happens should fall on a continent inhabited by civilized people speaking the same language, and that there should be two neighbors separated, say by a fence, on this very parallel. Then would not one say it was Thursday, at noon, while at the same moment the other would assert it to be Friday, at the like hour?'

M. Verne answers as follows: It is true that, whenever a person makes the tour of the globe to the east, he gains a day, and similarly when traveling to the west he loses a like period, that is to say, the twenty-four hours which the sun in his apparent motion occupies in describing a circle around the earth. This is so real and well recognized that the administration of the French navy gives a supplementary day's ration to vessels which, leaving Europe, double the Cape of Good Hope, while it retains on the contrary a similar provision from ships rounding the Horn. It is also true that, if a parallel existed, such as above described, across an inhabited region, there would be complete disagreement between the people adjacent thereto; but this parallel does not

exist, for Nature has placed oceans and deserts in our path where transition is made and a day gained or lost unconsciously. Through an international convention, the point for making the days agree has been fixed at the meridian of Manila. Captains of vessels, under the same rule, change the dates of their log books when they pass the 18th meridian.

Edgar A. Poe, if we are not mistaken, avails himself of this apparent puzzle, in one of his desultory sketches, to point the story of an individual whose would-be father-in-law refuses him the hand of his adored, with her concomitant of an agreeably large dowry, until that time shall happen when "two Sundays fall in a week." The luckless lover in despair goes to sea, sails round the world, and returns to renew his suit exactly one year from his departure. In the course of events a discussion takes place between himself and the stern parent relative to the present day of the week, in which he insists that it is Monday, and the old gentleman is equally positive that it is Sunday. The one produces his diary, kept since his departure; the other falls back upon the calendar. Finally it transpires that the traveler in sailing round the globe to the east has gained a day in his reckoning; hence both disputants are right, two Sundays have come together, and the happy dénouement follows.

THE TEXAS PACIFIC RAILROAD.

The line of the Texas and Pacific Railroad, which is one of the youngest of the great transcontinental routes now in process of construction, is, with its connections, to connect New York with San Diego, on the Pacific coast, and thence with San Francisco. In extent, the road to its terminus will be four hundred and fifty miles shorter than any line now connecting the metropolis with San Francisco, or, with its branch to the latter city, will not exceed, in the distance passed over, any of the present routes.

The surveys across the continent, which have recently been made, indicate that the region chosen is especially adapted to the construction. Among the remarkable features, it may be noted that the summits to be crossed are about thirty-two per cent less than those on existing Pacific roads, while the grades and curvature will be about sixty-two per cent less. The climate through which the line is located is so favorable that no train need be delayed by snow or similar obstructions, common upon the northern roads; and an abundance of excellent coal for fuel is accessible at numerous points. The entire rail transportation between the waters of the Pacific and New Orleans will be less than 1,800 miles, and with ports in Texas, something under 1,500 miles. Adding to these advantages the bordering Mexican States, with their great mineral wealth, together with the immense traffic of Texas, California, New Mexico, and Arizona, it certainly seems that the enterprise will prove of great value, both nationally in opening to trade an almost unrivaled section of the country, and individually in the large profit which it must yield to its projectors.

As regards the progress of the road, we have before us the report of the President, Hon. Thomas A. Scott, in which it is stated that nearly four hundred miles of the line have been graded, and the bridging so far advanced as not to retard the laying of the iron. The greater portion of the ties needed have been distributed, and the rails, etc., for three hundred miles, are being forwarded to cities along the route as rapidly as possible. The labor has been accomplished since last October in the face of serious obstacles in the way of transporting material. Work has also been begun at San Diego, and is being rapidly pushed forward. The grant of six millions of dollars of bonds, made by the State of Texas, to the road was coupled with the condition that the line west from Marshall, and west from Texarkana, should be completed to a point of junction near Fort Worth, by January 1, 1874, so that by that date quite an extensive portion of the route will be finished.

President Scott considers that, judging from past progress, the entire road will be built within a period of five years, and consequently much within the time granted for its completion.

Fishing Tackle.

We were shown a few days ago a trout fishing rod, made for a friend of ours by Mr. Thomas Tout, of Kingston, Mass., which excels in beauty anything we have seen in this line for some time.

It was made of lance wood, and provided with a number of extra tips of the same material and of bamboo. The mountings were silver plate, finely finished and of chaste pattern. The rod possesses, in an unusual degree, that peculiar elastic quality which an expert fisherman readily understands by the handling, but which it is difficult to adequately describe. It was very light, weighing only 8 ounces, as flexible as a whip thong, and strong enough to land a grampus.

A Competitive Trial of Rock Drilling Machines.

It has been announced that a trial of apparatus used in quarrying and boring rock will be held at Pittsburgh, Pa., on July 8, 9 and 10 proximo. To this competition, owners and patentees of drilling apparatus, whether worked by hand, compressed air or steam, drilling bits and tools, electric and other fuses, and all other appliances used in rock cutting and mining are invited to send their inventions. Steam power will be furnished gratuitously, and the trials will take place in a quarry, so that really practical results will be obtained. These experiments are likely to be of great interest to the coal mining population, to whom the necessity of practical mechanical appliances is one of great importance. Further particulars will be found in our advertising columns.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE PROPER MOTION OF PROCYON.

M. Struve, director of the Russian Central Observatory at Pulkowa, has discovered a very small star, at a distance of about two seconds from Procyon. The position which this body occupied during the observations accords perfectly with the hypothesis of Dr. Auwers that the irregular movement of Procyon is due to its movement around some smaller and hitherto unknown companion, through a period of about forty years. The mass of this new star, it is concluded, cannot be less than half that of the sun.

PROGRESS OF THE ST. GOTHARD TUNNEL.

During the month of March last, the piercing of the St. Gothard tunnel advanced to 806.4 feet. The total number of workmen employed is 813. Considerable difficulty has been experienced owing to the percolation of water through the micaceous rock. At one time, the flow averaged 75 quarts per second, greatly delaying the progress of the work.

RUSSIAN OBSERVATION OF TRANSIT OF VENUS.

The Russian government has appropriated 70,000 roubles (about \$55,000) for observation of the coming transit of Venus. Twenty-four expeditions will be dispatched to various parts of the globe.

A NEW BLUE COLOR.

A new shade of blue of great beauty has been obtained by Springmühl from a secondary product derived from the manufacture of artificial alizarine. The color is consequently extracted indirectly from anthracene, produced from tar. It is stated that, under certain conditions, it is superior to the aniline blues, but at present its cost is quite high.

CASTING THE STANDARD METERS.

The International Metric Commission, which met in Paris in October last, decided that each of the States represented should be supplied with a standard meter made from iridiated platinum, and that the manufacture of all the bars should take place at the same time and from one melting of the alloy. Before proceeding with this extensive and delicate operation, the French section of the commission, to which the work is entrusted, have recently caused to be made two type meters in order to test the processes which will be hereafter employed in forming the standards. M. Deville having succeeded in obtaining iridiated platinum in a perfectly pure state, the fusion and casting of the types recently took place in his laboratory in presence of the President of the Republic and many other distinguished personages. Nineteen and four fifths lbs. of platinum were, by the action of the oxyhydrogen flame, melted in 45 minutes with 2.2 lbs. of iridium, the latter, it may be here remarked, being by far the least fusible and hardest of the metals which accompany platinum in its natural state. The ingot was cast in a mold formed from a block of carbonate of lime, the interior surface of which was brought to the state of caustic lime under the excessive temperature therein developed. By this means all risk of fissures within was avoided. The metal cooled in the mold, retaining its brilliant surface, after which the bar was suitably rolled and finished. The operation was a complete success, and will be repeated with the 440 lbs. of alloy necessary to compose all the standards. This will be a metallurgical process, says *Les Mondes*, far exceeding in magnitude anything of similar nature that has yet been attempted with these inalterable metals.

NEW HORTICULTURAL FERTILIZER.

Some time since we called attention to a new chemical fertilizer for horticultural purposes, suggested by Dr. Jeannel of Paris. *Les Mondes* of recent date, in commenting on results obtained by its use, says that it represents the fertilizing principles of at least one hundred times its weight of concentrated animal manure, and supplies to the plants nitrogen, phosphorus, potash, sulphur, and iron in a completely soluble state. The compound consists of 400 parts of nitrate of ammonia; 200 parts biphosphate of ammonia; 250 parts nitrate of potash; 50 parts muriate of ammonia; 60 parts sulphate of lime, and 40 parts sulphate of iron. These ingredients are pulverized and mixed. One dram of the powder (about a teaspoonful) is then dissolved in a quart of water and a wineglassful of the solution given two or three times a week, in accordance with the health and luxuriance of the vegetation.

The plants may be placed in any kind of earth, however poor, even pure sand, or may not be potted at all. It is stated that certain flowers, the fuchsia, for example, may be cultivated without earth by simply placing the stalk in a jar, at the bottom of which is an inch or so of water, just sufficient to cover the ends of the roots. To the fluid a proportional quantity of the fertilizer is added, as above specified, once in eight days. The foliaceous development of plants treated with the substance is said to be truly wonderful, and yet the rapid growth of the leaves does not interfere with the most luxuriant flowering. To this we may add that quite recently we have tried a compound hastily composed of the majority of the substances above detailed, merely as an experiment, on a small and sickly fuchsia. The plant was drooping and little else remained than a half dry stalk. After two applications of the fertilizer, its effect was apparent, and at the end of ten days, during which probably half a pint of solution had been supplied to the earth, new shoots had sprung out, leaves formed, and the entire plant became perfectly loaded down with buds.

T. J. A. says: The *SCIENTIFIC AMERICAN* is the most valuable paper within my knowledge, and I have read all the foremost papers in the land.

NEW RIFLE ATTACHMENT FOR FOWLING PIECES.

We were recently shown, at the store of Messrs. Cooper, Harris & Hodgkins, No. 177 Broadway, in this city, a very ingenious device whereby an ordinary central fire, breech-loading, double barreled fowling piece can be at once transformed into a rifle. The appliance, which may be combined with either one or both barrels, is simply an extra barrel, or tube, of steel, rifled within. Exteriorly it is made to exactly fit the interior of the bore, a suitable enlargement at one extremity rendering it conformable to the cartridge chamber. It is pushed into the breech with no more trouble than an ordinary metallic cartridge, and completely lines the barrel, from the rear flush to the muzzle.

For sportsmen who desire to travel light, without the extra weight of both fowling piece and rifle, we should think this to be an excellent and convenient arrangement. Its small size enables it to be readily transported in the field, so that the hunter is provided with a piece, one barrel of which is adapted for shot and the other for ball; or if, while pursuing birds or small animals, he suddenly sights larger game, he can immediately alter his gun from a smooth bore to a single barreled rifle, or, if he has two extra tubes, to a double barreled rifle.

NEW MODE OF CHAIR CONSTRUCTION.

We have, in the past, called the attention of our readers to the defective construction of modern household chairs, which, however well seasoned the timber used in their manufacture may be, are rarely durable, or even able to withstand for a short time the ordinary wear and tear of moderate use. The inventor of the device which we illustrate herewith proposes a simple arrangement which, he claims, adds greatly to the strength of the piece of furniture through disposing the material so as to provide for opposing the strains in the most effective manner possible. The most destructive of these strains occurs when the chair is tilted back by a heavy occupant. The tendency is for the seat and back legs to close or form a more acute angle, and for the seat and fore legs to open or form a more obtuse angle, as also for the fore legs to withdraw from the seat.



These tendencies he directly opposes by introducing a brace, counterbrace, and tie; and in order that one shall assist the others, these various parts are embodied in light and handsome metallic trussings, which, at the angles, are let into and attached to the rails and legs of the chair by means of bolts or heavy screws, as shown in our illustration.

Very light castings, thus applied, securely hold the articles together, and give permanent stiffness and strength to the lightest chairs. These castings, of malleable iron, may be made plain or ornamental, japanned, silvered, or gilded, and are applicable to the cheapest as well as to the most costly chairs. Patented March 18, 1873. For further particulars address G. F. Ellis, Deposit, Delaware county, N. Y.

Miller's Combination Sprinkler.

Messrs. Underhill & Miller, of No. 183 Water street, this city, manufacture an improved form of combination sprinkler, which is excellently adapted for farm uses. The implement consists of a large syringe provided with a one-sided spout full of small holes on the upper side, through which a liquid, destructive to noxious insects, can be thrown in spray on the under side of the leaves of plants. The sprinkling spout can be easily detached and straight pipes of various sizes substituted in order to fit the device for use as a syringe for cattle or ordinary medical purposes. All the appliances are packed in a neat case, and are accompanied by packages of Miller's compounds for trees and plants and also for veterinary uses. We have used the apparatus and can recommend it to those of our readers who may have gardens to cultivate and cattle to care for.

PROFESSOR CRYNI, of Brussels, and others, have found favorable results from the administration of large doses of iodide of potassium in the second stages of Bright's disease.

BLACKING BOX.

Our illustrations represent an improved form of blacking box, affording both perspective (Fig. 1) and sectional (Fig. 2) views. It will be noticed that the receptacle for the blacking is made saucer-shaped, the rounded bottom allowing all of the composition to be used. The slides are vertical, extending down from the upper edge to form a support for the box and also to receive the cover which fits over the upper flanged portion, as shown.

Fig. 1



Fig. 2



The advantages claimed are economy in the use of blacking, none being wasted by caking in sharp corners, ready removal or affixing of the cover, and the absence of rough or sharp edges which cut the brush. Patented July 11, 1871. For further particulars address the inventor, Mr. Dennis O'Leary, Hubbard, Trumbull county, Ohio.

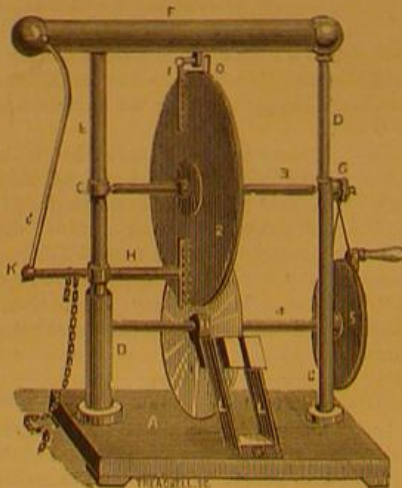
CARRE'S ELECTRICAL MACHINE.

This machine consists of an arrangement by which a current of electricity is derived from a combination similar to the electrophorus.

A is the base of wood or metal, 1 1/2 inches thick and 16 inches square. B and C are two round pillars of wood (or ebonite), B being 10 inches and C 17 inches long; they are both 2 inches in diameter. These pillars pass through the base, and have nuts below to fix them securely. E is a round ebonite (or glass) rod, 1 1/2 inches in diameter and 16 inches long + the piece of it screwed into B. The rod, D, is of glass or ebonite, 8 inches long, and the same diameter as the other, with a piece 1 inch long at the lower end fitted with cement into C, and a piece 2 1/2 inches long at the upper end going up into the prime conductor, F. The conductor is a cylinder of tin plate lacquered black, with two brass spherical ends fitted into it, one of which has a pipe soldered into it, up which the end of the glass rod, D, goes and fits tight. The rod, E, has a hole, tapped with a screw thread in the upper end, and a screw is put down from inside the conductor into this, and secures the conductor to the rod.

1 and 2 are disks of ebonite—1 being 12 inches and 2 being 18 inches in diameter. They are fixed to the axes 4 and 3 respectively. 4 is turned by the pulley wheel and handle 5, and this pulley wheel drives 2 at a rate six times as fast as 4 goes round. The rate of the upper disk may be more than this, but should not be less. The lower disk is 1/2 inch thick, the upper one a full 1/4. The axes are of wood, with brass fittings at the ends.

The band in the figure is represented as crossed, but it is no matter which way 2 turns. At G is a collar of brass, with a pinching screw to hold it on the rod, E, and this collar carries the pin at the end of the axle 3, on which it turns. H is a brass pipe carried by a similar collar, and carrying the comb for collecting the electricity as near as possible to the surface of 2; at the other end is a bell, K, capable of rota-



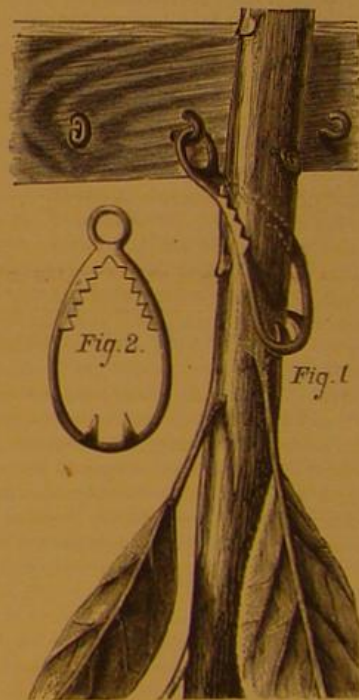
ting stiffly on its axis, carrying the brass wire, J, with a ball at the top, which can be thus made to touch the conductor or be fixed at any distance from it. At I is a comb attached to the conductor; and on the other side at O a piece of ebonite, about 2 1/2 inches long and 1 inch wide, is attached to the conductor parallel with the disk 2, and having on the side next the disk a piece of varnished paper cemented to it with four or five points cut on the edge of the paper, which is somewhat wider on one side than the ebonite plate, so that

these points are projecting in the direction in which the disk 2 is turning. A correspondent says that he put this apparatus to his instrument as a matter of faith: it seems to work as well without it, and he does not in the least understand what its office is. Lastly, at L L is the rubber, consisting of two cushions, which clasp the disk 1 closely, and are supported by two thin wooden springs, L L, fastened to a block of wood at the bottom, which slides on and off on a dovetail fixed to the base A. The cushions are covered with thin leather, stuffed with horsehair; and the amalgam is bisulphuret of tin, called *aurum musivum*, rubbed on the cushions. The disks overlap by 4 inches, and run as close together as possible. The disks should be carefully selected, without winding or buckles in them. When the machine is in action, the comb at H is connected with the ground by a chain, and the ball at the top of J is brought away from the conductor till the striking distance is attained. This machine gives from 3 to 5 inch sparks easily and in torrents, with a condenser showing a square foot of surface. One or two of the sparks are enough for most people. There is a necessity for occasionally washing the disks, first with fluid magnesia and then with paraffin, as the ozone appears to turn the sulphur of the ebonite into a coating of sulphuric acid, which attracts moisture. This would be avoided by glass discs, but they produce much more friction. A piece of Bristol board well dried, and when well dry well coated with shellac, might be tried for the disk 2. If glass rods are used for E and D, they should be coated with shellac, as the machine is much inclined to blow and leak everywhere.

The above, from the *English Mechanic*, will inform those of our correspondents, who have asked for descriptions of the construction of an electrical machine, how they may make a good instrument.

TOBACCO HANGER.

Green tobacco is suspended in the drying house by lashing the stalks to horizontal poles with twine, an operation requiring some skill, necessitating waste of cord, and often causing injury to the leaves. Dr. Frank C. Johnson, of Brooklyn, N. Y., in order to improve upon this system, has recently patented a simple and ingenious invention, illustrated herewith, which will doubtless find ready appreciation



among all cultivators of the nicotian weed. The butt end of each stalk is passed through an oval metal ring, Fig. 1, on the inner side of which are formed a number of notches and two spurs. By the means shown in Fig. 2, the plant is then suspended to a hook or nail, its own weight crowding it against the sharp projections, which firmly hold it. To remove the stalk when the tobacco is dry, it is only necessary to lift it and crowd it to the side of the ring opposite the two spurs, when it will readily pass out of the holder. Patented August 27, 1872.

How Deltas are Formed.

It appears from the observations of Mr. David Robertson, F. G. S., that in fresh water particles of clay were held suspended for a long time before wholly subsiding, while salt water, or a mixture of salt and fresh, became comparatively clear in the course of a few hours. The results showed that water only slightly brackish had a great power in precipitating the clay, and from this he concluded that the great bulk of the clay carried down in solution by rivers must be deposited before it could reach any great distance from the seashore. This may throw some light on the formation of deltas, and on the silting up of river courses within the influence of the tides. It may also assist in determining how far the glacial mud, for example, could be carried into the seas by tides and currents.

NEW MODE OF PREPARING ANIMAL MANURES.—Coignet purposes to treat animal refuse of all kinds with superheated steam to effect its conversion into manure without nuisance. He is convinced that this will be the best method of treating the offal of the slaughtered oxen or the La Plata.

STRAW-BURNING PORTABLE ENGINE.

The main obstacle to the employment of steam to any great extent, in the agricultural operations carried on over the great prairies of the West, is the difficulty of obtaining fuel. Forests are scarce, and from this are made the objects of preservation rather than depletion, while the high freights, and consequent expense of coal materially diminish the economical advantages of steam. It was for this reason that corn has recently been burned as fuel, the staple, owing to the excessive transportation charges to the Eastern markets, being cheaper to use for such purposes than either coal or wood. In view of the above facts the importance of the invention represented in our engravings, for which we are indebted to *Engineering*, will be widely appreciated, more especially when we add that it furnishes a means of employing straw, corn stalks, reeds, and similar vegetable matters, which abound in enormous abundance in our Western States, as a valuable and effective fuel, capable of generating sufficient heat to keep up steam in a boiler.

The principal ideas of the device were conceived by Mr. Schemieth, a Russian engineer, who communicated his plans to Messrs. Ransomes, Sims, and Head, of Ipswich, England. This firm, adds *Engineering*, "after fifteen months of continued trial, have at last produced the most perfect engine yet invented for burning straw or other vegetable products."

In some of the early experiments much trouble was experienced in obtaining sufficient atmospheric air through the bottom of the fire box, owing to a deposit of silicious matter which covered the bars with a sort of clinker; and after trying various schemes, the following simple method was found to be the most practical: The bars are placed about 4 inches apart, and between each pair is a blunt knife projecting about 2½ inches above them. Each knife is attached to a cross bar sliding on two guides under the grate, one end of this bar terminating in a long handle extending beyond the ash pan. When the bars require to be cleaned, the fireman moves the knives backwards and forwards, giving them, at the same time, a side action, which cuts out the clinkers, these falling into the ash pan, where they are immediately quenched by a jet of cold water from the feed pump, thus avoiding any danger from the escape of the burning ashes in cases of windy weather.

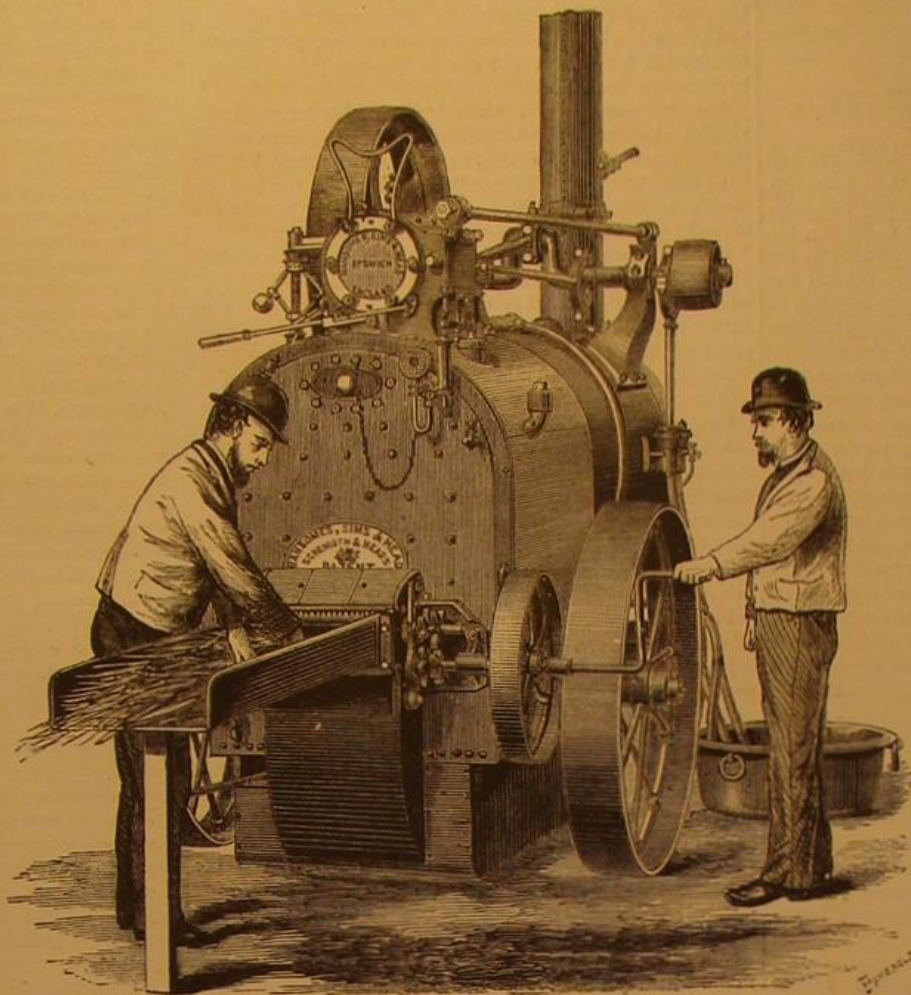
The apparatus for feeding the engine consists of rollers, which force the straw in so that each separate piece comes under the action of the flame. It is self-acting, and driven by means of a strap, and steam may be got up in the same way as with any other combustible, by attaching a handle to the feeding rollers and turning them by hand instead of by steam power. One man only is necessary to feed the straw into the engine, provided the material is brought to him and placed alongside the feeding trough. The average consumption is about four to five times the weight of coal; and according to experiments made, about ten to twelve sheaves of straw are required to thrash one hundred sheaves of wheat.

The engine represented is an ordinary 10 horse power portable, except that it is provided with a larger fire box than is used for coal burning, and that the tubes are of slightly smaller diameter than those ordinarily employed. The straw-burning apparatus is constructed precisely as shown by our engraving, and the straw is burnt in its natural condition, and not subjected to any artificial drying process. On first lighting up, the rollers have, of course, to be turned by hand to feed the straw into the fire box, but this is very light labor and can easily be performed by a boy. On the occasion of a trial, detailed in our cotemporary, in thirty-two minutes from applying a light, the steam had got up to 20 lbs. pressure, and the steam jet in the chimney was then opened. In eight minutes more, or forty minutes from lighting up, the steam pressure had reached 31 lbs., and the engine was then started, the steam jet being shut off and the belt put on to drive the straw-feeding rollers. The steam pressure then began to rise rapidly; and in fifty-one minutes from lighting up, a pressure of 60 lbs. was reached. Subsequently, the pressure

was raised to 70 lbs., and a brake, applied to the fly wheel, was loaded so as to cause the engine to develop 20 effective horse power, the speed being 140 revolutions per minute. With this load steam was maintained steadily and with the utmost ease, the whole of the arrangements working admirably. The combustion of the straw was thorough and complete, only a few stray particles of unburnt material occasionally finding their way into the ash pan, while, by an occasional use of the rake or knives already mentioned, the grate bars were readily kept clear. The water jets in the

straw back into the ash pan, and *j* is a wooden trough to contain the straw which is to be fed into the furnace, and which can be removed when the engine is traveling. The whole apparatus swings on a hinge, *k*, and can be taken off in a few minutes, and the ordinary fire door substituted when coal or wood is burned.

This is without doubt one of the most important steps that has been made in the construction of portable steam engines since their introduction, as they can now be used in any country where vegetable produce can be raised, instead of, as heretofore, being practically restricted to those countries where coal or wood can be procured.

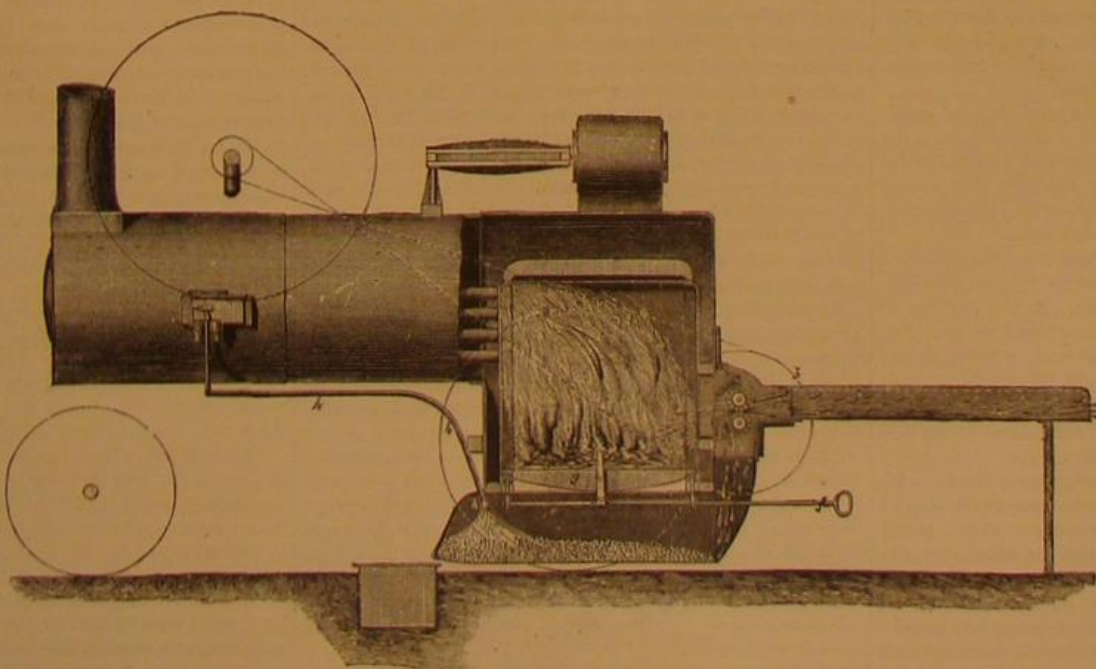


STRAW-BURNING PORTABLE ENGINE.

ash pan also thoroughly fulfilled their purpose of preventing ignited particles from flying about—an important matter where thrashing is going on—and altogether the trial was a most satisfactory one in all respects.

One of the illustrations which we give represents a perspective view of one of these engines getting up steam, showing the position of one man feeding and the other turning the rollers by hand. The other engraving consists of a section of the fire box. In these views, *a a* are toothed rollers fitted with malleable teeth, and connected with the engine

current. Now the heat developed in the Gramme machine becomes perceptible only when the work to be done is not proportional to the current generated. But as the electro-motive force varies with the rapidity of rotation, it is evident that the latter may be regulated to suit the requirements of the case. By attending to this, little or no heat may appear in the coils, and a very large fraction of the power expended may be converted into useful work. On the night of May 25, we had the opportunity of examining the apparatus on the clock tower; the speed was only 300 revolutions per minute. The machine is in the engine room under the peers' lobby; the interpolar wires are bracketed to the walls from which they are insulated by passing through the space between V shaped pieces of ebonite. The wires are not covered, insulation from the air being deemed unnecessary. They are carried from the engine room to the lantern of the tower, a distance of 900 feet; consequently three times that of the Foreland, and the greatest distance, we believe, the terminals of an electric light generator have as yet been carried. The gauge used is the 000 B. W. G., or 425 of an inch in diameter. The intensity of the light on the 25th of May was equal to 8,000 candles. Very dark glasses were required to look at the lantern even from a considerable distance. The beam, as it shot through the air, reminded one of the lustrous silvery appearance of the tail of the comet



by means of a pulley, *b*, driven by a strap from the crank shaft. These rollers make 48 revolutions per minute, and can be turned by hand when getting up steam. The movable sliding blunt knives or rake, *c c*, attached to a crossbar, *d*, slide on guides, *e e*, below the grate, as already explained. This rake can be moved with a forward and side motion by the stoker by means of the handle, *f*, thus breaking up the silicious crust deposited on the grate bars, *g*, while a perforated pipe, *h*, is provided for injecting water upon the burning ashes. A shoot, *i*, carries any small pieces of ignited

of 1858 when in perihelion. At the place illumined by the beam, objects could be seen, and books and letters read with as much ease as in solar light, allowance being made for the mellowness of the one and the brilliant argent color of the other. At Trafalgar square, a very black shadow of the pillar was cast over the National Gallery; at the Duke of York's column, a very pleasing effect was produced by the sharp and well defined shadows cast by the trees and their foliage. At these two places, we endeavored to realize the difference between the electric light and that emitted also from the

Trial of the New Electric Light Machinery at the House of Commons.

Gramme's magneto-electric machine has been now for several months before the public, and the effects obtained, says *Engineering*, have been of such a nature as to confirm our statement that, scientifically and practically, it is one of the great inventions of the age.

The essential requisite for the production of electric light is that the machine evolve a current of considerable quantity and tension, for experiment proves that the most effective arrangement for illuminating purposes is neither quantity nor tension alone, but a combination of both, which may be easily obtained by paying due attention to the gage and length of the wire, the connection of the bobbins, and the speed with which they are driven. In the present case, the velocity need not exceed a maximum of 350 revolutions per minute.

Such a moderate rate obviates the great inconveniences caused in other machines by the overheating of the armatures. This is the great drawback in Ladd's and Wilde's apparatus, which in other respects are admirable pieces of workmanship and skill. Practically this advantage appears to us to be of as much importance as the distinguishing feature of the Gramme itself, namely, the absolute continuity of the current and its uniformity of direction. This development of heat causes not only mechanical inconveniences, but also, by raising the temperature of the conductors, it increases the resistance and thus diminishes the strength of the

current. Now the heat developed in the Gramme machine becomes perceptible only when the work to be done is not proportional to the current generated. But as the electro-motive force varies with the rapidity of rotation, it is evident that the latter may be regulated to suit the requirements of the case. By attending to this, little or no heat may appear in the coils, and a very large fraction of the power expended may be converted into useful work. On the night of May 25, we had the opportunity of examining the apparatus on the clock tower; the speed was only 300 revolutions per minute. The machine is in the engine room under the peers' lobby; the interpolar wires are bracketed to the walls from which they are insulated by passing through the space between V shaped pieces of ebonite. The wires are not covered, insulation from the air being deemed unnecessary. They are carried from the engine room to the lantern of the tower, a distance of 900 feet; consequently three times that of the Foreland, and the greatest distance, we believe, the terminals of an electric light generator have as yet been carried. The gauge used is the 000 B. W. G., or 425 of an inch in diameter. The intensity of the light on the 25th of May was equal to 8,000 candles. Very dark glasses were required to look at the lantern even from a considerable distance. The beam, as it shot through the air, reminded one of the lustrous silvery appearance of the tail of the comet

clock tower by the 300 gas burners of Mr. Wigham, enhanced by the most elaborate optical aids; and we must say that the contrast was indeed very striking, a few minutes having elapsed before we were able to discover the path of the beam projected by the latter. In the immediate vicinity of the Houses, Mr. Wigham's light is very soft and pleasing to the eye; but at a distance, by no means considerable, it is scarcely visible. Perhaps the proximity of the electric light may contribute to diminish its splendor; if so, the results are all the more in favor of the new machine.

The carbon points are eight inches long and half an inch in thickness. They last for about four or five hours, and then require to be replaced.

Correspondence.

The New Corundum Mines of Pennsylvania.

To the Editor of the Scientific American:

In company with Professor Garth and Messrs. Wilcox and Green, the undersigned made a second visit to the recently discovered corundum mine, near Unionville, Chester county, Pa. The proprietors, Messrs. Ball, Chandler & Perrey, are now engaged in mining the corundum and preparing it for the market. For the latter purpose, they have erected the appropriate machinery to reduce the corundum to powders of various degrees of fineness. In the reduced state, it has a nearly white appearance and looks exceedingly clean.

The mine in its present state exhibits a good exposure of the nearly vertical bed of corundum. A deep excavation exposes a breast of almost fourteen feet in width, disappearing east and west beneath the superincumbent gravel and clay on the sides of the pit. The crest of the bed, upon which the corundum is being removed by blasting, is about five and a half feet in thickness. It is of course impossible to estimate the extent of the bed of corundum. It probably extends along the breadth of the hill, but may reach in depth for many hundred feet. Professor Garth has recently been investigating the corundum and the associated minerals of this mine and those of North Carolina; and he will shortly present us with a highly interesting and valuable communication on the subject.

JOSEPH LEIDY.

REMARKS BY THE EDITOR.—Corundum, it will be remembered, is the substance chemically known as alumina, which is an oxide of aluminum, being composed of two parts of the metal aluminum and three parts of oxygen gas. An impure variety of corundum or alumina is known as emery, while the purer varieties rank among the precious stones, known as the ruby and the sapphire. Corundum stands next to the diamond in hardness, and the prepared powders mentioned by our correspondent are extensively used in the arts for polishing and grinding purposes.

The Chloridizing Process of Extracting Silver from Refractory Ores.

To the Editor of the Scientific American:

I forward you a specimen of refractory silver ore (from the Gilpin mine near Georgetown, Col.), containing argentiferous galena, sulphuret of silver, black sulphide of silver, green carbonate of copper, covellite, copper pyrites, marcasite and zinc blende.

Enclosed you will find a sample of amalgam obtained from the same grade of ore (mineral from the same vein.) It was worked on a large scale, one ton and a half at a time, by the chloridizing process, and afterwards amalgamated at a cost (here) not exceeding ten dollars per ton, the mineral being delivered at the reduction works.

The specimen of retorted silver is from the same amalgam, and is over 920 fine, a quality which I believe has never before been produced in the United States, especially from refractory ore, except by John N. Palmer, Jr., who, in company with your humble servant, worked the ore above referred to. The ore was chloridized to 94½ per cent.

As much has been said about the impossibility of amalgamating refractory ores of Colorado, I forward you the samples so that you may examine them and test them for the benefit of science; and, if you consider this article worthy of publicity in the columns of your illustrious paper, please insert the facts after having tested them.

Georgetown, Col. PERCIVAL STOCKMAN.

REMARKS BY THE EDITOR.—This result evinces considerable progress in American metallurgy. A low bullion of from 300 to 500 fine used to be an ordinary result. The maximum chlorination by the Stetefeldt furnace is 92½, or two per cent less than by Messrs. Palmer and Stockman.

The Retardation of the Earth's Rotation by Tides.

To the Editor of the Scientific American:

Having given John Hepburn, in your number for June 14, permission to ventilate his reasons for holding that the tidal movements cannot influence the earth's rotary motion, please allow me to show why he should change his mind straightway.

Let us suppose that, in the course of a year, the two great tide waves make twelve revolutions, in direct order, that is, from W. to E.; also, that the earth rotates, in the same time and direction, 365 times. It is evident that the earth gains upon the tides over 350 revolutions; which is plainly the same thing, in all its mechanical effects, as if the tides stood still and the earth rotated between them 350 times. And we have here an exact picture of a rotating wheel, to which a brake is applied and held in position by some external power.

I suppose it is well known that the slow retardation of the earth's diurnal motion is an established fact in astronomy. If J. H. will station himself at the opposite celestial pole, perhaps he can favor us with an explanation of this fact.

ORTHODOX.

ALCOHOL FROM FLINT AND QUARTZ.

ABSTRACT OF A RECENT LECTURE BEFORE THE ROYAL INSTITUTION BY PROFESSOR ERNEST REYNOLDS, M. D.

Carbon has hitherto been considered the sole alcohol-forming element; but the chief constituent of flint and quartz, namely, silicon, must now be admitted to share in this power, and likewise in the ability to form other remarkable compounds. I have here a quantity of finely divided flint mixed with some powdered fluor spar; when I pour oil of vitriol on the mixture, and apply heat, a colorless gas is obtained, which, when passed into water, produces a highly acid and gelatinous liquid. The gas is a compound of the element fluorine with silicon—the tetrafluoride of silicon—and this, when brought in contact with water, produces an acid called hydrofluosilicic and a quantity of gelatinous hydrate of silica.

The clear acid liquid, when treated with caustic soda, yields this white salt, the fluosilicate of sodium, from which we directly obtain the silicon, as you see, by simply heating with some metallic sodium. In this case the sodium replaces the silicon, the latter separating, as you observe, in the tube as a dark brown substance.

Unlike carbon, silicon in any of its forms easily combines directly with chlorine, producing the liquid chloride which I have in this tube. This is a very volatile body, boiling at 59° C., and is half as heavy again as water. It can also be prepared from silica by heating to full redness the finely divided oxide and carbon in a current of chlorine. In composition, this chloride is the silicon representative of tetrachloride of carbon.

We can easily obtain the impure gas by Wöhler's method, in treating a compound of silicon and magnesium with hydrochloric acid. We thus obtain a colorless, spontaneously inflammable gas, which burns with a bright light on contact with the air. In its pure condition, silicuretted hydrogen is not spontaneously combustible at ordinary pressure, but in a slightly rarefied atmosphere it easily inflames.

The silicuretted hydrogen is evidently the chemical analogue of marsh gas, the tetrahydride of carbon.

It is usual to regard marsh gas as the typical carbon compound from which some alcoholic series may be supposed to spring, and, in fact, all the alcohols belonging to the group of which the well known wood spirit and spirit of wine are the chief members are commonly regarded as derivatives of marsh gas, in which a part of or all the hydrogen has been replaced by one or more compound radicals, such as hydroxyl, methyl, ethyl, propyl, etc.

In these cases the carbon of the marsh gas is the grouping element of the compound, or that constituent which serves to bind together the different materials of which the molecular edifice is constructed. In the same way, the silicon in silicuretted hydrogen may be shown to be the nucleus round which can be grouped hydroxyl, methyl, etc., so as to form the alcohols I shall presently have to refer to.

In 1857 Buff and Wöhler obtained a volatile fuming liquid on heating crystalline silicon nearly to redness in a current of dry hydrochloric acid gas. The precise nature of this liquid was unknown until 1871, when Friedel and Crafts published the results of their admirable researches upon Buff and Wöhler's liquid, and showed that it was a mixture of chloride of silicon with a new body, which proved to be the strict chemical analogue of our well known chloroform, silicon replacing carbon.

SiHCl₃ Chloroform. CHCl₃.

This body is a colorless, mobile, and very volatile liquid boiling at 35° C. I have a quantity of it in this tube. One of its most remarkable properties is that of exploding with great facility when its vapor is mixed with air. If I pass the vapor of silicon chloroform into water nearly ice cold, a white solid body is obtained without any evolution of hydrogen, and an acid liquid produced. The white solid then collected, washed, and dried at a low temperature, forms a white inflammable powder, which was first described by Buff and Wöhler. Friedel and Ladenburg have shown that this remarkable body is the anhydride of the silico-formic acid. According to the results of my own investigations, the acid liquid to which I referred just now contains, in addition to hydrochloric acid, the true silico-formic acid—a body possessing nearly as energetic reducing properties as the corresponding acid derived from wood spirit.

Starting from silicon chloroform, then, we have been led, by analogical reasoning in the first instance, to infer the existence of a simple silicon alcohol precisely corresponding to wood spirit. On testing this induction by experiment, we have obtained answers which are, so far as they go, altogether favorable to the view just stated.

In the course of their elaborate and able investigation of silicon compounds, Friedel and Crafts discovered that chloride of silicon easily acts upon common alcohol, producing a body which Friedel and Ladenburg have recently shown to be easily attacked by a mixture of sodium with a curious substance contained in this tube—zinc ethyl. The product, when treated with caustic potash, yields a body which bears the same relation to silico propyl alcohol that formic acid does to wood spirit.

This silico-propionic acid is in this tube, and is a white combustible powder, like the silico formic anhydride. It is soluble in warm caustic potash, but not in caustic soda; by which character it can be distinguished from silica. It is only necessary to state that it can be obtained in aqueous solution, and in the pure state, by Professor Graham's valuable dialytic process.

When chloride of silicon acts upon absolute alcohol a body is obtained which, on treatment with zinc ethyl and sodium, yields an ethereal product from which silico-propionic acid can be obtained by treatment with caustic potash.

If, however, instead of using the caustic alkali we continue the action of zinc ethyl and sodium, decompose the products with water in sealed tubes, and distil, a liquid is obtained which contains one of the "alcohols from flint" we are in search of. In this tube I have a small quantity of the alcohol. It is the silico-heptyl alcohol, precisely corresponding to a simple carbon alcohol recently discovered by Natanson, both being tertiary alcohols. We owe to Ladenburg the discovery of this lowest known term of alcohols containing silicon. As you can observe, it is a colorless liquid, not unlike the ordinary alcohol of wine. It is insoluble in water, but easily dissolved by spirit and ether. Chemically it acts just like any of the other alcohols, producing ethers, and dissolving the alkali metals to form sodium or potassium alcoholates. When common spirit burns, you are aware that its flame is nearly colorless, but I shall now burn some of our alcohol from flint, and you will find, particularly when we feed the flame with oxygen, that a bright light is emitted.

Clearly defined though this alcohol is, it does not stand alone, for at least one other compound of the same order is known. It was suggested in 1870, by Friedel and Crafts, that silicon ethide—a body easily prepared by the action of chloride of silicon on zinc ethide—might be regarded as the hydride of silico-nonyl, and should stand in the same relation to an alcohol that marsh gas does to common wood spirit, or ethyl hydride to ordinary alcohol. This happy idea, when put to the test of experiment, was fully justified by the result, for on treating silicon ethide in essentially the same manner that we should adopt in preparing wood spirit from marsh gas, a colorless liquid, lighter than, and insoluble in, water is obtained. The boiling point of this body is 190° C. It yields an ether with acetic acid, dissolves sodium, forming an alcoholate, and, in fact, conforms to the general habits of the alcohols of the series to which common spirit belongs. It is precisely similar to the nonyl alcohol prepared by Pelouze and Cahours from American petroleum.

Ladenburg has very recently advanced even beyond the point we have now reached, and has shown that the chloride of silicon can be made to yield two ethers, which correspond, as I may suggest, to silico-nonyl diatomic and triatomic alcohols.

In all the preceding compounds but one atom of silicon is present, and though the silicon in these cases occupies the chief position as the grouping element, we should much like to see silicon uniting with silicon and forming a more condensed compound with hydrogen. Happily, however, very important evidence, even upon this point, is forthcoming, for Friedel and Ladenburg have discovered corresponding hexa-chloride, iodide, and bromide of silicon, and treatment of the hexa-iodide with zinc ethyl enables us to obtain the ethide.

It is not improbable that, in the last named compound, we have the starting point of a new series of still more complex bodies, analogous to derivatives of olefiant gas rather than to those of marsh gas.

A rich and beautiful field for chemical research appears to lie before us in tracing out the analogies between the compounds of carbon and silicon, and recognizing the chemical representatives of many of the most complex "organic compounds" in the native silicates which form so large a part of the crust of this earth.

The practical value of scientific research is rarely apparent at first. Who could have suspected that the benzole discovered by the venerable philosopher whose name is so inseparably connected with this institution, would have proved, in the able hands of Perkin and of Hoffman, the chief source of many of the exquisite dyes now largely manufactured in this country? Yet in this, as in a hundred of other instances, the small and apparently useless scientific seedling has gradually expanded into the strong tree, yielding its rich store of useful fruit. Let us hope that a similar future awaits some of the alcohols from flint which have been referred to, and that, in pursuing our studies of the silicon analogues of the more complex carbon compounds, we may be led to appreciate more fully than we have hitherto done the admirable economy and harmony of Nature.

Booming.

"Booming" is the name of an operation with which probably our Eastern readers are not generally familiar. Hence, we extract, from the columns of the *Mining Review*, an explanation of the process as practised by the miners of Colorado. Booms are built and run for two purposes: the discovery of veins hidden under the deep slopes of the mountain sides and the working of gold placers on a large scale.

The reservoir is first constructed at the head of the ground to be worked; into this water is conducted, from the most convenient source still higher up, by flumes or ditches. These reservoirs vary in size from a small pond to an acre or two lake, and the ditches are often eight, ten, and twelve miles long. When the basin is full, and a continuous head of water is in running operation, gates are opened, letting loose the whole volume of the liquid, which tears down the mountain side in a huge volume, sweeping everything before it, carrying tons of boulders, gravel, and dirt down to the gulch below. If auriferous ground is to be worked, a long and massive wooden flume is built at the foot of the hill, into which the debris is carried, with all the force of the falling waters and the sand and rocks washed along in its course while the gold is deposited by its own gravity, behind the riffles in the bottom of the race. These flumes are often thousands of feet long, and as rocks of all sizes and weights are carried along in them, they must be built with great strength and solidity, to withstand the immense wear.

If it is the object, however, merely to uncover the veins of

which no trace can be found by scientific prospecting, no flame is built in the gulch, but the water allowed to take its own course. On its way down the mountain side, it cuts out a huge trough from 20 to 50 feet wide; and if the operation is prosecuted with vigor and plenty of cash, the bed rock is reached and swept clean from top to bottom, and a huge delta of mud, rocks and clay left in the valley below. The water is then shut off, and the owners of the boom examine the clean rock and claim all the veins exposed.

SANITARY NOTES--SEWERAGE AND SEWAGE.

It is no exaggeration to say that the problem of the conversion of the excremental waste of towns and people and the refuse of factories into useful materials is now engaging as much of the attention of intelligent minds throughout the world as any social question. The English press is burdened with publications on this general subject. Chemists, farmers, political economists, engineers, and physicians are all at work upon it. Costly experiments are being constantly made to test the worth of the various proposed plans. Stock companies are formed, whose business is first to make money for themselves at any rate, and, secondly, to benefit the rest of the world by their ventures. From all this excitement we ought to derive much useful information, and, from the experience gained in foreign countries, gather knowledge which may be turned to practical account in solving a problem which, in the natural course of the country's growth, must eventually be forced upon us. In briefly considering the subject, we draw for our facts upon the recent report of the State Board of Health of Massachusetts, and premise by explaining what is meant by the words

"SEWER," "SEWERAGE," AND "SEWAGE."

The last two are often confounded; but they signify quite different things. A *sewer* is an underground passage for the conveyance of water, filth and fluid, or half fluid, refuse emptied into it from the smaller drains from houses, factories, and streets. *Sewerage* is a system of sewers or subterranean conduits, and the word refers only to these works or constructions, while *sewage* is the material which is or may be conveyed in sewers. Public health requires that the foul fluids, half solids and solids, resulting from human excretion from the waste of food, from washing, and from the refuse of various manufactures, shall be either speedily removed from among the living, or that the character of these materials shall be so changed that they will not undergo decay. We have therefore to consider, first, the primary means of getting rid of this noxious waste; and second, how to utilize its valuable properties after we have provided for its removal. For merely disposing of human refuse, there are two principal systems to which we shall allude. The first is the

DRY EARTH SYSTEM.

Abundant experience has shown, and in these columns we have repeatedly explained the fact, that earth (not gravel or sand), when carefully dried so that it has lost all coherence or stickiness, and has become a powder, possesses the power of absorbing and reducing to an inodorous form the excretions of the human body, provided it be applied in quantities so as to completely cover and absorb all fluidity thereof. The mass may be removed at convenient times and seasons and used immediately as a fertilizer for land, or it may be dried and employed many times without giving off any offensive odor. Similarly, dry ash of hard coal or anthracite may be used instead of earth.

In densely populated cities and towns there are difficulties inherent in this system which will render its general use impracticable. If it is intended to absorb both the solid and fluid excretions of the human body (and the latter contain far more fertilizing material than the former), four or five pounds of dry earth must be supplied daily for each individual. Thus, in a city of 100,000 people, 250 tons must be brought in every day from the surrounding country, and a somewhat larger amount carried out. And this must be divided among some 10,000 different houses, each of which must be carefully provided for. At the present high price of labor, it is evident that, financially, such operations are out of the question. The case, however, is altogether different with country houses with land from which the earth may be taken and to which it may be profitably returned. Here the wells will be protected from fouling, the stench of unsightly outhouses prevented, and the annoyance occasioned by frost obviated. In prisons and large establishments where labor is cheap, and possibly in boarding schools, the system may also be advantageously applied. Without proceeding further into a subject which we have already fully treated both in theory and practically, by illustrating and describing the many excellent inventions which have been introduced for its application, we proceed to the second systematic method of disposing of human excretion known as the

WATER CARRIAGE SYSTEM.

This is by the underground drains and sewers which all compactly built towns are obliged to have in order to get rid of the surface water falling as rain, and also for drainage of the soil. With these sewers, by means of water closets, baths, etc., the interior of dwellings are brought into close connection. Consequently, whatever gases are contained in these underground passages seek to diffuse themselves through the buildings. These gases are dangerous to health, though what the specially noxious element in them is, no one can define.

The sensible properties of sewer air are quite remarkable. It is by no means fetid, as many people suppose, neither is it pungent or ammoniacal. It is rather negative in character, faint in odor, mawkish, smelling perhaps, more like soap than any other familiar substance. This air frequent-

ly escapes into houses, diffusing a virulent poison and carrying with it the seeds of disease; it is subject to pressure from sudden influx of water in rainstorms, and in sea board towns by the action of the tide. It is also caused to rise from the difference of temperature of the house and sewer; and unless the joinings of the soil pipes are perfect, and have not become leaky through contraction and expansion, it is forced out and quickly spreads through the dwelling. Defective traps and similar imperfections in the plumbing also form free vents. For these reasons, it is best to give the whole drainage plan of the house the freest possible communication with the outer air at a point so elevated that the sewer gases cannot fail to be diffused and got rid of. This can readily be done, while building, by carrying the soil pipe, made of iron, at full size, through the roof, and leaving it open like a chimney. By this arrangement all stagnation is prevented; the contents of the house drains are constantly exposed to the oxidizing and purifying influence of currents of air; when rain conductors are filled with water, there is still free escape for the sewer gases; and the water traps throughout the house are relieved from pressure both of the pent up sewer air on the one side, and of suction or atmospheric pressure on the other. In the houses already built, a lead pipe may be readily carried from the highest point of the soil pipe directly through the roof; but the larger the pipe and the straighter its course, the better.

THE TREATMENT AND VALUE OF SEWAGE.

Experience having shown that the best method of getting rid of excretal and other matters is by the water carriage system, the question arises what shall be done with the sewage. As we have above intimated, many and various plans have been proposed, from which the conclusion may be justly reached that the purification of sewage is a possibility to an extent that it may be discharged into running streams without vitiating the water to any extent other than to unfit it for drinking purposes. The writer of the report before us qualifies this view, however, with the opinion that no process has yet been proposed which, unless in exceptional cases, renders the purification an operation of real profit, although it may be conducted so that there shall be some pecuniary return. Before entering upon the description of some of the principal plans, it may not be amiss to add a word as to the value of this waste material. The value of the annual voidings of an average individual is, by competent authority, estimated at from \$1.61 to \$2.01. The value assigned to "average" sewage by the English Rivers Pollution Commission is per 100 tons \$4.10, or about 4 cents per ton. Then sewage of London, for example, is estimated to amount to 260,000,000 tons annually, which, considered as worth only two cents a ton, aggregates \$5,000,000; that of New York would be worth close upon \$2,000,000.

THE LIME PROCESS

consists in mixing the sewage with a certain proportion of milk or cream of lime, agitating the mixture violently and then allowing it to subside. There settles from the mixture a copious precipitate of a highly putrescible mud, while the liquid flows off in a tolerably clear condition. As far as purifying the sewage is concerned, the process is a failure. The suspended matter removed are also found to contain only about one tenth of the valuable constituents; so that, as a manure, the product is of no special merit. The drying of the mud is a very offensive operation. Practised in England, the manure only brought 1s. per ton, and sold sparingly. This sum was about one third its cost of production.

BLYTH'S PROCESS

consists in attempts to recover the ammonia from the sewage. Superphosphate of lime and a salt of magnesia are added, under the supposition that an insoluble phosphate of magnesia and ammonia will be thrown down. Unfortunately, however, this compound is only insoluble in the presence of an excess of ammonia; and, moreover, analyses show that a third part of the phosphoric acid added is left in the solution, proving absolute loss. The English Sewage Commission consider this the worst and most costly plan yet proposed.

HOLDEN'S PROCESS

is a patented operation, and consists in mixing the sewage with sulphate of iron, lime, and coal dust. It not only fails to remove the putrescible organic matters in solution, but actually augments their quantity. An analysis of the air dried mud showed the presence of only .3 per cent phosphoric acid, .004 per cent ammonia, and .0555 per cent of organic nitrogen; so that, as a manure, it is practically worthless.

THE A B C PROCESS

we fully described in a recent issue of our Journal. It derives its name from its essential ingredients, alum, blood, clay, and charcoal, which are mixed with water and run into the sewage in a continuous stream. The good results obtained by its use we have already fully detailed.

THE PHOSPHATE PROCESS

is founded on the fact that certain mineral phosphates, especially those containing alumina, when in a hydrated or freshly precipitated state, eagerly combine with the organic matter contained in the sewage, it being sufficient merely to agitate them in the most fetid sewage to deprive it of all its odor and color, even if tinctorial substances of great intensity be present in the solution at the same time; while the phosphate of magnesia combines with the ammonia contained in the sewage, and precipitates it also in the state of the double phosphate of ammonia and magnesia. The process delays putrefaction in the effluent water, but the amount of ammonia carried down by the precipitate is found to be practically

nothing. The manure is of course valuable on account of the proportion of the phosphate used in its manufacture; but it is hardly probable that it could be made the source of extended profit.

MORFIT'S PROCESS

replaces the natural phosphate of alumina by a new artificial material, which is in fact a waste product at present, being the "mother water" as eliminated by the processes of the inventor for the precipitation of pure phosphates of lime from hydrochloric solutions of mineral phosphates of lime. In his recent work on chemical fertilizers, Dr. Morfit says that the precipitate forms a superior special manure for clay soils, and devotes an entire chapter to detailed descriptions of methods for its utilization.

The Largest Railroad Shops in the World.

Located in Cheshire, one of the midland counties of England, and situated on the London and North Western Railway, some five sixths of the distance between the metropolis and Liverpool, is Crewe, a small and insignificant town by itself, but a city of no mean importance when considered in connection with the vast works which it contains. The establishment which supports, and, in fact, forms the town, the population and extent of which is about half that of Worcester, Mass., was originally laid down by George and Robert Stephenson, and is known as the Crewe Works, or, as it would be termed in this country, the shops, of the London and North Western Railway. Here no less than six thousand hands are employed, building or rebuilding the two thousand locomotives used upon this longest of English railways, or working upon the two hundred and twenty engines which, it is calculated, are always at the works for repairs.

A correspondent of the *Boston Journal of Commerce* has recently visited this great factory, and, from the graphic letter which he writes, we extract the following interesting particulars: He says that a most extraordinary variety of especial tools is employed, among others several testing machines for trying the strength of materials used. Samples of every variety of material, and especially the boiler iron and steel, are submitted to these machines. For the proving of the iron for axles, there was a little machine in which a sample was submitted to a rapid series of torsional strains till it broke, the number of these, registered by a counter, being an index of the character of the iron. As an illustration of the attention to the smaller details of expense, a cleaning machine was running in the brass shops, consisting of an endless belt studded with small magnets, which, passing through the mass of filings in an inclined trough, thoroughly cleaned them of all fragments of iron. A large number of milling machines were in use for smaller work, especially such as finishing the heads of nuts and bolts, and many small bench shaping and slotting machines were running as many as 160 strokes per minute; engaged in a similar work, by using cheap labor (boys of twelve), the latter could compete with the former. Among other larger machines was one for grinding large plane surfaces, such as base and frame plates and side plates of tenders, instead of planing them, the work moving in a trough containing water, and the whole arrangement being quite on the plan of a Daniells planer. Much smaller flat work was finished by grinding in machines arranged to produce a level surface by self-operating attachments.

Perhaps the most remarkable thing in this part of the works was the huge lathe room, more than two hundred feet long, and filled with a double row of driving wheel lathes. Many of these were of eight feet swing, and of the heaviest description, carrying four cutters at once. A remarkable machine, near these, was a milling tool for milling out the inside cranks. All the engines have inside connections, the axles are forged solid and milled, instead of being turned out. The cutter of this machine was four feet in diameter and about five inches fall. There were here many other peculiar tools, such as a machine milling two key ways, exactly at right angles, at once, in the two ends of a locomotive axle. Also a wheel rimming machine, and another for slotting out in a proper curved form, the inside rims of locomotive wheels between the spokes.

A new process for making steel tires is here employed. The steel is cast in the form of truncated cones, the smaller end to form the outside of the tire. While still hot it is introduced to the horizontal steam hammers. These consist of a couple of enormous masses of iron, each running on a little track, and moved back and forth, by means of piston and rod, by a large steam cylinder behind each, the steam valves of each of which cylinders are operated by a common lever. By passing through two sets of these hammers, the steel is thoroughly worked up, and leaves them in the form of a thick disk. Carried from these, it passes to an upright hammer, with a sharp conical end to the striking part. This soon forces a hole through the disk, which, being turned round and round, and over and over, becomes a thick ring. Again heated, it goes to another hammer. This hammer has a very heavy anvil, with a peculiar slope to one side, from which projects a stiff horn. Upon this horn the ring is hung. The face of the striking part is formed to the slope of the rim and flange of the wheel, and as the workmen manipulate the wheel under its blows, slipping one portion after another of the rim up to receive the stroke, the whole tire gradually expands to the requisite diameter, and is ready to be turned on the inside and driven on to its wheel.

These details were noticed in but a small portion of the vast factory, but serve to give an idea of the completeness and magnitude of its construction and fittings.

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.

BEE PROTECTOR.

The ingenious inventor of this device, before putting his ideas into practical shape, doubtless became convinced of the immutable truth of these facts: First, the busy bee improves only "shining hours," and gathers honey from opening flowers only by day; second, the bee moth has a predilection for stealing honey under cover of the night; and, third, chickens retire to their roosts at twilight, and are aroused by the "shrill clarions" of the masculine portion of their population at an excessively early matutinal hour. To utilize these propositions to compass the desired end, was the problem: how it has been solved, we proceed to show. The bees are expected to enter their domiciles a little before dark. After they are all in, the period for the roosting of the chickens arrives. The latter, alighting on their perches, operate machinery which closes the hive gates and shuts the bees in. The bee moth, on attempting his burglarious operation, finds himself barred out, and as the mechanism of the device is beyond his comprehension, it is to be inferred that he retires in disgust. Meanwhile the chickens repose until the early village cock proclaims the morn, when they abandon their perches to resume their geological investigations into the surface of the adjacent soil, and thus return the bees, their honey all safe, to the airs of heaven and flowers of earth. For the benefit of all who may be interested in this strikingly novel application of the force of gravity through the medium of chickens, we append the following detailed description of the mechanism, a patent on which was granted June 28, 1870, to Jeremiah Cory, of Holden, Mo.:

A is a horizontal rock shaft, secured in suitable bearings and provided with three arms, B, C, and D. The arm, B, within the house supports a vertical sliding post which is held in guides, and bears the perches. The arm, C, carries an adjustable weight, sufficiently heavy to overbalance the post and keep it elevated when the roosts are unoccupied. The upright arm, D, is connected as shown by the dotted line with the rods, E E, attached to the gates of the hives. Suitable weights, F, are arranged in connection with the rods, E, so as to hold the gates open.

As the fowls mount upon the roost their weight depresses the post, and it, in turn, presses down the arm, B, and thereby rocks shaft, B, and its arm, D. The latter, operating the rods, E, closes all the hives. As soon as the roost is vacated, the weights bring the parts to their original positions. The advantages claimed are the regularity and certainty with which the hives will be closed and opened, and the fact that any number of hives may be connected with the device and simultaneously operated.

BREWSTER'S PATENT COMBINATION TALLOW CUP.

The object of the invention herewith illustrated is a steady

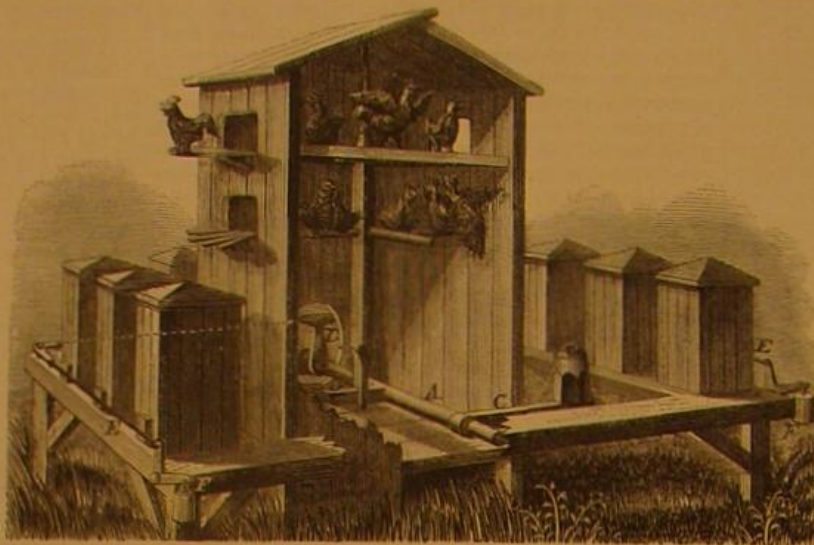


or continuous lubrication of the cylinder and slide valves of a steam engine, thus preventing all wear of the working parts and economizing power without the usual waste of lubricating material. It consists in a combination tallow cup, and is claimed to be equally well adapted to marine, stationary, and locomotive engines, and also to have afforded results in every way satisfactory, during the period in which it has been in use.

In the sectional view annexed, A is the main reservoir and B an auxiliary reservoir or charger, containing one tenth the quantity of material that the former receptacle is capable of holding. C is the main valve connecting directly with the cylinder, and D is a secondary valve closing communication with the reservoirs, A and B. These valves are operated by the handle, E. F is the feeding valve, closed when the main valve, C, is opened and actuated by the wheel, G, serving to regulate the openings, H, in the stem, I. J is the inlet fun-

nel with valve-seated plug. The main valve, C, being closed by means of the handle, E, the plug, J, is unscrewed, and the reservoir, A, is filled with tallow to the openings, H, when the plug is replaced and the valve, F, is closed. By opening the valve, C, and closing D, the tallow in the charger, B, is allowed to pass into the cylinder, when the valves are brought back into position. Nothing further is required until the supply of tallow thus afforded is exhausted, when the same operation is repeated and the contents of the charger again allowed to escape.

To render the action of the apparatus continuous, the valve, F, is opened, when the steam, passing up through the stem, I, into the reservoir, A, condenses and falls to the bot-



BEE PROTECTOR.

tom, raising the tallow to a level with the openings, H, from which it is sucked into the cylinder by every stroke of the piston as long as the supply of tallow remains. The reservoir is left filled with distilled water, which is let through the cylinder after stopping the engine, by removing the plug, J, and opening valves C and D. In case of any foreign substance entering the reservoir, it may be blown out while the engine is in motion by allowing the steam to rush through the plug funnel.

Among the other advantages claimed may be noted strength and cleanliness, together with beauty and simplicity of construction; it is also stated that the device is steam-tight, precluding leakage, and thus dispenses with the usual means employed to absorb the waste. It may be used as an injector at stated intervals or, by arranging the valves as above described, as a self feeder, as desired. The cup requires filling but once a day, feeds regularly, has no cocks or similar mechanism to get out of order, and is economical in its expenditure of lubricant.

The manufacturers state that it has elicited favorable testimonials from many leading engineers and master mechanics, and that its efficiency has been, in every respect, demonstrated. For further particulars address Messrs. Davis & DuBois, southwest corner Leopard and Otter streets, Philadelphia, Pa.

SOLDERING TOOL.

Mr. John C. Tauber, of Ridgeville, Ind., proposes to do away with the present rather inconvenient method of handling a stick of solder and the heated iron, by the use of the device illustrated herewith, for which he has recently ob-



tained a patent. It consists in a metallic vessel, in the form of an inverted cone having a minute aperture at the bottom. It is provided with a flanged rim and socket to receive a handle; and around its lower part is placed an annular bowl or trough. The conical vessel is filled with solder and flux, and the trough, with cotton cloth or wick saturated with kerosene. The latter, being ignited, melts the solder, which, flowing from the hole, can be distributed uniformly upon the work, in greater or less quantities, as may be desired.

BOYNTON'S REVOLVING EVAPORATOR.

The invention represented in the accompanying engraving is a portable revolving evaporator, by means of which it is claimed that fruit, vegetables, meat, fish, and similar perishable substances can be dried, each forming an excellent preserve which, while compact in bulk, retains all the value of the fresh product and can be kept and transported in any climate.

The material to be treated is spread upon the shelves of netted wire shown in the foreground of the illustration. A number of these when filled are placed upon the projecting rails, A, which line the sides of the eight compartments into

which the rotary portion, B, of the apparatus is divided. No air passes through these chambers entering from the pipes C and D, in the manner hereafter to be described.

The hollow fixed base, E, and also the similar upper portion, F, are, by radiating partitions, divided into inclosed sectors to correspond and coincide with the compartments in the rotating part above and below. All of these partitions, with the exception of those which form, as it were, the prolongation of the walls of one chamber, are provided with apertures, as shown in section at G. The solid partitions just alluded to are securely packed with felt, so that when, by the rotation of the revolving portion, B, any one compartment is turned so that its walls correspond with them, such compartment is completely cut off from all communication with the rest of the device, and hence from any supply of heated air. The object of this is to enable each chamber to be filled in succession without allowing of the escape of the heat during the operation. From this it will be observed that, of the eight compartments, one is always ready for filling, and consequently the evaporating process is restricted to the remaining seven.

Let it be supposed that a chamber has received its supply when in the position, H, and that the machine has been revolved to the right, and the compartment opened as shown. The heated air then enters from below by the pipe, C, passes in the direction of the arrow up through the material on the shelves, thence through the orifice, G, down through the next chamber, thence under the right hand wall of the latter through the perforated partition, up again through the following compartment, and finally makes its exit through the conduit, I. In the remaining four compartments the heated air proceeds down from the pipe, D, through the first division, up through the second, and so on through all the chambers, at last escaping through the chimney, J.

When the material is over the pipe, C, it is acted upon by air heated to 220°; when under the pipe, D, the temperature is 180°; and in the last compartment from which it is finally withdrawn, the heat is 120°. The windows shown in the covers of the chambers afford admission to the shelves for examination; and at any time the rotary portion can be set in motion, carrying any desired compartment to the filling door.

It is hardly necessary to point out the advantages of this device for preparing vegetables and articles of similar nature for transportation or for naval and military purposes. The inventor states that, during the past year, apples, peaches, pears, strawberries, raspberries, grapes, potatoes, corn, and, in fact, almost every variety of fruit and vegetable, have been successfully treated, producing preserves equal to the best canned articles. For fruit growers, who during the coming season may suffer through overstocked markets, an excellent means of utilizing their produce, which might otherwise prove a total loss, is here afforded. The apparatus can be seen in operation and in all its various sizes at the factory of the Vineland Dehydrating Company, Vineland, N. J., or further particulars may be obtained from the manufacturers, Messrs. C. A. Boynton & Co., at same address. Patented April 23, 1872.



ther particulars may be obtained from the manufacturers, Messrs. C. A. Boynton & Co., at same address. Patented April 23, 1872.

PUTTING SCREWS IN PLASTER WALLS.—It often becomes desirable to insert screws in plaster walls, without attaching them to any woodwork; but when we turn them in, the plaster gives way and our effort is vain. And yet a screw may be inserted in plaster, so as to hold light pictures, etc., very firmly. The best plan is to enlarge the hole to about twice the diameter of the screw, fill it with plaster of Paris, such as is used for fastening the tops of lamps, etc., and bed the screw in the soft plaster. When the plaster has set, the screw will be held very strongly.

Robert Marsden Latham, Secretary of the Inventors' Institute of London, and editor of the *Scientific and Literary Review*, died recently at Hampstead, England, at 38.

PARLOR AQUARIUM AND FOUNTAIN.

That there are no ornaments so beautiful as those formed by the hand of Nature, is a fact which is becoming generally recognized in the decoration of our dwellings. Rustic baskets, filled with gracefully trailing plants, vases of growing flowers, clinging vines allowed to run in unkempt profusion over windows and doorways, are now among the most admired embellishments even of the stateliest saloon or drawing room. Not only is growing vegetable life in its ever changing form thus employed in the beautification of modern homes, but, beside, animal and insect existence is called in to aid in the general adornment. A foreign cotemporary recently published an engraving of an insectarium, consisting of a Wardian case of glass, inclosing a number of growing plants, among the verdure of which were represented gorgeously hued butterflies, which, placed in the receptacle, were kept alive and nourished by the growing vegetation.

Our engraving illustrates a very tasteful parlor aquarium, made of cast iron and bronzed. The design is taken from the catalogue of the Jordan L. Mott Iron Works, of 90 Beekman street, in this city, from which work we recently made other selections of ornamental objects in metal. The height of the stand is 57 inches, and its diameter 34 inches. Above is an octagonal glass-sided vessel for the reception of the aquarium, in the middle of which is arranged a miniature fountain, and around the corners are placed vases for living plants.

The constant inflow from the fountain will keep the water always fresh and pure, though, even if the latter be not always in operation, the sanitary condition of the finny inhabitants can be maintained by a suitable selection of aquatic plants, placed in the bottom of the vessel. To prepare an aquarium of this kind, about an inch of clean sand should first be put in, and above that a light layer of gravel; then a few stones, bits of coral, shells, or clean cinders, may be built up in miniature grottoes or other pleasing forms, which will serve as shelters for the fish and add to the beauty of the ornament. Fresh water plants, suitable for planting in the bottom, may readily be obtained from any country brook. Eel grass, water weed, arrow head, frog's bit, duck weed, are all well adapted for the purpose. After setting out water is poured in, and the aquarium left for a week for the plants to vegetate. To absorb the fungous and mucous growths, fresh water snails are added, and afterwards the fishes are put in by degrees, care being taken to maintain the due balance of animal and vegetable life. A day's ramble, near a brook, will be sufficient to obtain a multitude of both animals and plants. Newts, tadpoles, sticklebacks, small sun fish, water beetles, minnows, one or two frogs, and may be a turtle, will thrive in a receptacle of this kind, and form an endless fund of amusement and instruction to lovers of natural history. The temperature of the aquarium should not rise above 70° Fah., nor fall below 50°. In hot summer days a screen should be used to cut off the sun light.

A Wonderful Model.

An elaborate model of a harbor, ordered by the Senate of Hamburg to be constructed for the Vienna exhibition, has been completed in due course. The model is 17 feet by 6 feet in dimensions, and it exhibits the ships moored to the wharves, and the laborers employed in their different occupations. On the side of the dock is a railway with a freight train to receive goods from the ships. The vessels are of all sizes, from the huge steamer down to the smallest yawl. The whole represents, with pleasing accuracy, the busy life of a sea port.

Dyeing Aniline Green on Wool.

This dye, unlike the majority of aniline colors, has but a feeble affinity for wool. When this fiber is dyed in a green bath without previous preparation, but a very slight amount of the color is fixed. Some manufacturers have proposed to employ for this color the alkaline process, which gives such excellent results for blues, but it is with greens less certainly successful. The author's process is to prepare the wool in a bath containing a solution of hyposulphite of soda mixed with an acid or an acid salt. The sulphur suspended in the water becomes fixed in the wool, and enables it to attract the aniline green. It is advisable to add to the mordanting bath a small quantity of alum, or of a salt of zinc, the presence of which prevents the "tendering" of the wool. It is singular to see the action which the sulphur of the hyposulphites exerts upon this fiber. It becomes soft, loses its elas-

ticity, and contracts considerably. This depends evidently on the penetration into the capillary tubes of the wool, of that soft and viscid sulphur which is liberated from the hyposulphites. The singular property which sulphur in this state possesses of acting as a mordant for aniline green is not common to sulphur in all its modifications. Thus the solution of flowers of sulphur in the sulphide of carbon leaves wool completely incapable of attracting the dye. The same rule holds good, though to a less extent, with the polysulphides, which in all probability generally contain traces of hyposulphite. The mordant for aniline green is the insoluble electro-positive sulphur, as proved by the following experiment: When a sample of wool mordanted with hyposulphite is exhausted with sulphide of carbon, it loses nothing of its

it appears that the green does not "work on" sufficiently, a little acetate of soda may be added. With the aid of these two salts the dyer can produce blue or yellow shades of green at his pleasure, and can make use of his bath for an indefinite length of time. This procedure applies equally well to mixed goods of wool and cotton. After the wool is mordanted as above, the pieces are washed in sumach for an hour or more. The dyeing is then conducted in the ordinary manner, beginning at a low temperature. Or the wool may be dyed first, and the goods may then be sumached, and the cotton dyed in a cold color bath.—*Chemical News*.

Metal Casting under Compression.

By Smith & Locke, of Boston, Mass.—The patterns are first brushed over with a mixture of olive oil and paraffin, after which they are coated with a slip composed of clay and fine sand. They are then placed in a flask which is filled in with a mixture of terra cotta (the old molds ground to powder) and clay. The flask is then placed under a powerful press, and submitted to a pressure of 400 lbs. per square inch, the mold thereby becoming condensed. From the press the molds are taken to a furnace, where they are hardened, and when ready they are placed in a casting chamber, to the number of ten or twelve at one time. The chamber is then tightly fastened, and the molten metal is forced into it, becoming distributed among the molds, and entering into the most delicate tracery of the patterns. The metal is injected through a cylinder attached to one end of the casting chamber, in which a piston is fitted, the cylinder being lined at each operation with a non-conducting substance, which prevents refractory metal from becoming chilled or adhering to the cylinder, and at the same time serves as a packing for the cylinder. The end of the cylinder next the mold chamber is fitted with a clay heading, to which is a gate stopped by a movable plug, and opening into the chamber. The molten metal having been run into the cylinder the piston is screwed up, slowly at first and afterwards quickly, when the plug is forced forward into the chamber, the metal following it, and running into the molds under considerable pressure, which is maintained until such time as the metal has set.

The above description is from *Engineering*. Mr. Smith is now in England engaged in the development of the improvement. The process has been in operation at Somerville, near Boston, since the 1st of May, 1869, where Mr. Smith has produced round as well as flat castings, such as ornamental columns. He has also cast monumental tablets 7 feet 6 inches high by 3 feet 6 inches wide, and one quarter inch thick, notably one to the memory of 400 soldiers, whose names were all cast on it. The process is both ingenious and successful, and is capable of a wide range of application in the arts and manufactures.

Paper in the Boston Fire.

Curious results followed some of the experiments made upon charred papers and documents, and the examination of books in safes which proved worthless in the great fire. It was found that what paper makers call poor paper, paper considerably "clayed," stood the test best. Parchment paper, used for bonds and legal documents, shriveled up exceedingly, and the print blistered so that it could be read when writing was illegible. So it was with the engraved work on notes. The gilding, on the account books burned and charred, showed out as bright and clear as when the books were new, which brings up the question if to introduce gilt-edged account books would not be well, on the ground that the gilt would stay the passage of fire to the pages within. Books crammed into a safe, so that it was difficult to get them out, suffered considerably less than those that were set in loosely, and in some cases came out from safes, in which every thing else was worthless, so far preserved that the figures on their pages could be deciphered. With charred papers, which could not be made transparent by any light whatever used, it was found, after the employment of vitriol, oxalic acid, chalk, glycerin, and other things, that any thing that moistened them to a certain stage—to which it was delicate work to get and not to pass—made the lines, words, and figures legible through a magnifying glass. It has been the almost universal experience that lead pencil marks show out all right where ink marks cannot be distinguished. The success of the use of photography has already been noted.—*Boston Advertiser*.



PARLOR AQUARIUM AND FOUNTAIN.

power of attracting and fixing aniline green; while another portion of wool saturated with the bisulphide of carbon which has served to extract the former, and which has been subsequently concentrated by distillation, takes up the color no better than does unprepared wool. If the operation is carefully conducted, taking suitable proportions of hyposulphite, and of alum, or zinc salt and acid, success is certain, and the wool is uninjured. It is scarcely needful to add that the wool must be previously cleansed from grease, and freed from all metallic contaminations, by passing it through very weak hydrochloric acid. If this is neglected the shade may be saddened by the formation of metallic sulphides upon the fiber. The actual dyeing is performed in a solution of the green in hot water, raising the temperature to close upon 100° C. If yellowish greens are desired it is necessary to add to the bath some picric acid, and a salt capable of raising this coloring matter, which will only dye in presence of an acid. As, on the other part, the green does not dye in presence of acids, a difficulty presents itself. This is overcome by the use of the acetate of zinc. This salt attracts the picric acid without injuring the green dyeing. If

Recent American and Foreign Patents.

Improved Rotary Steam Engine.

William Crain, New York city.—This invention has for its object to furnish an improved rotary steam engine, which shall be so constructed as to relieve the shaft from all side pressure, and thus diminish the friction and the consequent wear. The cylinder is made elliptical in form, and to its ends are secured the heads in the ordinary manner. To the shaft within the cylinder is secured a cylindrical drum of such a size as to revolve in the said cylinder, a space being left upon the opposite sides of the drum for the steam. In the opposite sides of the drum are formed deep longitudinal grooves to receive the valves, upon the inner part of the end edges of which are formed pivots, which enter elliptical guide grooves formed in the inner surfaces of the heads, which are so formed as to hold the outer edges of the pistons out close against the inner surface of the cylinder. Two inlet ports are used, formed in the opposite sides of the cylinder and provided with slide valves. Said valves may move together, being connected by a yoke with which is connected one end of a lever, which is pivoted to a bracket attached to the cylinder head. The inner end of the lever projects into such a position as to rest upon a cam wheel attached to the shaft against which it is held by a spring. By this construction the steam will be received upon the opposite sides of the cylinder, so as to balance the engine and prevent side pressure.

Improved Doll Joint.

Joel A. H. Ellis, Springfield, Vt., assignor to the Cooperative Manufacturing Company, of same place.—This invention relates to the manufacture of dolls, and to the class of dolls which are usually made of wood, with joints for the legs and arms; and it consists in the manner of forming the joints and securing the requisite friction thereto. A slot and tenon are fastened together by the pivot pin. The tenon is divided by a saw kerf. The double tenon is designed to fit the slot a little full, and be sprung together slightly, when the tenon enters the slot, thus producing the requisite friction, and preventing any binding or looseness by the shrinking and swelling of the wood at any time. The shoulder piece is cut or slit at right angles, and fitted into a round socket having a groove to receive a pin, so that the arm will be securely held, while it will freely revolve. The socket is a little smaller at the back end, so that the shoulder piece is compressed, as represented, which secures at this point the required degree of friction. The arm is attached to the shoulder piece in the manner already described.

Improved Mail Bag.

Thomas J. Hardaway, Macon, Ga.—This invention is an improvement in the class of mail bags provided at the mouth with hinged bars or plates adapted to be locked together. Four bars are hinged together so as to form a rectangular and nearly square opening, and a locking piece is attached to one of the bars near the joint. The said piece may be conveniently used as a handle for opening and closing the bag. When adjusted for locking it covers the contiguous and middle joint of the hinged bars, and thus imparts a strength and rigidity highly necessary to security of the contents of the bag. The piece is also adapted by its position to receive a label relating to contents, destination, etc., of the bag.

Improved Detachable Boot and Shoe Tip.

Michael R. Hanley, Providence, R. I.—The object of this invention is to so construct a metallic tip that it can be applied not only to shoes or boots in process of manufacture, but to those already completed or in use; and it consists in a tip having lips or teeth turned inward from its lower edge, and hook pins at each end.

DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

REFRIGERATOR PATENT.—GEO. C. ROBERTS vs. WM. F. RYER. BLANCHFORD, Judge.

This suit is brought on rehearing letters patent, granted April 21, 1857, to D. W. C. Sanford, for an "improvement in refrigerators," the original patent having been granted to Sanford as inventor, November 13, 1855, and the patent, as rehearing, having been extended October 23, 1869, for seven years from the 13th of November, 1869.

It is apparent, from the language of the specification of the original patent, that Sanford, when he applied for his original patent, believed that he was the first inventor of any arrangement in a refrigerator whereby there was effected a complete and constant rotation, purification, desiccation, and refrigeration of the whole of the contained air of a closed refrigerator. He, therefore, claimed, in that specification, the use, in a closed refrigerator, of an endless passage, furnished with walls, shelves, and ice receptacle, so placed and constructed as to compel the perpetual rotation or circulation, throughout the entire apartment or apartments, of the whole of the air contained therein, with the provision described for the discharge of the water of the melting ice, the whole being constructed as set forth.

The defendant has a refrigerating room which he uses in his business as a butcher, and which is alleged to infringe the plaintiff's patent. The room is eight feet three inches long, six feet two inches wide, and six feet high. The ice box, at one side and in one corner, elevated, is five feet ten and a half inches long, the lower side of the room, three feet six and a half inches high, and two feet six and a half inches wide. On the two sides of this ice box which are toward the room, there is a space between the top of each of such sides and the ceiling of the room, of eight inches in height and the length of such two sides, for the ingress of the air of the room into the ice box. A door from without opens into the ice box, by which to put ice in. Another door opens into the room from without. The ice in the ice box rests on a wooden rack on its bottom, which affords a free passage for air. Below the rack is a cold air chamber, the roof of which is the bottom of the rack, and the bottom of which is formed by two inclines, which slope downward and toward each other, and toward a center line midway of the width of the ice box, so as to leave a central opening, five feet eight inches long and two and a quarter inches wide, through which the cold air finds its way downward. The water from the melted ice falls on these inclines, and runs down them and through this central opening, where it is caught by a trough five feet ten inches long and six and a half inches wide, and set three and a half inches below such central opening. This trough is one foot eight inches above the floor of the room. There are no shelves below the central opening, but there is a rack on the floor, on which meat is placed. The water from the trough is conducted, by a pipe, out of the room. The room has been used in this way for more than nine years.

There can be no doubt, that the defendant's refrigerating room contains, in combination, the three elements which are found in combination, as before explained, in the first claim of the plaintiff's patent, and that it also contains, in combination, the three elements which are found in combination, as before explained, in the second claim of the plaintiff's patent. The heat given out by articles placed in the room warms the air, which then ascends, and passes over the tops of the sides of the ice box, and thus around the partition, and into contact with the ice, and is thus cooled, and dried, and purified, and descends through the open bottom of the ice box, and then through the central opening, and, descending further, according to the law governing the action of cooler air, displaces the warmer air, and pushes such warmer air before it, and upward, around the partition, and so a rotation or circulation of the contained air in the closed room is established, which goes on so long as any part of the contained air is warmer than any other part of it. The cooled air can fall directly down upon such articles as are placed under the central opening, without being interfered with by, and without interfering with, the disposition of the water from the melted ice, and such water is carried off and not allowed to drip into the room. The modes of operation of the combinations found in the defendant's room, are the same as the modes of operation of the like combinations found in the claims of the plaintiff's patent.

The defense principally relied on in this case is, that, as to both of the combinations in the claims of the plaintiff's patent, he was anticipated by Azei S. Lyman, in inventions and structures previously made by Lyman, and that the defendant, in using a refrigerating room constructed and operating as above described, has done no more than he was fully instructed to do by such structures of Lyman.

The earliest date sought to be assigned to Sanford's invention is the summer of 1855.

It is in evidence that Lyman, on the 29th of August, 1852, filed, in the Patent Office, a caveat for "improvements in railroad freight cars, for transporting fresh meats, and other articles, which require a very low temperature, and pure air." Such caveat contains a description, and drawings referred to therein. The object of the arrangement is stated, in the caveat, to be to transport dressed meats. The walls, sides, and top of the car are made double, and filled in with a bad conducting material, the car is closed, and the air in it is reduced in temperature by passing it, in rotation and circulation, through ice, or other cooling material, contained in a box in the car, or through tubes immersed therein. A fan driven by a cord from the axle of the car drives the air down through the cooler. After the air leaves the bottom of the cooler, it passes through a box containing disinfesting material. The air is stated, in the caveat, to be preserved cool, pure, and dry by being passed frequently through the cooler and the disinfesting material, so as to keep the meats from putrefying, the moisture from the meats being deposited on the cold surface, and floating down and off, by a tube, to the outside of the car. The caveat states that Lyman proposes to claim the providing for a constant circulation of air from the car, through the cooler, and through the disinfesting box, back into the car, by means of a fan, or some other similar mechanical arrangement; the drying of the air, by the precipitation and condensation of the water held by it in the same process; and the construction of a cooling house, or refrigerator, in the manner above described, except that there would be other arrangements for driving the fan.

Between the date of this caveat and the year 1855, Lyman constructed, and put into successful operation, refrigerating cars and stationary refrigerators, embodying the principle set forth in such caveat, and constructed

substantially on the plan therein stated, the cars being arranged with fans, to assist in the circulation of air, and the stationary refrigerators having no fans, but depending for such circulation on the law governing the movements of cooler and warmer air, free to communicate with each other through an ice box open above and below. All these structures embodied the combinations and modes of operation before stated as found, in common, in the defendant's refrigerating room and in the plaintiff's structure. In April and May, 1854, Lyman caused to be constructed for one Tilton, a closed refrigerator, which was put in use by him in Franklin market, New York, during the summer of 1854, and was used by Tilton there for several years afterward. It embodied the same principles of construction and mode of operation as the Syracuse refrigerator. It had a descending conduit five or six inches wide and about three and a half feet long, and the lower end of which was about sixteen inches above the floor. It was used to preserve poultry, which was placed on three shelves. One of the shelves extended under the conduit. This refrigerator stood in the open market for several years after the summer of 1854. Lyman personally showed it to a great many persons, and explained its internal arrangements, and its principle and mode of operation.

In the summer of 1854, Lyman used to be built nine closed refrigerators, for domestic use, which were like the Syracuse refrigerator in construction and mode of operation, except that they had no shelf below the cold air opening, but had a space or chamber there for articles to be refrigerated. These refrigerators were built at Mount Vernon, Westchester county, N. Y. Lyman used one of them in his family, for a dozen years or more from and after July, 1854. Some of the others were sent to New York and disposed of to various persons, and some were used in Mount Vernon.

Between 1852 and 1855 at the Novelty Iron Works, in the city of New York, according to plans furnished by Lyman. In some of them the conduit extended down only one and one half inch below the cold air chamber under the ice grate, and in others it extended down to within twelve or sixteen inches of the floor of the refrigerator. These refrigerators were delivered to various parties for whom they were made. Of the above number, eight or ten were constructed at such works during the year 1854, and one of those, made there by one Hadden, for his own use, is still in existence, and has been put in evidence and produced for the inspection of the Court. This refrigerator was used by Hadden in his family for four or five years. It is what is claimed in the plaintiff's patent, and is the same as the defendant's, except that it has no shelf below the cold air opening. In using it, however, Hadden placed on the floor, in and under the descending current of cold air, articles which he desired to keep the coldest.

On the 1st of September, 1854, Lyman filed, in the Patent Office, an application for a patent for an "improved mode of cooling, drying, and disinfesting air for ventilators and refrigerators."

The drawings represent a refrigerator constructed substantially like the Syracuse refrigerator, and the Hadden refrigerator before mentioned. There is nothing in the patent of 1854, to Lyman, that is not found fully developed in his application of September, 1854. In view of that application, the patent to Sanford, of November, 1855, ought not to have been granted. Lyman's application contained everything claimed by Sanford in his patent. The evidence shows that Lyman was the first inventor, as between him and Sanford, of what is claimed in Lyman's application of 1854. It is what is claimed in Sanford's patent of 1855, and of what is claimed in Lyman's patent of 1854.

So, too, everything that is claimed in the claims of Sanford's reissue of 1857, as those claims have been heretofore explained, is found in Lyman's application of 1854.

The conclusion which I have arrived at, after a careful consideration of all the evidence and of the argument of counsel, is that the Sanford reissue is void for want of novelty.

As to the questions made respecting the want of notice, in the answer, as to some matters put in evidence, I think, that, in any view, the case is a proper one to allow the amendments to the answer, which were moved for at the hearing, on notice given *pro tunc*, as of the time the answer was filed. The bill is dismissed, with costs.

Barrett & Bedford and Thomas A. Jencks for complainant.
F. A. Betts, J. Gutman, Jr., and J. N. Piper for defendant.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From May 16 to May 29, 1873, inclusive.
AIR MOTOR.—H. Bushnell et al., New Haven, Conn.
ANCHOR.—C. A. Chamberlin, Pittsburgh, Pa.
BALE FARTENING.—E. J. Beard, St. Louis, Mo.
BANDSAW MACHINE.—D. B. Whitney, Winchendon, Mass.
BOOTS, ETC.—T. Tucker, Oakland, Cal.
CARRIAGE WHEEL.—N. G. Old (of Fort Wayne, Ind.), London, Eng.
CLOTHES WRENGER.—C. E. Haynes, Boston, Mass.
ENGINE, ETC.—R. Elckemeyer, Yonkers, N. Y.
GENERATING STEAM.—J. H. Mills, Boston, Mass.
HARVESTER.—J. F. Gordon, Rochester, N. Y.
HOSE PIPE.—T. A. Dodge, Cambridge, Mass.
LIFE RAFT.—S. W. Torrey (of New York city), London, Eng.
MAKING GAS, ETC.—W. H. Spencer, New York city.
OIL BURNING STOVE.—L. E. Truesdell, Warren, Mass.
PRESERVING MEAT, ETC.—G. W. Scollay (of St. Louis, Mo.), New York city.
PURIFYING GAS, ETC.—E. Kavanagh, Peabody, Mass.
RAILWAY BARS, ETC.—J. Henderson, New York city.
SEWING MACHINE.—W. P. Brock, Philadelphia, Pa.
SPEED INDICATOR.—J. W. Osborne, Washington, D. C.
STUFFING BOX PACKING.—J. Glanding et al., Philadelphia, Pa.
UNITING METAL BANDS, ETC.—C. G. Johnson, New Orleans, La.
VAPOR OF CARBON.—W. Wells, Salem, Mass.
VEHICLE WHEEL.—A. L. Blackman, Cross Plains, Tenn.

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. Larger inventions are found to pay correspondingly well. The names of Blackard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Rice, 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.

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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, New York, 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.

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Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate. Address MUNN & Co., stating particulars.

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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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Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is \$10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

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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.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, for full particulars.

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A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

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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, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

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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 the former, 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.

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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, N. Y., who will give prompt attention to the business and furnish full instruction.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office \$1.

A copy of the claims of any patent issued since 1836 will be furnished for \$1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent. Address MUNN & Co., Patent Solicitors, 37 Park Row, New York city.

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an honest opinion. For such consultations, opinions and advice, no charge is made. Write plainly do not use pencil, nor pale ink; be brief.

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V. V. will probably find the directions for silvering glass on p. 150, vol. 21 answer his purpose.—W. D. B.'s query about making soap with bicarbonate of soda is answered by anticipation on p. 259, vol. 25.

J. W. L. asks how to separate the constituent parts of sawdust or wood so as to get the pure cellulose. Answer: "It is scarcely possible," says Professor W. A. Miller, "to obtain cellulose free from ligneous tissue by artificial means, since the incrusting woody matter, when once deposited within its meshes, is retained with great obstinacy; but it is presented in a pure condition in finely carded cotton, in linen, and in the finest kinds of filtering paper; for these sources the chemist usually has recourse when he desires to examine the properties of cellulose. Cellulose or cellulose is dissolved by a solution of oxide of copper in ammonia, from which it is reprecipitated by acids."

R. J. asks: What is best to mix with fire clay for lining a furnace that is partly burnt out, and to stand the fire? 2. What is the best way to take soft solder out of zinc? Answers: 1. In making fire brick, the refractory fire clay is mixed with old firebrick pulverized or with sharp, clean sand and gravel. Such brick will stand an intense heat without fusing. 2. Soft solder melts at a lower temperature than zinc, so that you may be able to remove part of the solder by carefully heating it to a temperature of about 600° Fahr. If you wish to use the sulphate of zinc (white vitriol) for any purpose, or are able to dispose of it, you can dissolve the zinc in dilute sulphuric acid, which only slightly attacks the solder. Hydrochloric or muriatic acid also dissolves zinc, forming chloride of zinc, which has the property of rendering paper hard and waterproof. Nitric acid will dissolve both lead and zinc and leave the tin as a white powder.

W. McN. asks: What set, and what difference of set, if any, should there be between saws cutting pine and those cutting spruce logs? Answer: About one thirty-second of an inch on a side is sufficient for ordinary timber. Generally the same set would be required for both kinds of timber. Some kinds of pine will cut very clean and require but little set in the saw to clear; other pine timber has a very tough fiber. In such, more set would be required. Spruce varies in the same manner in different localities; practical experience is the best guide.—J. E. E.

B. G. asks how to prepare caustic lye from soda ash. Answer: Caustic soda lye for soap making can be prepared from soda ash by the use of quick lime. The soda ash is first dissolved in hot water and to the boiling solution is gradually added thin slaked lime in small quantities, and the boiling continued until a drop of the clear liquid gives no effervescence with a drop of acid. The lime takes the carbonic acid from the soda ash and is itself converted into an insoluble carbonate of lime, which settles to the bottom, so that the clear solution of caustic soda lye can be easily decanted after allowing the solution to stand until cool. The boiling should take place in an iron vessel; for a very pure quality of caustic alkalis silver vessels are employed, as the alkalis attack both glass and porcelain perceptibly when hot and strong.

A. R. asks: 1. What is the Newtonian theory of astronomy? 2. What is the cause of the diurnal motion of the earth on its axis? 3. What is the cause of the annual motion of the earth round the sun? 4. What is gravitation? Answer: 1. That there is a mutual attraction existing between all bodies of the universe, that it is directly proportional to the masses of the bodies, and inversely proportional to the squares of the distances between them; and that the planets were originally impelled by some force, which would cause them to move off in a straight line, unless acted upon by other forces. 2. The original impelling force. 3. The original impelling force, and the attraction of the earth by the sun. 4. We cannot tell. It is something by virtue of which all bodies attract each other, in accordance with the law enunciated above.

W. D. D. asks whether the principle, for multiplying power, of a screw acting upon a lever is in use, and if it is, in what machine? Answer: The principle of multiplying power by means of a screw operating on a lever is very old.

C. D. R. & Co. say: We have a return tubular boiler 18 feet long, with 40 two and a half inch tubes; and would like to know what size and height of stack we should have made to insure a good natural draft. Answer: The data sent are rather insufficient. Probably a round stack, 15 inches in diameter and 50 feet high, would answer.

A. 33 asks: What are the dimensions and best form of a steam engine of about ½ horse power? It should be made portable, and so as to connect the smoke stack with a common chimney. The need of such an engine has long been felt in the dairy regions, for churning, etc. Answer: The boiler should have about 12 square feet of efficient heating surface. The cylinder, with a diameter of 2 inches, should have a piston speed of 75 feet per minute. You will find dimensions and descriptions of small boilers in communications from other correspondents.

A. D. says: In Worcester's "Dictionary" (illustrated edition), there is a picture of a windlass of peculiar form, called a "Chinese crane." Will you give me your opinion whether there is any mechanical advantage in it over a common windlass? A friend of mine, who goes into the mathematics of the question, thinks that he proves that there is none. My faith in the cleverness of the Celestials makes me doubt his conclusions. Will you tell us which is right, he or I? Answer: It has a mechanical advantage over the common windlass, because the ratio of power to weight can be increased to almost any desired extent, without great complication of parts or excessive dimensions of wheel.

C. N. D. says that L. L. can repair his mirror by taking a piece of old mirror and apply a drop of quicksilver to it. He can so lift from it a scale that will effectually patch the damaged mirror, the spot of glass having been previously well cleaned.

D. R. W. asks: Will a cup made of plaster of Paris answer as the inner cylinder of a Daniell's sulphate of copper battery, instead of an earthenware one? Answer: Yes, but it will be difficult to cast it free from blow holes. No. 1 baked porous cups for Daniell's battery are only \$2.25 per dozen.

W. H. I. says: I have a small cylinder boiler 2½ feet long x 10 inches diameter, made from ¼ inch iron, with cast iron heads. What pressure ought it to bear and what power should it develop with an engine 1½ inches diameter x 3 inches stroke? Answer: The boiler could safely sustain a pressure of more than 200 lbs. per square inch. At 100 lbs. pressure and a speed of 150 revolutions per minute, the engine would develop about ¼ of a horse power.

C. D. says: I have a well 30 feet from my stable; it is 12 feet deep. By means of a ½ inch lead pipe, the siphon, the water is conducted to a tub in the stable. I do not let the water run full stream, but through a pipe stem. Every 3 or 4 days, I have to take out the plug containing the pipe stem to let out the air, or the water would stop running. Can you tell me the cause of this? Answer: The air in the water generally collects at the highest point of a siphon which is used continually, as the pressure is least there. There is no way of preventing this, and every few days the air must be drawn off. By placing an air vessel at the highest point of the siphon, it will work much longer before requiring to be freed from air. Siphons are sometimes fitted with small pumps at the highest point, by means of which the air can be drawn off whenever necessary.

E. G. L. says: What is the meaning of "gresse"? Is it a composition or a separate metal? 2. In tinning small malleable castings, I cannot get a smooth bright surface. How can I prevent the scum and impurities in the tin from adhering to the casting, and how can I obtain a bright finish? Answers: 1. We do not remember ever to have seen the word about which our correspondent desires information. 2. The following method is commonly employed to tin iron, and generally with good results: Clean the casting with nitric acid, afterwards washing it with water. Dip it first into muriate of zinc, and then into the bath of tin.

E. A. F. T. asks how to make a small portable boat, light enough to be carried on horseback or in a small buggy? Answer: Try a boat made of canvas, stretched on a frame, which can be folded up and light and portable. Such a boat was used by our soldiers in the late war.

T. J. says: In a train of wheels, 3 drivers and 3 driven, the drivers are proportionally 30, 40, and 60. The first driver is the crank of a 5 horse power engine, 10 inches long; the next is a gear, 30, and the next a 30, which gives out all the power. What power is acting at the pitch line of each wheel? The engineer says it is as follows: 5 h. p. x 20 (double of crank) = 20 (1st driver) = 5 h. p. on crank and 5 h. p. on 1st driver. 5 h. p. x 20 x 20 = 20 x 40 = 25 h. p. on 2nd driver and 2nd driver, etc. 5 h. p. x 20 x 20 x 20 = 20 x 40 x 60 = 125 h. p. on pitch line of last driver 60, and last driver, 30. I think there is 5 horse power acting at the pitch line of all of them. He also says if the crank could not bear a strain of more than 5 horse power, the last driver, 60, and last driver, 30, could not bear a strain of more than 125 horse power, without breaking, providing the crank and wheels were proportioned by a good engineer. Please let me know if this is calculated right; and, if not, give me a simple rule for doing it. Should not the pitch of the wheels in each pair be altered? If 5 horse power would break the crank, how much would break each wheel separately? Answer: The results obtained by the engineer are correct, if the diameter of first wheel is double the length of the crank.

E. O. L. asks: What is nitro-glycerin composed of? Answer: The wonderful explosive termed nitro-glycerin is composed of nitric acid, sulphuric acid and glycerin. It is made by mixing together equal parts of the above acids and adding glycerin to the mixture, to the extent of one sixth of the weight of the acids. Precautions to prevent explosions are required in the manufacture.

M. A. asks how to manufacture paraffin. Answer: You can procure paraffin at the drug stores. It is made from wood tar, which is distilled, and the thick portion remaining is placed in hot sulphuric acid which burns up nearly everything except the paraffin. The latter is then pressed and purified. This is done by dissolving the paraffin in a hot mixture of alcohol and ether, which causes the deposit of the paraffin in beautiful flakes. Paraffin is also obtained from peat and from a soft coal found in Scotland.

C. F. asks (1) if there is any rule for lining up shafting from the main shaft to other parts of the mill. 2. Is there a rule for cutting belt holes through the floor? Answers: 1. With pieces of fine cord and a square, lines can be laid out, parallel or perpendicular to the line of the main shaft. 2. By making a diagram and finding the angle of the belt, the positions for the holes can be ascertained by using a string and a bevel.

M. H. asks: With 6 feet head of water, what sized turbine water wheel will be required to pump water through 1 inch pipe 1500 feet long up to 100 feet elevation? What kind of a pump shall I use? Answer: It depends entirely upon how much water you wish to deliver per minute. That being settled, you can find the size of wheel required, by examining the circular of the water wheel builder. By consulting our advertising columns, you will find the names of pump makers, to whom you can write for further information.

M. M. asks by what process he can harden cast or German steel plow molds, ¼ inch thick, to make them of even temper and as hard as possible. Answer: It will probably be difficult to harden the metal without retorts, but possibly the following method, if carefully conducted, will answer: Coat the metal with prussiate of potash, mixed with flour paste. When it is dry, cover it with clay to keep the potash from coming off, and heat to a bright red.

O. G. asks: 1. Is slaked lime injurious to a horse if sprinkled on the floor in his stall to keep or stop the bad smell that is in stable? If so, what can I use in place of it? 2. I want a 2 horse engine that will burn wood or coal; whose make is the best? How much will such an engine weigh? 3. Iowa coal is \$8 per ton, and soft wood is \$5 per cord; which is the cheaper? 4. What book contains engravings of the latest and best electrical machines, for motive power? Answers: 1. Use chloride of lime or carbolic acid. 2. Consult our advertising columns for information as to makers of engines. An engine and boiler of 2 horse power will weigh from 1,500 to 1,800 lbs., and cost about \$300. 3. Unless the coal is of unusually good quality, wood will be the cheaper fuel for you to use. 4. Noad's "Text Book of Electricity," Ganor's "Physics," and Stillman's "Principles of Physics," all contain illustrations of recent forms of electrical engines.

G. I. B. says: In my show windows, I have great trouble arising from damage to various kinds of goods exposed there. Iron or steel is quickly covered with rust, and brass wire or thin plate brass becomes almost as brittle and black as scorched paper. The windows are enclosed with glass, have but little sun, and appear to be tight. No gas is burned inside the case. Is there any way to prevent it? Answer: Try ventilation. Put a piece of stove pipe perpendicularly into the upper end of the window and burn a jet of gas in or under it to produce a draft. An opening at the bottom covered with gauze will admit air and keep out insects. Have you nothing but hardware in the window, and nothing to generate sulphureous fumes?

F. E. W. asks: How can I remove an old berry stain from a white dress? Answer: Try sulphurous acid.

A. & B. say: 1. A hires power from B; A is to have the use of a 6 inch belt to run on the pulleys as they stand. When A goes to work, the driving belt that is intended to drive the 6 inch belt runs off the pulley, which leaves A without power. A claims that B has not got sufficient power in that driving belt to give A the use of the 6 inch belt, or it would not run off the pulley. B says that A takes more power than the 6 inch belt will drive. A contends that, if he did, the 6 inch belt would run off the pulley, and the driving belt would stay on. Which is right by the law of mechanics? 2. B hires a so-called first class machinist. He takes down the 30 inch pulley and puts on an 18 inch; thus, he claims, will give more speed, which will give more power. A claims that to increase the speed is to decrease the power. A does not want speed; he wants power. B then puts an 8 inch belt on the 18 inch pulley and lets it hang over 3 inches, and claims that A has more power. A claims that he has less power. A and B leave it to you to decide. Answers: 1. It is somewhat difficult to decide a question of this kind, without a personal examination, to render it certain that we are in possession of all the facts of the case. Your first statement is correct if the driving belt slips off, it does not furnish all the power that could be transmitted by the 6 inch belt. In the second case, if, as we understand it, the changed pulley is the driver for your 6 inch belt, and if, with the present modification, your 6 inch belt is driven satisfactorily, you have more power than before.

S. A. H. asks us to state, briefly and clearly, what we understand by "Science," as used and applied in our publications. Answer: We will answer our correspondent's comprehensive question by a few quotations: "Science is applied to the knowledge of many, methodically digested and arranged so as to become attainable by one." "A science is a body of truths, the common principles of which are supposed to be known and separated, so that the individual truths, even though some or all may be clear in themselves, have a guarantee that they could have been discovered and known, either with certainty or with such probability as the subject admits of, by other means than their own evidence." "Science is applied to any branch of knowledge which is made the subject of investigation with a view to discover and apply first principles."

D. C. asks: 1. What percentage of power has ever been developed with rotary engines, compared with other kinds? 2. Can perfect condensation be secured by any means now in use? 3. What is the relative advancing power of a locomotive when the connecting rod is at each of the four cardinal points of the circle? Answers: 1. We have never seen reports of any careful tests of the performance of rotary engines. 2. No, if you refer to the production of a perfect vacuum. 3. At top and bottom, the full power of the engine, multiplied by the sine of the angle between the connecting rod and the crank, is exerted; at the other two points, no power is imparted by the engine.

W. P. asks: 1. How can I set a plain slide valve of a stationary horizontal engine (so as to cut off at any given point), without removing the steam chest? 2. What ingredients can I use to stop the foaming in my boiler? Answers: 1. It can only be done by making a diagram, or model to scale, knowing the size and position of ports, etc. You will find plain rules in "Link and Valve Motions," by W. S. Auchincloss. 2. If the foaming is caused by insufficient steam room, no ingredients will have any effect. Carrying a higher pressure of steam, if your boiler will safely sustain it, may remedy the trouble. If it is caused by dirty water, frequent blowing off will be advisable.

A. Y. S. says, in reply to the question of the advisability of having fewer teeth in a saw: I would say yes, for two reasons: the first is that, having more room for sawdust in the cut, power is saved; the second is that it takes less power to cut one eighth of an inch with one tooth than it does to cut it with two, for the front cut of one tooth is the same in both cases; and if the side cut were the same in both, one tooth would take but half the power. But if it is twice as great (and it cannot be any more), we have a saving of one front cut.

A. S. says, in answer to G. F. C. who asked for a description of the electro-plating process of Professors Jacobi and Klein: Professor Jacobi states that deposits of nickel can be obtained just as well from other double sulphate of nickel salts as from the sulphate of nickel and ammonia. He remarks further that the deposition of nickel succeeds far better by the application of an anode made of pure nickel, than by the saturation of the solution with soluble double sulphate of nickel and ammonia, etc. Professor Klein says that, in the Imperial printing establishment, the process of Becquerel (published in 1863 in *Comptes Rendus*) is applied, namely: a solution of a double salt of nickel and ammonia, modified by the insertion of a nickel anode. There is no necessity of particular care or precautions for avoiding the presence of traces of alkali in the solution; on the contrary, experience has proved that regular deposits will be obtained from solutions containing considerable quantities of sulphate of potassa or sulphate of soda. See "Business and Personal" column in this issue.

C. A. says, in answer to E. F. C.'s question for something that will prevent rats from gnawing his bellows: Skunk's oil is the only preventive I have ever found, and I have perfect confidence in it for the above purpose. It is perhaps scarce and hard to obtain, owing to the disagreeable smell while rendering it from the animal's flesh. But I feel justified in recommending it for the above purpose. It not only prevents rats and mice from gnawing bellows, but its use ought to be apparent to careless farmers, who often leave their harness, saddles, etc., wherever they use them last. Skunk's oil is a sure remedy in all cases, as no animal will chew or gnaw leather where it is present, and it is not disagreeable to the user. It has little or no tendency to rot the material on which it is used.

F. A. M. says: In reply to A. H. G.'s query about his water not rising in the morning to the same height in a gage as it was at night, I will suggest that there is distillation along the pipes between the boiler and the engine.

R. H. A. says, in reply to many queries in reference to sharpening old files: The difficulty, and the only one, seems to be this, that the action of acid reduces the acute angle, which the cutting point of the tooth takes, to an obtuse angle, like that of a squared tap; and the file has none of the means of force which render a blunt tap effective. To illustrate, we suppose a file tooth to be in section like a V; the acid acts on one side and in the groove between the teeth equally. If this V is at an angle of about 10° , it will be seen, by anyone who chooses to prove it, that the first cut of the acid, or the action on one side only, has lowered the point of the tooth double the distance of the depth of the perpendicular cut; and when the effects of the acid on both sides of the tooth are combined, the best result will be a right angled edge or point. In the grooves, the acid has a far greater surface, proportionally, to act on, and become

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INDEX

ray, the Belgian.....	*371
cell bar and bits, infra'a.....	*354

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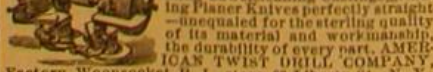
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