SCIENTIFIC AMERICAN

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

Vol. XXVIII.—No. 17. [NEW SERIES.] NEW YORK, APRIL 26, 1873. [$3 per Annum, IN ADVANCE.

TAYLOR'S AMERICAN FIELD PIECE.

First successfully employed during our late war, and more recently in the struggle between France and Prussia, the battery gun, like the submarine torpedo, may be safely predicted as designed to exert no small influence in the determination of future conflicts. Even in the crude forms in which, as necessity demanded, it has been hurried to the field, its terrible execution has proved it a most formidable and deadly arm: and as in late years improvements have been made in its construction, all tending to increase its power, the fact has become more clearly apparent that the mitrailleuse forms still another link in that chain of weapons of human destruction, which, beginning with the bow of the savage, the world believed forged and complete when the needle gun at Sadowa brought to a sudden ending a short though bloody war.

With the general principles upon which the construction of the battery gun is based, we presume our readers to be reasonably familiar. Explanations and illustrations of the Imperial, the Gatling and others, have already found place in our columns; so that, in illustrating the new mitrailleuse of Mr. Taylor, description of the minor details will be dispensed with. A short brass cylinder, containing twenty-four barrels, together with a quantity of machinery, is mounted on an ordinary gun carriage. Such is the general appearance of the invention. The length of the piece is about 28 inches, and its weight, with its appurtenances, is in the neighborhood of a thousand pounds. We begin our description with the loading mechanism. A is a magazine consisting of 24 tubes, each of which contains nine cartridges of size suitable to the caliber of the barrels. The tubes are confined between heads. The entire receptacle can be instantly removed from its position when its charge of ammunition is exhausted, and another similar filled magazine substituted, so that the gun may be thus kept almost continually supplied with cartridges. A suitable number of these charged reservoirs are designed to be carried in the ordinary caisson. At B is a cylindrical case, which encloses the feeding apparatus, consisting of 24 steel rods, which are intermittently moved forward into the magazine tubes through the medium of the rack shown above the casing, actuated by suitable mechanism in connection with the lever, D. At each movement of the rods one cartridge is forced out of every magazine tube, and into corresponding cavities in a rotating chamber plate, a portion of which is shown projecting at C. This plate consists of four wings, and revolves in the slotted breech piece into which the barrels are screwed. In each wing are 24 cartridge chambers circularly arranged. Of course all four wings or sets of chambers are on the same plane, and rotate on a common axis, so that one after the other, as each is charged from the magazine, is revolved so as to come into exact line with the barrels of the piece.

The same lever, D, that actuates the feeding apparatus, also communicates motion to the volley firing plunger or piston, E. F is a movable latch fixed longitudinally upon the top of the latter, holding it out of action when a fusillade discharge is desired. The details of the mechanism which explodes the cartridges are necessarily unrepresented in our engraving. We need, in reference thereto, only allude to a number of spring spindles which are either simultaneously thrown against all the cartridges, in the wing that is in position, by the piston E, or which are caused to strike their corresponding cartridges separately by means of a cam arrangement, within the breech and rotated by the steel crank, G. The first system causes a volley; the second, a fusillade.

When firing on the latter plan, as soon as each wing of the chamber plate is exhausted, a spring catch, H, automatically stops further rotation of the crank until another filled wing is revolved into position by the lever, D. Between the wings are arranged brushes and sponges which, in passing, clean the rear of the barrels between the discharges.

The lever, D, performs three offices; it works the feeding apparatus, rotates the wings, and operates the shell ejector. This last mentioned apparatus is contained in the case, I. The movement of the lever which brings up a filled wing necessarily turns away the one that has just been fired and which still contains the empty cartridge shells. The cylinder, I, however, is so situated as to be exactly in the path of the discharged chambers, and besides other mechanism, encloses 24 rods, which, as above intimated, by the action of the lever, D, are caused to enter the chambers and push out the discharged shells, which fall to the ground.

The arrangement of the barrels is clearly indicated in the gun to the left of the engraving. It will be noted that their muzzles are placed in the form of an ellipse, while at the breech they are circularly disposed, the object of the former configuration being to give a wider dispersion to the balls. J is the water casing, into which water may be introduced through the orifice, K, and the barrels thus continually kept cool. But three men are necessary to operate the piece, one at the crank and lever to fire, another at the rear to point, and a third to renew the magazines; and it will be remarked that all vulnerable portions are carefully so placed as to be out of danger from damage by rifle shots from the front.

At Sand's Point, L. I., a series of interesting experiments were made by the inventor, which proved quite satisfactory. At a range of 100 yards the target was pierced by a broadside which described an elongated horizontal ellipse, 2 feet wide at center and 12 feet long. At a range of 200 yards the width of this ellipse remained nearly the same, but the length increased in the same proportion as the increase of range. This was repeated, both by broadside and fusillade, a great number of times, the effect being uniform throughout the experiments. The piece was discharged several times over the waters of Long Island Sound, and the effect was quite interesting. A volley or broadside of shot striking the water 1,200 yards away produced a noise like that of beating the surface with the flat side of a board, the projectiles covering a line of about 144 feet. The effects of the fusillade were equally curious. The missiles would fall in quick succession, producing the same sharp sound, and for more than



TAYLOR'S AMERICAN FIELD PIECE.

a second after ceasing fire this would continue, so that a charged wing could be brought up to the lever, the shells ejected, and the fire reopened by the time the last missile of the previous charge had struck. The inventor concludes that, virtually, a continuous and unceasing stream of bullets may be kept up by the crank fire, for any desired length of time.

To Mr. J. P. Taylor of Tennessee is due the credit of this very ingenious weapon, of the successful operation of which we have assured ourselves by personal observation. In the experimental battery, an excellent piece of mechanical work from the shops of the Holske Machine Works in this city, from which our engravings were made, we remarked but few points that were susceptible of simplification, and we could suggest nothing which had not been anticipated by the inventor and fully provided for in a second gun which we learn he is about to construct. The piece has already attracted no small degree of attention in military circles, and we do not doubt but that it will excite even a greater interest when it appears, as we understand it will, according to the intention of the inventor, at the Vienna Exposition. Further and more detailed particulars may be obtained by addressing J. P. Taylor, patentee, or D. Hockett, attorney, Knoxville, Tenn.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year - - - - - - - - $3 00
One copy, six months - - - - - - - - 1 50
CLUB RATES { Ten copies, one year, each $2 50 — 25 00
Over ten copies, same rate, each — 2 50

VOL. XXVIII., No. 17. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, APRIL 26, 1873.

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THE SOURCES OF OUR MODERN KNOWLEDGE.

In the uncertain prehistoric ages during which the ancient human civilization was evolved, Science, which regulated the social relations, did not rise above the purely material purposes which occupied the minds of men. The small number of truths, of which Science then consisted, were only empirical deductions from facts; but she advances with the progress of humanity, and from Thales to Archimedes immense scientific labors extend her limits and tend to generalize human knowledge.

Thales, who lived twenty-six centuries ago, is one of the first philosophers, known to us, who brought his knowledge to a systematic whole. He was the founder of the Ionic school in Greece, and was equally successful as a mathematician and an astronomer. The school founded by him was afterward split up into different sects, which embraced in their researches all branches of human knowledge.

Pythagoras then appeared; this philosopher, who by grateful mankind of his age was called "divine," extended the domain of the mathematical sciences, and the tradition that he sacrificed one hundred oxen to the gods, from gratitude for the discovery of the famous problem which bears his name, is a proof of his trust in the guidance of a superior power. He had clearer notions than his successors; he taught the globular form of the earth, of which Anaximander had not the least idea, and he described the earth's motion around the sun; but mankind was not yet able to grasp this truth, and it had to be elaborated for two thousand years before general recognition of it was obtained.

After Plato, who, 2,200 years ago, had above the door of his lecture room the words "Nobody can enter here who is no geometrician," came the great Euclid, and then the illustrious Archimedes, the greatest philosopher of his time, who solved the most advanced problems with all the might of genius. The works of Apollonius, Hipparchus, Ptolemy, Diocletian, etc., fill up this earlier period of scientific history; but the authors are more specialist than universal philosophers; however, they contributed powerfully to the progress of knowledge.

At the beginning of a second period, Science seems to have been suddenly arrested, and ceases to appear as an element in the regeneration of humanity. She sheds, however, some of her light in the school of Alexandria; but after Diophantes her lamp appears to be everywhere extinct. Several centuries later, Science revives and is given back to the world by the same people that once slew her in her last asylum and surrendered the celebrated library of Alexandria to the flames, a library which contained all the philosophical works of preceding ages.

If the Arabs gave back to Europe, during the middle ages, some of the sciences, the records of which they destroyed in Alexandria, Europe in her turn became not only a rival, but a far superior master in the advancement of philosophy. It was then that Science took possession of certain grand theories, of which the preceding ages had scarcely any presentiment; the war which thus far had only existed in the moral world was carried into the scientific field; and human intelligence had begun to crave the discoveries developed by examination and discussion in the realm of positive sciences. It was then that Luther defended freedom in the examination and discussion of moral principles, and Copernicus defended freedom in scientific research, and established the true astronomical system. Then a galaxy of great men appeared: Italy produced Galileus Galileo; Germany, Gottfried Leibnitz; Holland, Christian Huyghens; England, Isaac Newton; and France, Rénate Descartes. Since that time discoveries have succeeded discoveries with the most unexampled rapidity; and thanks to their practical tendency, the appearance of the surface of our earth has changed during the two centuries since the time of these great men more than in the two thousand years previously. The number of discoverers and promoters of progress of the present day is indeed too great to enumerate, and what is a most striking fact, it has been steadily increasing during this century. In regard to the discoveries themselves, it appears to be reserved for the end of this century to place the crown on the now magnificent edifice of human knowledge, the labor of so many centuries, by a mighty doctrine which reunites all the isolated and various phenomena, by deducing them from a single absolute principle, the main object of modern research: The conservation of force or motion, which is founded on the principle of universal gravitation.

THE BROADWAY UNDERGROUND RAILWAY.

The bill for an underground railway beneath the great thoroughfare of New York city, known as Broadway, has finally passed both branches of the State legislature, received the Governor's signature, and become a law. The wonder is, in a community like this, so noted for the number of its intelligent, active, and vigorous men, that such an important enterprise should have been so long postponed. No city in the world has more pressingly needed the facilities for rapid transit than New York.

It has always been conceded that the best route for a fast railway was under the surface of Broadway. The peculiar formation of the metropolis, very narrow, surrounded on two sides by deep rivers, permits the movement of its population along one general line only—towards the north. The splendid thoroughfare of Broadway, seventy-five feet in width, lies in the very center of this movement, forming in fact the backbone of the city. Business of all kinds has Broadway for its focus, and probably no other street in the world is so constantly thronged with passengers and vehicles. The value of property on Broadway has become very great, and it is lined with many noble and costly edifices. Its peculiarly central position, the ease of its grades, the firmness of its soil, to say nothing of its enormous traffic, have always marked it as the natural route for an underground railway; and many different companies of railroad builders have vainly attempted to secure it as a prize. The property owners on the street, comprising many of our most wealthy and influential citizens, have always, until recently, opposed the railway, and nobody appears to have had wit or power enough to overcome their opposition.

The grounds for their hostility were plain and simple. They alleged that the operation of digging for the railway would endanger the water mains, break up the sewerage, set the gas pipes leaking, and tumble down every building on the street; causing a thousand times more damage and mischief than all the underground railways in the world were worth. This idea, in whole or in part, has pervaded the minds of owners and so united them in purpose that whenever any persons made a movement for the railway, they met with formidable opposition and signal defeat. Many and memorable have been the contests in the State legislature on the subject, and immense the sums of money expended; but the property owners invariably triumphed. In vain were they told that London had built such a railway and property, instead of being injured by it, was improved. To this it was replied that New York was not London, and that a road built here would certainly destroy the houses. For fifteen years has this sort of nonsense been allowed to bear sway, while the people suffered for want of the railway; and by reason of its lack thousands of families and business establishments were driven out of the State into New Jersey.

Our readers are familiar with the details of the construction of the short experimental section of railway under Broadway, by the Beach Pneumatic Transit Company. They will remember how this tunnel was bored by mechanism, under the surface of the pavement, below the water pipes, sewers, gas pipes, and foundations of adjoining buildings, the enormous traffic of the streets going on as usual, directly over the heads of the diggers. The public had no knowledge of the work until it was finished, and were greatly pleased with the quiet but effective manner in which it was done. That tunnel has been in existence and the experimental railway has been in operation for three years, presenting at all times an unanswerable argument in favor of an enlarged railway, and a practical refutation of the frivolous reasoning of the property owners. Meantime the company asked from the legislature the privilege of enlarging and extending the work, so as to provide a first class underground railway, and the public gladly seconded their request. For three years the company have pressed their enterprise upon the attention of legislature, and have at last succeded. Their charter is secured. Their aim now is to make the work the model of its kind. The railway is to extend under Broadway, Madison avenue, and Harlem river to Westchester county, nine miles, with an additional lateral branch. The work of construction is to be done under the supervision of State engineers. Stringent provisions are made by law to guard all public and private interests.

We shall, from time to time, present such information concerning the progress of the work as may be of interest to our readers. The ofice of the company is at No. 260 Broadway, corner of Warren street, and all communications should be addressed to the Secretary, Joseph Dixon, Esq.

THE FIRE ON BOARD THE STEAMER ALASKA.

We recently published a communication from Mr. Norman Wiard, giving us the particulars of the ignition, by "over heated steam" as he alleged, of the felting of one of the boilers of the United States steamer Alaska. The report of this fire was sent to us by Mr. Wiard for the purpose of vindicating his theory of "ignition by superheated steam" from the charge of being "absurd," as criticised in the SCIENTIFIC AMERICAN, and also for the purpose of placing before our readers a positive example of such ignition, the facts concerning which might be examined and verified by any one who so desired: the previous examples referred to by Mr. Wiard not being open to such examination.

It appeared to us when we published Mr. Wiard's last letter that the fire on board the Alaska could not have been caused by overheated steam, and we then gave our reasons for so thinking. We will now present further information concerning the fire in question, derived from an authentic source, which completely upsets Mr. Wiard's superheated steam theory.

We give a diagram showing the general form of the boilers of the Alaska, and the arrangement of the superheating tubes. The steam passes from the boiler into the superheater and thence to the engine in the usual manner. We also give a diagram on an enlarged scale of the upper portion of the boiler and superheater at the junction with the uptake. It was at the corner *A*, where the uptake begins, that the felting took fire, and the ignition was occasioned by the contact of the felting with the uptake. The felting had very improperly, been packed against the uptake, the heat of which finally produced ignition. Neither the boiler proper, the superheater, nor "overheated steam," had any thing to do with the fire, and so Mr. Wiard's superheated steam theory is again shown, by the facts in the very example he adduces, to be absurd.

Fig. 1.

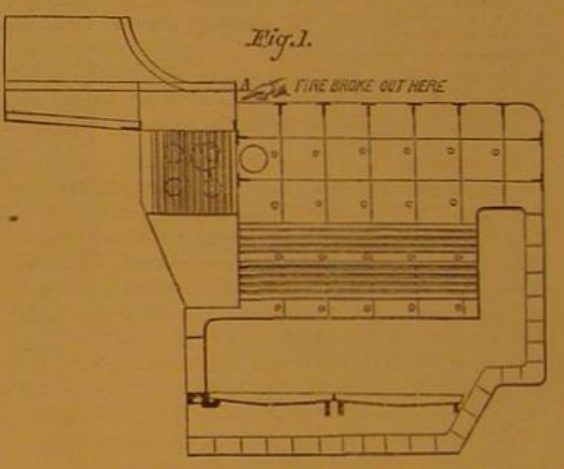
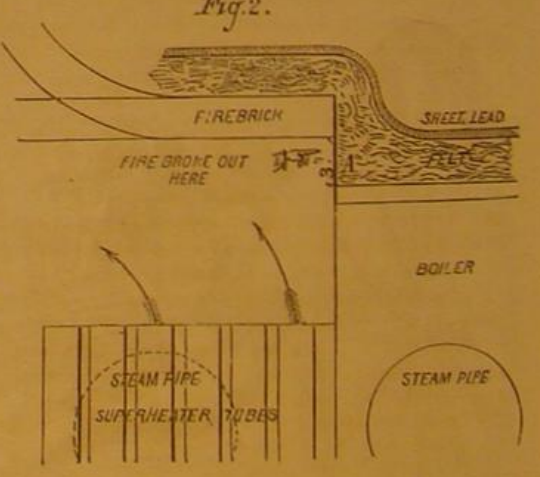


Fig. 2.



We trust that the fire on the Alaska will serve as a warning to engineers, and others who are charged with the duty of clothing boilers, to use proper care in such matters. The felting should never be packed against the uptake or chimney, as in this case. We are glad to know that since the fire the proper precautions have been taken on board the Alaska to prevent a recurrence of a similar disaster. The felting

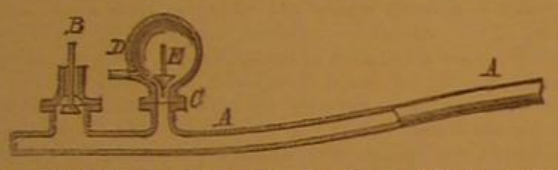
around the uptakes of the boilers has been removed a distance of twelve or fifteen inches, and cement substituted.

In relation to the superheating of steam, we have frequently shown that it was always difficult to bring up the vapor to a temperature sufficient to cause ignition, and, practically, impossible to do so in any of the boilers ordinarily used. In the case of the Alaska, if we are correctly informed, the ordinary boiler pressure is 30 pounds, and at this pressure the ordinary heat of the steam, on issuing from the superheater, as shown by the thermometer, is from 276° to 278° F. Every intelligent person knows that this heat is not sufficient to ignite combustibles such as felting or wood. On the occasion of the fire referred to, the engineer reports that the fires in the furnaces were low, indicating that the pressure and temperature of the steam were not as high as usual.

THE HYDRAULIC RAM.

We have received a number of communications, recently, from readers who desired information relative to the construction and efficiency of the hydraulic ram, and take pleasure in giving them a brief account of it.

This ingenious piece of apparatus is generally said to have been invented by the French aeronaut, Montgolfier, and improved by his son, but the earliest recorded accounts of the apparatus indicate that it was built in a ruder form, and still earlier, by an English watchmaker, Whitehurst, of Derby, in 1772. It consists simply of a pipe, A, large enough to convey the whole required volume of water from the upper to the lower level, and fitted at its lower extremity with a check valve, B, so weighted that it will remain open until the water, rushing out around it at nearly the maximum velocity due to the hight of fall, lifts it and suddenly closes the orifice. The long column of water contained in the pipe A, is thus, while in rapid motion, refused egress at B, and its great inertia and its almost perfect inelasticity compel it to seek some other outlet; and if that were not found the heavy shock of such a mass of water, instantaneously checked, would burst a very strong pipe unless it were "cushioned" by an air chamber. In the hydraulic ram the new outlet is at C, and the water forces its way up through the air cham-



ber, D, lifting the check valve, E, without difficulty, and is finally delivered by a properly arranged pipe, leading to a reservoir which may be at a considerably higher level than the original source.

This action is one of those whose effects are estimated by reference to the principles stated in an article which we recently published on the laws of impact. Were there no friction, the energy due to the weight of water and the hight of fall would all be expended in raising a part of the water to the reservoir. One hundred gallons falling ten feet would be capable of raising ten gallons to a hight of one hundred feet, or twenty gallons fifty feet. As soon as the work done in throwing water into the reservoir has equaled the energy of the whole moving mass, the stream ceases flowing and the valve, C, closes, B opens and the stream starts again, its velocity accelerating until B is again thrown up to its seat, and the operation just described is repeated.

The friction of the pipe and the tortuous course of the water prevents the full realization of the effect as above estimated. This machine where well designed and properly made gives, on the average, about sixty per centum of the perfect result. We have, in our replies to correspondents, assumed forty per centum as the more common measure of its efficiency. It evidently is not as efficient a means of raising water as a good turbine or overshot wheel and pumps, as the latter should be capable of throwing nearly twenty per centum more water into the reservoir than the ram, with the same available quantity of water. The ram is, however valuable where the quantity of water is too small to justify the use of the wheel. The fact that small wheels are not as effective as large ones is also a fact telling strongly in favor of the ram.

ESTIMATING POWER BY SIZE AND SPEED OF BELTS.

We have already complied with the request of some of our readers who desired us to state how the proper width of belting to transmit a given power was estimated.

We have now before us a request from others that we should give the rules adopted in determining the power actually transmitted by belts of given widths and speeds.

The rule already given was expressed by a formula which can be readily transformed into another, which shall meet the wants of the present case. It would be $HP = \frac{W S V}{7{,}000}$, that is: Multiply the width of the belt by its speed and by the length of that portion of the circumference of the smaller pulley which is in contact with the belt, and divide the product by 7,000. The result is the power which the belt is proportioned properly to drive.

Or, accepting the common millwrights' rule of 1,100 feet per minute on a belt one inch wide, for a horse power, we should state it thus: Multiply the speed of belt in feet per minute by its width in inches, and divide by 1,100. The result is, as before, the proper amount of power to be driven by the belt. The first rule is the most exact, the latter the most convenient for rough estimation. It must be remarked, however, that it by no means follows that the belt, in any particular case, transmits this estimated power. It may drive much less or, if running very tight, it can be made to carry more than the proper amount.

It is evident that, where power is rented, its amount cannot be accurately computed from the size and speed of belts. The policy of those who have power to rent to others is always to charge for the maximum capacity of the belts, and those who use the power and pay for it will use the smallest belts and drive them at the highest power possible. The only satisfactory method of settling disputes between landlord and tenant is by the application of the dynamometer, thus measuring precisely the power used. Every one dealing in power should keep a dynamometer of good construction on hand, and should use it more frequently than a good engineer uses his steam engine indicator. There are several good dynamometers in the market; and if those directly interested cannot use them, or do not find time, they can always find reliable consulting engineers to do the work for them. We know manufacturers who understand this, and who send hundreds of miles for an engineer and his apparatus, to give them trustworthy information regarding the amount of power which their machinery is using.

ZIRCONIUM.

This metal takes its name from zircon, the mineral in which it was discovered by Klaproth in 1789. Although the metal is rarely met with and has no use in the arts, the mineral zircon is comparatively plentiful. It is found in many parts of the United States, among which the localities nearest to New York city are in Orange and Essex counties, N. Y., and at Trenton and Franklin, N. J. It is usually of a reddish brown color, and is very hard. The colorless and yellowish zircons of Ceylon have long been called *jargons* in jewelry, in allusion to the fact that, while resembling diamonds in luster, they are comparatively worthless. Zircons occur in crystaline rocks, especially in granular limestone and granite. They are infusible before the blowpipe. If pulverized and fused with soda on a platinum wire, the product when dissolved in dilute muriatic acid, gives a characteristic orange color to turmeric paper. Zircons are almost pure silicate of zirconium, containing less than 2 per cent of oxide of iron. The finer specimens of zircon have been used for ornaments, resembling, as we have said, the diamond. Zircons have also been employed, on account of their hardness, for axles and bearings.

Metallic zirconium was first prepared in the amorphous form in 1824, by Berzelius; Troost prepared crystallized zirconium in 1865. The former obtained it by heating a mixture of the double fluoride of zirconium and potassium with metallic potassium. It can also be prepared by conducting the vapor of chloride of zirconium through a red hot porcelain tube containing metallic sodium; or by heating the chloride of zirconium and sodium in a crucible with sodium or magnesium. The amorphous metal prepared in this way burns with a bright light at a temperature below redness. *Aqua regia* and the ordinary acids have but little effect on it; although it dissolves in hydrofluoric acid.

Crystallized zirconium was prepared by Troost by heating 2 parts of the double fluoride of potassium and zirconium with 3 parts aluminum to the melting point of iron in a plumbago crucible, and dissolving out the aluminum with hydrochloric acid. In this state it is easily attacked by *aqua regia*, but resists the ordinary acids. It is less fusible than silicon, and burns only at the temperature of the oxyhydrogen blow pipe.

A metal possessing such a remarkable power of resisting the action of acids and heat will one day become invaluable in the arts, if methods of preparing and working it with some degree of facility are ever discovered. Let those inventors who wish that they had been born a century or two earlier, before everything had been invented, take heart, for wide fields of usefulness as well as glory await those who possess real genius and talent. To-day metallic zirconium is of no use, and only exists as a curiosity in a few cabinets.

Oxide of zirconium, or zirconia, is more easily prepared and better known, for Tessie Du Motay and others have proposed to employ it instead of lime or magnesia for the oxyhydrogen lamp. It is prepared by Du Motay for this purpose by mixing the finely pulverized zircons with charcoal and exposing to the action of a current of dry chlorine gas, which decomposes it into the volatile chloride of silicon and the basic chloride of zirconium, which latter is sublimed, and may be dissolved in hydrochloric acid and the zirconia precipitated by ammonia. The precipitate is dried, ignited, and mixed with borax, clay, etc., and pressed into cylinders the size of a pea. When these cylinders are heated in a jet of oxygen and hydrogen gas, they become intensely luminous, giving a steady white light fourteen times brighter than street gas. The advantage which it possesses over lime and magnesia are its perfect infusibility and its non-attraction for moisture from the air; it crumbles as lime does by air slaking. The great difference in cost has, however, overbalanced the advantages on the side of zirconium, and it seems doubtful at present whether it will ever meet with extended use.

When perfectly pure oxide of zirconium is required, the above method cannot be employed; for although the chloride of silicon is much more volatile than the chloride of zirconium, it is practically very difficult to separate them completely in this way. A better method is that of Marignac. The mineral is broken in small pieces and ignited in a platinum dish with 2 or 3 parts of the acid fluoride of potassium. The mass, which consists of the double fluoride of potassium and zirconium, mixed with the double fluoride of potassium and silicon, is boiled with water containing a little hydrofluoric acid, filtered, and the residue washed with a small quantity of hot water. On cooling, the fluoride of potassium and zirconium crystallizes out. After purifying by recrystallization, the crystals are evaporated to dryness with concentrated sulphuric acid, and the sulphate dissolved in water. From this solution the hydrated oxide is precipitated by ammonia.

As to the salts of zirconium, the preparation of the chloride and fluoride has already been described. Bromide of zirconium was first prepared in 1869 by D. E. Melliss of New York, then a student of Professor Wöhler at Göttingen. The oxide of zirconium was mixed with charred sugar, and kneaded into pellets by means of starch paste and dried. These were then introduced into a tube of hard Bohemian glass. The tube was heated to redness, while a current of bromine vapor was conducted through it by means of dry carbonic acid. The bromide of zirconium is a white crystaline powder. It has a great affinity for water, with which it forms an oxybromide of zirconium, by exchanging two atoms of bromine for one of oxygen. The sulphide of zirconium is prepared by heating the metal with sulphur in a vacuum or in hydrogen gas. Zirconium forms double fluorides resembling the fluorsilicates. Its oxide also combines with bases after the manner of silica.

Zirconium, then, may be said to stand intermediate between silicon and aluminum, being willing to combine with either: with this difference, that no compound of silicon and zirconium has been prepared without oxygen, while its union with aluminum more nearly resembles an alloy. At all events, until it has been more thoroughly studied, we must class it among the metals.

PATENT MEDICINES.

The German scientific papers are accustomed to publish the results obtained by analyzing the various quack medi- and nostrums that come under their notice, thus exposing humbugs and warning their readers against wasting money and endangering their lives by the use of such compounds. Of course our American patent medicines are often subjected to the same test. Recently the Berlin *Industrie Blätter* published the composition of Mrs. Allen's "World's Hair Restorer." In a recent number of the same journal the following is given as the composition of the stuff sold as Dr. Sage's "Catarrh Remedy":

It contains 7 grains carbolic acid, 7 grains camphor, and 2·57 drams common salt. The whole is colored with a little Prussian blue, and sold at 50 cents per bottle, which affords a nice little profit above the expense of labels, advertising, etc. The same number of this journal exposes an eye balsam sold by a widow Müller in Berlin, which is warranted to cure every form of eye disease. It consists simply of 3 grains oxide of mercury (red precipitate) and 2·5 drams strong, unsalted butter. This old and well known salve is sold in boxes holding about 3 cents worth for the modest sum of 15 cents. From this statement it will be seen that the German quacks are satisfied with smaller profits than our people; for it is not long since a Philadelphian firm had the audacity to put up less than a cent's worth of carbolic soap and sell it for 25 cents as a sure protection against small pox.

The composition of the article called Dr. Pierce's alterative extract or "Golden Medical Discovery" is given as follows: 4 drams purified honey, 15 grains extract of poisonous lettuce, 30 grains tincture of opium, 3·5 ozs. dilute spirits tasting like fusel oil and wood spirits, and about 3 5 ozs. of water. Ten cents worth of this trash sells for $1.00.

The Cincinnati Industrial Exposition.

The fourth yearly Industrial Fair will open in Cincinnati on the 3rd of September and close on the 4th of October. We take this early opportunity of calling to it the notice of our readers generally, and of suggesting that they prepare their contributions in due season. The exhibition, we are informed will be one of the largest and most extensive yet held in the West, and will form an excellent medium for Eastern manfacturers to introduce their new products to the people of that great section of the country. Rules, premium lists, etc., may be obtained upon application.

New British War Steamer.

An event of interest recently took place at Chatham, Eng., in the launch of the Raleigh, a ship built, not, as the majority lately constructed, to offer great resistance to shot and shell, but with a view to combine great speed with a very heavy armament. She is therefore built of iron, sheathed with wood and coppered, and lined with brown cardboard, as being less likely to splinter, and also less inflammable than timber; and her dimensions are: Length, 208 feet; breadth, 48 feet 6 inches; draft of water, forward, 20 feet: aft, 23 feet; tunnage, 3,210 tuns; armament, upper deck, two 12½ tun guns, four 64-pounder guns: main deck, fourteen 90 cwt. guns, two 64-pounder guns; horse power, 800; crew, 530; and she is estimated to cost, when entirely finished, about $1,000,000.

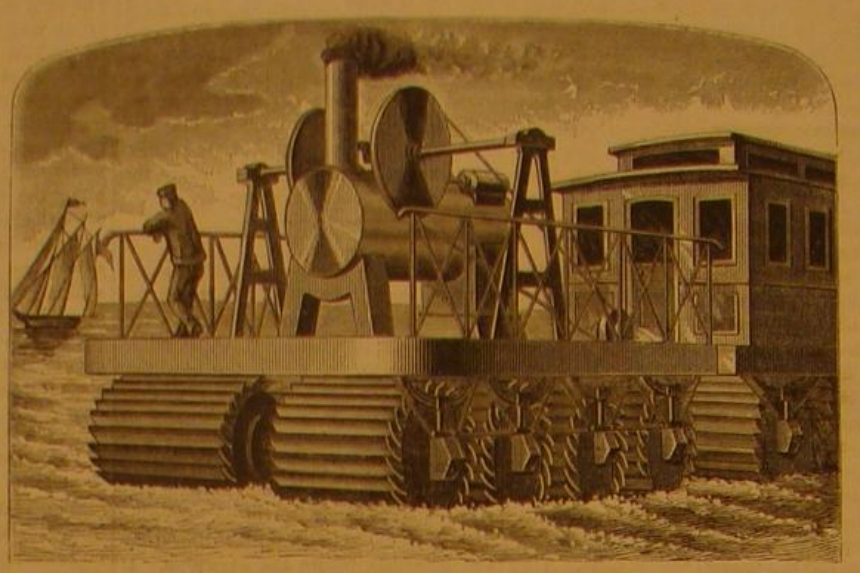
A SHELL which exploded recently at the shell foundery at the Royal Arsenal, Woolwich, when placed in a cupola for being melted down, is believed to have been a 600 pounder for the 11 inch gun, a conical projectile constructed on the Palliser system which had been returned from the practice ground at Shoeburyness. The roof and skylights of the adjacent buildings were damaged more or less by fragments of coke and chalk thrown up from the furnace by the force of the explosion, but the mischief done is comparatively trifling.

A GENIUS in New York has notified the Post Office department that he has applied for a patent for printing two or more advertisements on the new postal cards. He wishes he may get the patent, but probably he won't.

A NOVEL MODE OF MARINE PROPULSION.

M. A. Huet, a Dutch civil engineer, has invented a marine carriage; or, in other words, he proposes to propel a locomotive, with its train of cars, over the surface of a canal or river at as great a speed as upon a railway on land. How this result is to be accomplished our engraving illustrates. The locomotive and cars are separate vehicles, and each rests on a number of cylinders placed as represented, and arranged to revolve freely on axles. Each cylinder is a paddle wheel, the buckets of which are placed parallel to its axis, and are bent upwards so that the lower portion of the curve strikes the water nearly parallel to its surface, thus tending to lift the superstructure upwards as well as propel it forwards. The inventor suggests that some of the paddle wheels may be constructed with floats arranged spirally: those on one side of the car being inclined in one direction, and those on the opposite side in the other, so that the water may be thrown obliquely outwards to the rear.

The motive power is supplied by a small double cylinder engine placed horizontally upon the boiler upon the platform of the locomotive. The machine is of the simplest form. The piston rod actuates a shaft on which are driving pulleys, from which, by means of a belt, motion is communicated to the two rear paddle wheels. These are connected by an endless belt with pulleys situated on the inner ends of the other cylinders which are thus rotated. Steering is accomplished by going ahead with the paddle wheels on one side, and, if necessary, reversing the others, according to the direction to be taken up. A number of rudders may also be arranged, one in front of the locomotive and the others in rear of the cars. The platforms of the vehicles have rounded ends to admit of their turning curves, and springs are provided above all the axles to lessen the vibration caused by the paddles striking the water.



A NOVEL MARINE PROPELLER.

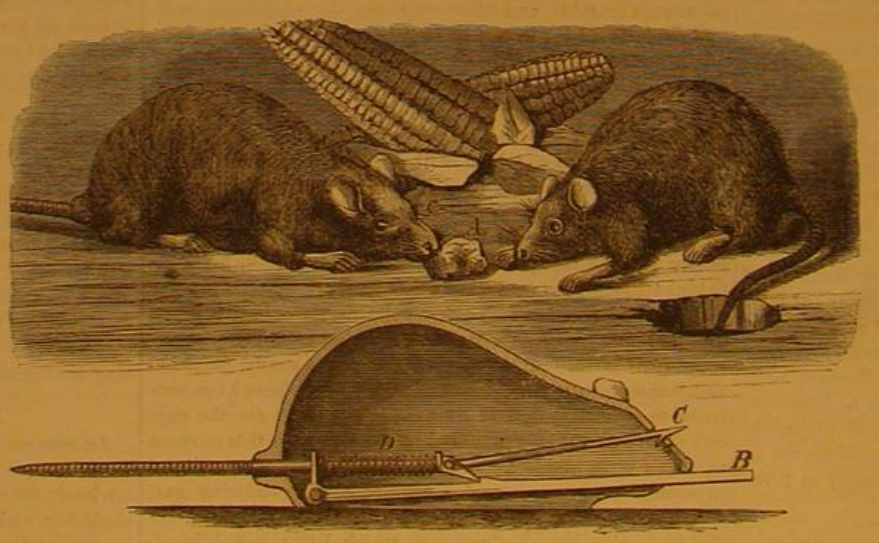
The inventor states that the machine can be quickly stopped by arresting the motion of the engine. The train, which when moving is slightly lifted up by the downward action of the paddles, then increases its draft of water, becoming more submerged, and so opposes a larger surface of resistance to the fluid. Consequently its momentum is quickly overcome. For sudden stoppage, broad boards are to be dropped at right angles to the line of advance, and the same are also to be used at either side of the vehicles when they are running with the wind abeam, in order to prevent lee way.

The plan, we think, would be plainly impracticable in a sea way, while the probability of the cars remaining upright, even in smooth water, during a strong wind seems to us very slight. The practical feasibility of the idea remains yet to be demonstrated.

NOVEL RAT TRAP.

The Spanish Inquisition, among its other diabolical implements of torture, had a life sized figure, sumptuously dressed to represent some female saint. After a victim had been put through the usual course of rack, hot pincers, etc., he was requested to kiss the image. The moment, however, he began his osculatory performance, the dummy extended its arms, enfolded him in an embrace which was lined with dagger points, and then, a convenient trap door opening, dropped him into unfathomable depths below.

This rat trap is something on the same principle, only the rodent is drawn to his doom through his unquenchable appetite for cheese. A dummy rat is constructed of any material to closely imitate the real animal. From his nose extends the rod, B, to which the bait, A, is affixed. D is another rod surrounded by a coiled spring, one end of which catches in a projection in the rod, B, and the other emerges *à posteriori*, and serves for a tail. C is one of two long needles barbed at the ends, fastened to the rod, D, and protruding from the eyes of the imitation animal. The genuine rat, smelling the bait, perceives it under the nose of a rival. He immediately prepares to capture it, collects his energies, makes a rush, and springs the trap. The keen points shoot forth from the eyes of the artificial monster, bury themselves in his body, and the barbed ends hold him fast. Then he remains and absorbs the cheese at his leisure. J. W. Ellis, patentee, of Pittsburgh, Pa.



A NOVEL RAT TRAP.

The Spontaneous Ignition of Oiled Cotton or Silk Waste.

Major Majendie has communicated to the Royal Artillery Institution the results of certain experiments, instituted to ascertain the relative degree of risk accompanying the presence of oiled cotton waste and oiled silk waste in buildings and stores.

Mr. Galletly, who made the investigation referred to, read a paper at the Brighton meeting of the British Association for the Advancement of Science in August last, on a series of experiments carried on by him, with a view of determining precisely the conditions under which spontaneous combustion takes place in cotton and other combustible material, when impregnated with animal or vegetable fatty oils. Mr. Galletly found that cotton waste soaked in boiled linseed oil and wrung out, if exposed to a temperature of 170°, set up oxidation so rapidly as to cause actual combustion in 105 minutes in the case where the action is slowest. The quantity in this instance was sufficient to fill a box 17 inches long by 17 inches broad, and 7 inches deep, but unfortunately it is by no means necessary that the waste should exist in any such bulk, a common lucifer match box full igniting in an hour in a chamber at 166° Fah.

Raw linseed oil ignited less readily. The experiment was made in a smaller case than the first one above mentioned. Active combustion took place in four or five hours. Rape oil and Gallipoli olive oil ignited somewhat less readily, taking at least five hours, though generally a good deal more. Rape oil, in fact, took over six hours at 170°. The temperature of 130° was employed in the case of the Gallipoli oil, and also in the following instances: Castor oil took over a day before ignition; lard oil took four hours; salad oil, one hour and forty minutes; and sperm oil refused to char the waste at all.

Mr. Galletly considers that the heavy oils from coal and shale tend remarkably to prevent the oxidation described, by protecting the tissue from contact with the air. It appears that the so-called spontaneous action of oiled cotton waste proceeds from the substance being exposed in a finely divided condition to the oxidizing action of the air. In point of fact it is the same action that causes the bloom in some of the direct processes for the reduction of iron to revert to the oxide when exposed in a heated state to the air, and the still more remarkable action that is said to have taken place in the iron removed from the Mary Rose, which had lain at the bottom of the sea till it became eaten into a porous condition. It appears to have been hoped that silk waste might have offered greater security, but this proves not to be the case: a little powder in the center of silk waste igniting in an hour, while under the same conditions powder enveloped in cotton only fired in an hour and a half. The silk of course did not itself fire like the cotton, but this would be a matter of little moment, unless the quantity of powder in its immediate locality was very small indeed. It is important to note results which may be of such importance to shops, and other factories than those for powder. It is to be regretted that nothing more encouraging can be drawn from them than the caution not to leave oiled waste about, even in the smallest quantities, especially in warm places.

THE ONEIDA COMMUNITY has, according to the *Circular*, been recently exercised by the posting upon its bulletin of the following conundrum: "Why does a spinning top, at the close of its whirl, apparently go into a motion in the opposite direction from that in which it started?" This inquiry set all tongues in motion, men, women, and children, and the discussion is doubtless still in progress.

THE new railway from Joppa to Jerusalem conveys passengers through in two hours. The romance of traveling in the Holy Land is forever gone.

How to make Good Butter.

Philadelphia butter is a luxury which probably a very large number of our readers know only by name, and which, like the Devonshire cream of England, is believed unattainable save in the immediate neighborhood of the place of its production. Although this idea is doubtless correct regarding the latter delicacy, still it is not true of the far famed "gilt edged" butter of our sister city; at least so says a correspondent of the *Practical Farmer*, from whose letter we extract the following hints, by observing which, we are assured, the genuine article may be made:

Premising that good cows—Jerseys are the best—and excellent feeding and management are secured, the following essential points must be noted. Stable, milking sheds, and spring house must be clean, well ventilated and free from all noxious odors. The milk must be skimmed soon enough after milking to obviate all danger of moldiness or absorption of the results of fermentation. This must depend largely upon the experience, judgment, and observation of the person in charge, though perhaps the best rule is to skim at the precise earliest moment when all the cream can be procured from the milk. Keep the vessel containing the cream down to a low temperature, stirring it daily with a long handled wood spoon. This low temperature for the cream, so as to avoid all dangers of fermentation, is very important. Avoid what is called washing the butter, as the fine flavor is thus carried off. Churn the cream at such a low temperature that, at the point of turning into butter, it will come hard; and this is entirely within the control of the dairyman, by throwing in either lumps of ice or pounded ice at the critical moment, and giving the churn a few more turns, so as to lower the temperature of the mass, and allow the butter to be taken out hard. If this is not done, and the mass of butter is soft or oily, it cannot be properly worked and will never make a good article. Two workings are required, one on taking out of the churn, to get rid of most of the buttermilk, when it is salted and laid away for two or three hours. The final working is then done on the butter table, ten or twelve pounds at a time, or on the butter worker. A fine muslin cloth is wrapped around a fine sponge, with which the flattened out surface of each lump is patted till everything like buttermilk or water is absorbed. The sponge and cloth are, of course, from time to time, wrung out as needed. The sponge is a powerful and thorough absorber—nothing equals it in this respect. The salting is at the rate of two thirds of an ounce to each pound. Butter may be worked too much, and it may be worked too little. It must be solidly and neatly printed, have a fine white muslin wrapper around each pound or half pound, and be delivered in market as solid as when it left the spring.

An Air Well.

A correspondent, G. W. G., asks the opinion of the scientific world on the following:

A tube well was driven to the depth of 53 feet for water, but instead of obtaining the object, a strong current of air came rushing out of the tube with such force that the noise could be heard at a distance of several rods. Fire at the bottom of the tube burned brightly, and the air came out with a steady flow. This continued for about five days, when the current changed, and air flowed into the tube at about the same velocity. The location is on a divide—the highest point of land between Toledo and Chicago; the country is generally level, but somewhat rolling. Professor Foster, of Chicago, has been written to for his opinion; he thought the current of air might have connection with a subterranean cave, and thence rose to the surface; but the reversal of the current, without any change of temperature above, exploded that theory. If it was in the vicinity of coal, instead of pure air, gas would naturally escape. The soil is sand and gravel, with blue clay beneath. The tube was with withdrawn and sunk in another place to the depth of 70 feet, when rock was struck, but no water was found.

The "Scientific American" Cubically Considered.

C. J. F. writes to say that he has collected his numbers of our journal, from its birth, from his shelves, and finds that the pile measures forty-three inches in hight. He could not but be gratified to think how considerable was the knowledge he had acquired by reading such a mass of information, obtained at so small a cost.

Treating Hardened Leather.

A. J. B., a practical man, says: "Mineral and vegetable oils are of no use on leather, and fish oils destroy leather when used pure. One part fish oil to three parts neats' foot is good for common half finished leather: but for highly finished leather, pure neats' foot is best. The white or yellow neats' foot oil is the proper sort; the reddish is adulterated. Sheep's foot oil, nearly white, is better still. If leather valves, etc., are made of half cured hides, they become converted into horn, and will stay in that condition. To soften hardened

leather: Wash in lukewarm water with a little soap, use a wooden-backed brush with short bristles, as used for washing horses; scrape off the dirt and outer skin with a blunt knife. Keep on this treatment till the hide is half saturated; then twist, turn and roll the leather with both hands till all the pores are open, and work them well; if you see small cracks on the surface, good; if the leather splits, it is rotten. While the leather is damp, begin to rub in the oil with a brush as before described; use a little oil at a time and apply four or five times, and work the leather well with the hands after oiling. Set it in a hot sun for half an hour, and then put in a damp place with a wet sack over it. To keep off rats, invert a wooden box over the heap. Oil and work again the next day, and for many days after; and then compare with an old pump valve, and observe the difference."

THE WONDERS OF THE EGG.

Professor Agassiz recently delivered a most interesting lecture at the Museum of Comparative Zöology, Harvard University. It was profusely illustrated by specimens from the shelves of the museum. We take the following report from the New York *Tribune*:

The Professor said: The formation and growth of the egg and its fecundation prior to the formation of the new being are among the most mysterious processes of the organic world. The eggs laid by different kinds of animals are themselves so various in size, form and appearance that it is difficult to believe they are all one and the same thing. Look at this huge egg, for which a man's hat would be too small a cup. It is the egg of an extinct bird found at Madagascar (the epiornis), the largest bird's egg known. Compare it with the egg of the humming bird, smaller than a hazel nut, scarcely larger than a small pea. In form and general aspect the difference, even among birds' eggs, is endless. Some are elongated, some are spherical, some are dull on the surface, some are polished, some are dark, others gray or white, others very bright. The number known is large. Ornithologists are acquainted with about 5,000 different kinds of birds' eggs While they differ in detail, the general pattern of birds' eggs seems the same. The outside shell is brittle, and within there is a lining membrane covering the white, while in the center is the yolk, differing in dimensions in different species of birds as much as the eggs themselves. Quite otherwise, seemingly, is the egg of the mammalia. Those which are developed are never laid. As eggs they are microscopically small, and they undergo all their transformations within the mother. Yet their structure at some time or other, in an early stage of their growth, is the same as that of the egg in all other classes of animals.

Among reptiles the eggs exhibit great variety. The eggs of alligators are elongated, almost cylindrical, evenly rounded at both ends, and about the size of an ordinary duck's egg. The eggs of the sea turtle are about as large as a small apple, rounded, and have a flexible shell. Those of the snapping turtle are much smaller, but also rounded. Those of our terrapins are oblong, as are also those of lizards. Snakes' eggs are oblong and sometimes cylindrical in shape. Frogs and toads lay numbers of small eggs. They are dropped in the water like fish spawn, in large clusters or strings. The Surinam toad (pipa) carries her eggs soldered together like a honeycomb on her back. The alytus carries them between its legs, rolled up in a bunch.

Among fishes the eggs of different kinds differ amazingly in external appearance. Some of them would hardly be believed to be eggs at all. Take, for instance, the skate's egg.



THE SKATE'S EGG.

It looks like a flattened blackish leather bag, with four horns or handles at the four corners. The yolk in such an egg is the size of a walnut, or larger or smaller according to the species. All skates and sharks have eggs like these, though not all lay them, the young in many instances undergoing their development within the mother. The chimera has a still more curious egg. It is like a leaf made out of parchment. In the center is an oblong cavity containing the yolk.

The number of eggs laid by animals belonging to the same class is again singularly different. The eggs (or, as we call them, the spawn) of some fish are exceedingly small and are laid in large masses. The spawn of a single herring is made up of hundreds of thousands of eggs. Other fishes lay only a few dozen at a time, and in some kinds they are of considerable size. Some fishes let their spawn fall into the water; others make nests for their eggs, and others carry them until the young are fully developed. Some catfish carry their young in the mouth till they can provide for themselves. Certain fishes carry their young along the gills and they go in and out at will through the gill cavity. Some carry them attached to the surface of the belly or under the tail, and among the pipe fishes, strange to say, this office devolves upon the males (syngnathus).

In the higher vertebrates the young are less numerous. A great many mammalia bear but one at a time.

Insect eggs are, as a general thing, too small to be perceptible at a distance. The egg of a day butterfly is attached by a string to a twig. Those of certain water insects are kept floating by string-like appendages. The eggs of the pearl wing fly are fastened by the frailest possible threads to the margins of leaves [*a*, *a*, *a*, in diagram]. Those of the seventeen year locust lie side by side in rows in the branches of trees. Those of the so-called soothsayer (mantis) are deposited in large, elongated clusters which might be mistaken for a caterpillar at rest.

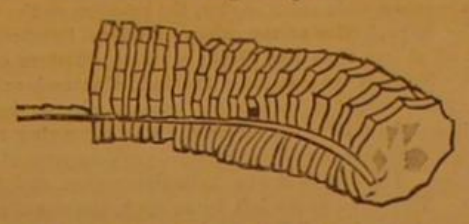


THE EGGS OF THE PEARL WING FLY (CHRYSOPA).

In the two other classes of articulates, in the crustacea, (crabs, lobsters, shrimps, and the like), and in worms, the eggs vary less than in insects. In the crustacea they are always small, and are carried under the tail.

In the type of mollusks we find great variety among the eggs. There are mollusk eggs which might easily be mistaken for birds' eggs, some of which are larger than most birds' eggs. At first sight one would be quite sure that the egg of a bulimus was a humming bird's egg. Others again are very different from the eggs of any animal belonging to other types.

Here, for instance, is the long string of



EGG CASES LAID BY THE PYRULA,

every such case containing from 15 to 20 eggs, and sometimes more. Others lay clusters of eggs surrounded by an egg case. The periwinkle lays an immense mass of eggs, larger than the shell itself. Here are what are called sand saucers formed by the eggs laid by the natica. The mass of eggs is pressed out between the shell and the soft parts of the animal, which at the moment are so expanded and protruded as to cover the whole surface of the shell. The mass of eggs thus laid is molded as it were to the external form of the shell; and being laid while the animal is buried in the sand, the sand accumulates upon them and forms the disk like shape. If you cut such a so-called sand saucer across, you will find minute eggs the size of a pin's head laid side by side throughout it, every egg containing, perhaps, from six to seven individuals.

Among bivalves there is not so great a diversity of eggs as among univalves. They are usually small, like spawn, and generally retained by the mother.

THE CONFIGURATION AND DIMENSIONS OF BLAST FURNACES.

We extract the following description and illustrations from Stölzel's work on metallurgy:

In building a blast furnace, it is usual to make the exterior either in the form of a quadrilateral pyramid, or a truncated cone; sometimes, however, a conical superstructure is placed upon a pyramidal base. The shell, in many furnaces, rests on four corner pillars, the tops of which are connected by arches, or the pillars are surmounted by iron girders set in form of stairs. In other cases, the shell is supported by a ring wall and boshes, with a cast iron crest resting on pillars. In this latter arrangement, commonly used in Scotland, the hearth is free and accessible in all parts. Sometimes the construction is varied by setting only the ring wall and boshes on pillars, the outer shell resting on a solid wall. In the truncated conical furnaces it is often customary, especially in England, to use a sheet iron mantle instead of one of masonry; the mantle then consists of rings or riveted iron plates, and is lined with stone.

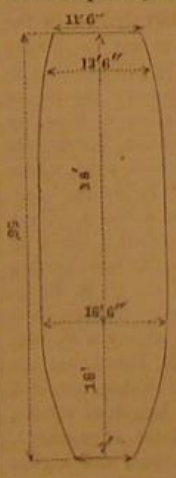


Fig. 1. Capacity 9,300 cubic feet, Schneider, Hannay & Co., Barrow-in-Furness, Lancashire.

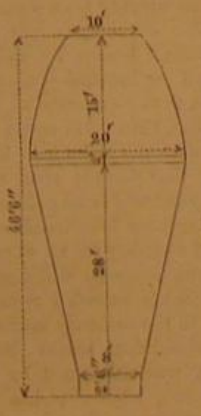


Fig. 2. Capacity 8,000 cubic feet. Ebbw Vale, Wales.

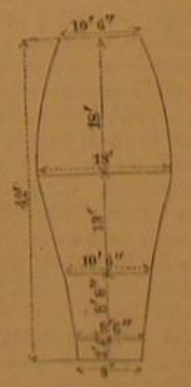


Fig. 3. Capacity 6,160 cubic feet. Dowlais, Wales.

But the variations in the form of the interior of the blast furnaces are still more important. The differences which exist in this may be seen in Figs. 1 to 12, in which the sections of various blast furnaces are represented.

Either these changes are made to suit the different processes and the diverse natures of the raw materials, or else the different forms have been brought about by the absence of any well known rules. In some instances the latter deficiency is easily seen; and so various are the forms employed, that we cannot attach much importance to uniformity in these structures.

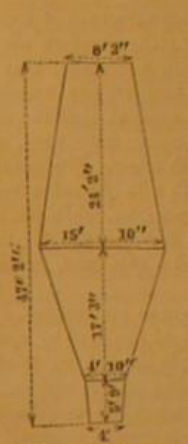


Fig. 4. Capacity 4,580 cubic feet. Niddsdale, Scotland.

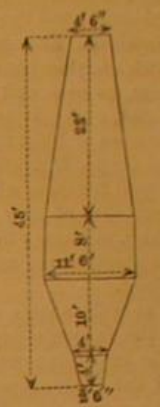


Fig. 5. Capacity 2,600 cubic feet. Madeley Wood, Shropshire, Eng.

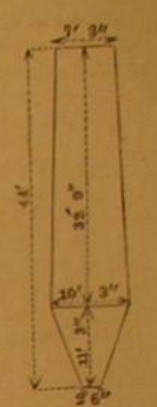


Fig. 6. Capacity 2,300 cubic feet. Low Moor, Yorkshire, England.

The hight of the shaft is, in charcoal furnaces, from thirty to forty feet, and in stone coal and coke furnaces, from forty to fifty feet, rarely more or less. Higher shafts are especially suitable for fuel (with the exception of anthracite) requiring a strong blast, for uncalcined and refractory ores and for unburned limestone; this is owing to the fact that the heat is better utilized in a tall furnace. Yet there is a certain limit to the hight, because (1) the materials forming the lower courses would be weakened by the superincumbent weight, and (2) on account of the resistance which a high column offers to the passage of blast and gases, a sort of

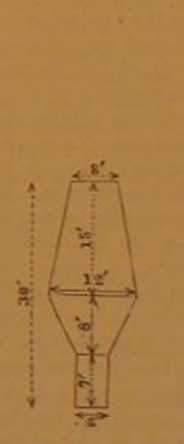


Fig. 7. Capacity 3,440 cubic feet. Muirkirk, Scotland.

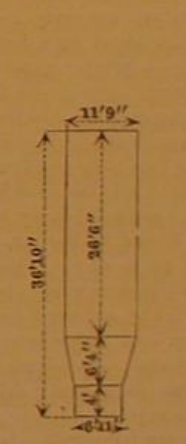


Fig. 8. Capacity 4,211 cubic feet. Königshütte, Upper Silesia.

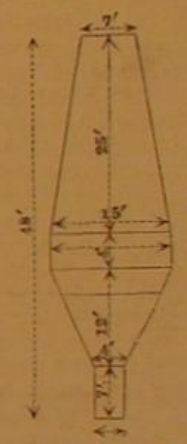


Fig. 9. Capacity 1,720 cubic feet. Watney's anthracite furnace, South Wales.

back pressure. Hence, in order to increase the capacity of a furnace, it is preferable to increase the width rather than the hight. The diameter of the furnace at its belly, or widest part, is from one fifth to one third of the entire hight of the stack; in charcoal furnaces it is from five to eight feet, in coke furnaces, from ten to sixteen feet, or even more; and the belly is set higher or deeper in the length of the shaft according to the time which the materials require to be subjected to heat before smelting, and according to the pressure of the blast. In recent times, the belly or largest part has often been constructed in a cylindrical form, or in a slightly bent curve.

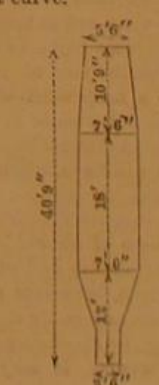


Fig. 10. Capacity 1,384 cubic feet. Charcoal blast furnace, Kärna, Sweden.

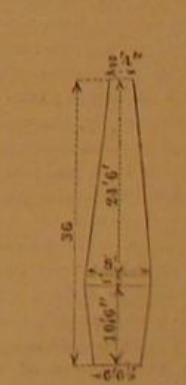


Fig. 11. Capacity 1,000 cubic feet. Charcoal blast furnace, Eisenerz, Styria.

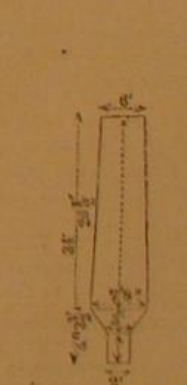


Fig. 12. Capacity 1,067 cubic feet. Charcoal furnace, Rothehüth, Hartz Mountains.

The diameter of the stack at the top varies from one third to three fourths of the diameter at the belly. In small charcoal furnaces, it is often not more than three feet, while in coke furnaces, it may be twelve feet or more. In general, it is considered advantageous to use wider tops than was formerly the practice; in the Hartz and in Sweden, the change has done excellent service. By narrowing the tops, the rate of outflow, as well as the tension, of the ascending gases is increased, and the heat is also drawn more to the point of exit; in consequence thereof, a part of the fuel is consumed where it is entirely wasted, and ores as well as fuel are not sufficiently prepared. This is especially objectionable where

refractory unroasted ores, poor fuel, and crude fluxes are used. Another drawback is that the narrow exits facilitate unequal sinking of the charge and prevent a quick combustion. Baranzoff, Truran, and more recently Rachette, have widened the top of the stacks so much that the dimensions of the furnace, contrary to the form generally in use, gradually increase from the base upwards; but how this extraordinary construction can be of use is a question which has called forth various views, and which can only finally be settled by practical experience.

For easily fusible charges and the manufacture of a white pig iron, free from silicon. Tunner still considers narrow tops, narrow belly, and a wide hearth, necessary, that the gases may reach the tension and temperature necessary for the reduction of the ores. It is evident that the capacity and daily production of blast furnaces must vary, with their dimensions and forms, from each other. For instance, there are small charcoal furnaces with a daily production of scarcely two and a half tuns of gray pig iron, while the coke furnace of A. Schneider, at Barrow in Furness (Fig. 1.), turns out daily as much as ninety-seven and a half tuns, the maximum thus far obtained.

Boshes deviating at wide angles are to be avoided. Although facilitating the carbonization of the iron by retarding the descent of the intervals towards the hearth, it often occurs that a part of the charge remains on the boshes, unaffected by the heat; but with steep boshes the charges sink more rapidly and uniformly, and smelt sooner, especially if coke and a hot blast are employed.

The construction of the hearth, or that part of the furnace in which the carbonized iron is brought to a liquid, is of essential importance, as on it depends the quantity as well as the quality of the pig iron produced; and it must be adapted to the nature of the materials as well as to the blast, and in proper proportion to the capacity of the boshes. Narrow and high hearths concentrate the heat more than wide ones, hence they are especially used in smelting gray cast iron and difficultly reducible ores, and with light coal and weak blast; while wide and low hearths are found to be more suitable for white pig, readily fusible and easily reducible ores, dense coal, and strong blast. As the charges fall more rapidly in the latter, they are used wherever a large production is needed, the temperature necessary for the production of gray pig being brought about by a hot and concentrated blast, and by the use of a greater quantity of fuel, in case the ores need the addition. The hearth is generally of a circular, square, or oblong section, and it widens towards the top; and, as already mentioned, it is either free of access or is built solid, in which case only the four arches leading to the tweer and the side where the door is remain open. In the first instance, the hearth is easily accessible in case of repairs, and it can be cooled by the air, which is desirable, for it has, of all the parts of the furnace, to endure the greatest heat, and hence is most subject to destruction. Cooling is sometimes effected by surrounding its sides as well as the boshes with hollow iron water boxes, through which a current of water circulates; sometimes the sides are kept merely moist on the outside by slowly dripping water. However, such a protection requires a larger quantity of coal for maintaining the necessary temperature in the interior of the furnace, and is likely to cause explosion if the water, by accident, penetrate through into the melting mass.

In many furnaces, especially in those for making white pig, a hearth is not used; and other conditions being equal, the temperature in the melting zone is thus decreased; the boshes are here made steeper and the belly higher up the shaft. We find this construction especially in many blast furnaces in Wales and Scotland, using ores found in the coal formation; and sometimes also in the furnaces of Styria, which use readily fusible spathic ores and brown iron ores.

TO TRAIN FUCHSIAS.—When a slip has grown six or eight inches high, nip out the top down to the last set of leaves; it will then throw out branches on each side. Let these grow eight or ten inches; then nip them out as before; the tops of each branch, when grown the same hight as the others, nip out again; then procure a stick the size of your finger, eighteen inches in length; take a hoop skirt wire, twine back and forth alternately, through holes made in the stick equal distances apart; place this firmly in the pot back of the plant, tie the branches to it, and you will have, when in flower, a beautiful and very graceful plant.

AMMONIA FOR VERBENAS.—The sulphate of ammonia is an excellent manurial liquid to apply to verbenas and other flowers, giving to the foliage a dark green, luxuriant and healthy appearance. It is economical, clean and easily applied. Prepare it in the evening before using, by dissolving one ounce of ammonia in two gallons of water. It may be applied with safety about once a week.

A FISH, 3½ feet long, with a slender eel-like body and a large head with a mouth like a crocodile's, has been brought to San Francisco, says the *Mining and Scientific Press*. The teeth are sharp and transparent, sloping backwards from the jaws. Immediately back of the head commences a large wing-like fin, about six inches high when erect, which runs the length of the back. The fish was found dead at Humboldt Bay, and is preserved in alcohol.

AN old lady said to her sons: "Boys, don't you ever spekerlate or wait for something to turn up. You might as well go and sit down on a stone in the middle of a medder, with a pail twixt your legs, and wait for a cow to back up to you to be milked."

Correspondence.

Working Steam Expansively.

To the Editor of the Scientific American:

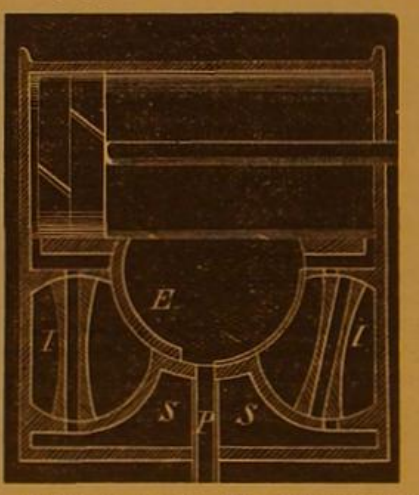
I have a few ideas in regard to steam engine economy which I wish to be made public through the columns of your valuable paper.

There are but few, if any, steam engines in use that utilize the full expansive force of the steam; nearly all use steam expansively to some extent, but in most cases there is but a small percentage of its force utilized. For the purpose of showing the great waste of power in nearly all of our machine shops, manufacturing establishments, saw mills, etc., I submit the following table, showing the comparative power of engines using the same amount of steam, steam pressure at 100 lbs. and an engine cutting off at full stroke being taken as giving a unit of power:

Cutting off at	full stroke	will develope	1	unit of force.
" "	¾	" "	1·13	" "
" "	½	" "	1·28	" "
" "	⅜	" "	1·40	" "
" "	¼	" "	1·71	" "
" "	⅛	" "	2·23	" "
" "	1/16	" "	2·71	" "
" "	1/32	" "	3·60	" "
" "	1/64	" "	4·48	" "

An engine cutting off at less than one eighth of its stroke will not utilize as much force as an engine cutting off at one eighth of its stroke, as steam at 100 lbs. pressure, expanded into more than eight times its volume, will be at less than atmospheric pressure.

In a common slide valve engine, the pressure on the valve and the imperfection of the exhaust render it impracticable to cut off at less than two thirds or three quarters of the stroke. Now, if we can have the induction and exhaust valves independent of each other, we may change the cut-off without deranging the exhaust. The engraving represents a vertical section of the interior working parts of such an engine. I I represent the induction valves, and E the escape. The valve at the left being open, the steam passes from the steam chest, S S, through the valve to the cylinder, and the escape, being open on the other side, allows the steam to pass from the other end of the cylinder, through the valve, E, and the escape pipe, P. The valves move in orbits, and



hence the motions are rotary. The valves are moved, but the width of the port thus reduces the friction. There is but a portion of the valve (equal to the area of the port) exposed to steam pressure, and this is partially balanced by the pressure on the same amount of surface from the cylinder. Now if by a certain mechanism the induction valves may be made to open and cut off at one eighth, one sixth, one quarter, or one half of the stroke, and the escape remain open during the whole of the stroke, would there not be a great increase of power? I have a mechanism by which these ends may be accomplished. I have written this for the purpose of eliciting the criticism of some one of experience, as my knowledge is wholly theoretical. C. H. C.

REMARKS BY THE EDITOR:—Our correspondent has fallen into an error, which has already led to the fruitless expenditure of vast amounts of time, thought, and money. Although his statement of the relative powers developed by steam of the different degrees of expansion noted is, in the abstract, correct, he would find (were he to test the matter experimentally, as has already been done by others) that in practice the anticipated economy never follows the use of highly expanded steam. Losses by radiation of heat, by leakage, and above all by internal condensation, become far greater in proportion to the quantity of steam used, where great expansion occurs, than with steam "following" further, and these losses do not enter into his account. They are so great, finally, that there is soon reached a limit, in ordinary engines, beyond which no gain results from further expansion. Chief Engineer Isherwood, of the U. S. Navy, in whose ability and accuracy as an experimenter we have the greatest confidence, although differing widely with him in our deductions from his recorded results, found that the maximum economy, in the ordinary marine engine, occurred with the cut off at about four tenths the length of stroke, and this conclusion was confirmed by later experiment. With jacketed cylinders, higher piston speed, and higher steam pressure, a shorter cut-off is allowable, and great economy is realized, as is seen in the "compound" or "double cylinder" engines now so rapidly coming into use.

Our correspondent, were he to build his engine, would therefore be likely to find himself sadly disappointed in the result expected from a short cut-off. Again, the best engines in the market, if of sufficiently large size to justify the expense of such valve gear, are now invariably provided with independent steam and exhaust valves, and are capable of expanding to any desired extent. In first class engines, the point of cut-off is adjusted by the governor, a requisite which has escaped the attention of our correspondent.

The most intelligent, practical, and best educated engineers in the country have been studying the use of steam for many years, and are now far ahead of our correspondent in both theory and practice. They understand the requisites of economy and the methods of securing it, and, as a consequence, the American stationary engine leads the world, and is copied by all the most enterprising builders of Great Britain and the continent of Europe.

A Pennsylvania Gas Well.

To the Editor of the Scientific American:

I wish to give you some description of a gas well here in the Butler county oil fields. It is situated about two miles from the village of Fairview, and was drilled last June in search of oil. It was put to the depth of 1,200 feet and was abandoned on account of a strong flow of salt water and gas; so much came out that the boiler that made the steam had to be moved to a distance of 25 rods. After the well had been abandoned about two months, the pressure of gas became so strong that it forced the water entirely out of the hole, and last fall a company was formed here to utilize the gas, which was done by bringing it through 3½ inch pipe here to Fairview and thence to Petrolia, three miles from Fairview. The gas will be used to light and warm both places. I visited the well in company with two other gentlemen; the gas is taken out of the well through 3 inch pipes into an old fashioned two flued steam boiler; upon the boiler is placed a steam gage which indicates a steady pressure of 80 lbs. The boiler has also upon it two safety valves steadily blowing off, also a cock in the boiler of one inch in diameter open all the time. This well has also an escape through a 6 inch pipe, the noise of the escaping through which can be heard readily for a distance of two miles. I was told by a gentleman here that the main discharge was closed for a second of time, when the indicator on the steam gage instantly flew around to its utmost capacity, which is 250 pounds. This well is a great curiosity to the neighborhood. W. E. P.

Lens Fires.

To the Editor of the Scientific American:

On page 193 of the current volume of the SCIENTIFIC AMERICAN, appears an article on lens fires, which reminds me of an affair that was reported in the daily papers eighteen or twenty years ago; and believing the subject is entitled to more consideration than most people imagine, I send you the substance of the event alluded to.

A legal gentleman, in one of our large eastern cities, upon entering his office one summer morning, found the loose papers on his table just starting into a light flame, which surprised him greatly, as there was no fire in the room at that time, neither was it apparent how they could have ignited from any external cause, the windows being closed. This happened several mornings in succession, but one day he arrived at his office earlier than usual and succeeded in detecting the origin of the fire. Sitting at his table, he felt a burning sensation upon one of his hands, which gradually increased until it became insupportable; and on looking at the window through which the sun was shining, he noticed that one of the panes of glass had a bubble or flaw in it which served to concentrate the rays of light in the same manner as a burning glass, and with sufficient power to ignite paper in a few minutes. The dangerous pane was at once removed, and with it the cause of a "mysterious conflagration."

J. H. L.

Sugar Manufacture in the Sandwich Islands.

To the Editor of the Scientific American:

The sugar planters of the Sandwich islands have had, and many of them are now having, a hard struggle for life. Many of us had had no experience in the sugar business when we commenced our plantations; and what little knowledge we have now has been attained only at great expense and loss of time and material. I have received many valuable hints from your paper, and would like to see more upon the subject of plantation sugar making. My plant consists of 500 gallon clarifiers, precipitators, an open train, a steam leach and a vacuum pan. I want to know how best to apply sulphurous acid gas to the cane juice in order to check fermentation and bleach the sugar. Also, whether sulphate of baryta is used for precipitating the dirt in the cane juice? If so, how should it be applied, and in what quantity?

S. L. AUSTIN.

Onomea Plantation, District of Hilo, Hawaii, Sandwich Islands.

Low Water in Steam Boilers.

To the Editor of the Scientific American:

Reading the many articles in your paper on boiler explosions, and especially on the low water question, I venture to give my views and experience which, perhaps, may benefit some of your readers. I once attempted to raise steam and pump up a two flue 40 inch boiler with water only just up to bottom of the flues; but before I got 15 lbs. steam, I heard a report like a pistol shot; and on looking under the boiler, I saw the third sheet cracked from about two inches below the water, running up about a foot, and the water squirting out like a saw blade. The sheets were not overheated, for I had fired very slowly and carefully. I claim that it was caused by the expansion of the flues. I think that a boiler,

with water enough in it to protect any considerable part of it and yet let the flues become hot, must be subjected to a strain sufficient to open any weak places in it without the aid of internal pressure.

I am now running a boiler, similar to the one above referred to. The feed water enters through an ordinary stand pipe, near the back end. The engineer let the water get low and then crowded on the pump. The result was that one of the flues cracked for about 4 inches across its bottom just where the feed water strikes it. A boiler maker repaired it by putting on a soft patch, that is, a plate screwed on with red lead under it and it does very well. But on one occasion since, the water was low again, and it leaked as at first, but the pump was kept going, and when the flues were covered it stopped. These cases, and others of the same nature which I have known to occur, lead me to believe that a large per cent of explosions are due to expansion.

East Pascaquola, Miss. P. BERGER.

Discriminating Flax and Cotton Fibers.

To the Editor of the Scientific American:

On page 194 of your current volume, Mr. C. R. Stodder says: "No chemical tests are known to distinguish flax from cotton fiber." Allow me to refer Mr. Stodder to the SCIENTIFIC AMERICAN, Vol. XIII, No. 3. "These two fibers are distinguished by rosanilin, or fuchsin. Loosen one end of a piece of linen so as to separate the woof and warp, and dip it into an alcoholic solution of fuchsin; wash in water as long as it colors the water, and then put it in weak ammonia. The ammonia will discharge the fuchsin from the cotton fiber but not from the flax, so that the cotton thread will become nearly white, while the flax retains its red color." This is Böttger's test. H. M. WILDER.

Philadelphia, Pa.

AMERICAN LOCOMOTIVES.—THE BALDWIN WORKS.

Let a man stand beside a railway when an express train thunders past at forty miles an hour, with its ten or twelve heavy coaches and sleeping cars; and, if he does not feel mingled sentiments of awe and admiration, he must be very unimpressible. Grade or level, straight line or curve, all are alike; it whirls over one and round the other, never ceasing in its energy for a moment.

The modern locomotive is truly the most wonderful of all man's inventions; and though many may gainsay this, and point to another triumph of ingenuity as its peer, we think, when all its complex parts and the functions they are called on to discharge under trying circumstances are considered, the locomotive engine will stand out as one of the greatest of man's works. It is not alone required that it shall be powerful and capable of drawing great loads, but it must be enduring; it must adapt itself to the work required of it; it must be rigid and yet capable of a certain flexibility in its parts. It must ride on its springs and yet hold firmly on the track; its driving machinery must be permanently attached to its boiler and yet in a certain sense entirely independent of it; and the whole of the vast machine, although exercising the most varied and opposite powers, must be so designed as to work harmoniously together. One end of it—the furnace—generates the most intense heat while the other end is comparatively cool. One half, so to speak, the boiler, is undergoing tremendous internal and external pressure from the force of expansion and the steam within it, while the other portions have no strain whatever, except when in actual operation. When it is in operation, suddenly the driving machinery is called upon to not only carry and withstand the burthen of the boiler and its duties, but to transmit force in an entirely different direction; to do it economically and constantly, in all temperatures and all atmospheric changes; through dust and drought, and at a velocity of twenty or forty miles an hour as the case may be. It has not only to withstand its own internal forces, which tend to derange it, but also encounter others which it would seem impossible to provide against. Think of a mass of intricate machinery, thirty tuns in weight, in motion all over, hurled at the rate of forty miles an hour over the face of the country, and then consider whether our claim is extravagant.

If such a specification as the foregoing were handed to an inventor at the present day, and he were requested to provide a machine to comply with the conditions, he might be pardoned for some incredulity as to the sanity of the man who drew it. It is a thing of slow growth, the modern locomotive.

From the rude germ of the first high pressure boiler and engine mounted on wheels has sprung, piece by piece and detail by detail, the present magnificent and wonderful machine, a piece of mechanism, capable of drawing—in the case of the heaviest machines fifty tun engines—forty times its own weight. Without apostrophizing the locomotive further, let us look into a modern locomotive shop—the largest of its kind in the country—and see what is being done there, and follow hastily the details necessary to produce such machines.

The Baldwin Locomotive Works of Philadelphia has a world-wide reputation for its engines; and, being recently in that city, we were accorded permission to visit them. The concern has been in existence nearly forty years, and in that time has built engines for nearly all quarters of the civilized globe. At the present time the average rate of production is nine complete engines per week. Of these, some are for home use and some for foreign countries, but the essential character of them remains the same. All are built according to well known plans and specifications, such as have been proven and found reliable. Respecting those for foreign countries, the works are now just finishing a number for Russia, which are of the usual American type of wood burning engines. Some months ago the company sent a number of engines to Russia to show engineers in that country how to use their anthracite coal, of which large veins exist in the southern part. Until the advent of these machines, the Russian capitalists had become quite skeptical as to the possibility of utilizing the coal, for their own mechanics had essayed the solution of the problem in every conceivable type of boiler and grate, only to abandon them all. The intense heat generated burned out all their appliances, and it remained for American engineers to put the American locomotive in successful operation. The result is that large orders may be in time expected from the country, and it is to be hoped that the Baldwin Works, who, if we are not in error, were the pioneers in this enterprise, will reap some profit, the first venture being quite unprofitable. The Russian mechanics were so dilatory and slow to comprehend that a force had to be sent out from the Baldwin Works to erect the machines and put them in operation.

Of course, in making such a number of engines as these works turn out—over 450 annually—the greatest exactness and rigid attention to system must be observed, else all would be confusion. Therefore, as the first step toward getting machines under way, systems of "cards" or specifications are provided for the guidance of the foremen in charge of the several departments. For example, the superintendents, or parties immediately in charge, decide that engines of such a type must be ready on the 20th day of May. Immediately upon this decision, the schedule for so many crossheads, so many feed pumps, so many guide bars, rocker arms, links and reverse levers is made out and handed to the foremen in charge of the shops where these parts are made, and the date is mentioned when they are to be delivered to the company—say for April 5th. The same plan is observed with all the other details, parts, and appurtenances; and it is found to work harmoniously and satisfactory. It has the great merit of reducing every foreman to his own place, or, more properly, of confining his attention to his own affairs. It will readily be seen that the foreman knows nothing as to whether the parts he makes are needed now or next year, but that all he has to do is to make them out of the material furnished. He cannot say, as some might: "Why, they don't want these now; the boiler ain't made yet," and then give his attention to what he thought most satisfactory; but he does the work he came to do, and leaves the direction of it to the persons who undertook that department. This is really the secret, if it is a secret, of the possibility of making nine or more engines per week. Without it the other vast capabilities of the works would go for nothing.

The usual routine of machine work is so well known and familiar that we shall not attempt to describe any "ponderous shears that bite cold iron as a cat does cheese." These and kindred machines have no especial novelty in them, but there are some points about the system employed in duplicating work which are worthy of attention. A routine similar to that observed in the manufacture of sewing machines and pistols is practiced wherever possible. For example: All engines of a certain type have their details exactly alike. For such machines a system of "jigs," or cast iron frames, are provided, which have holes in them wherever the part under execution at the time should have them. These jigs are, therefore, merely bolted on to the rough casting—the crosshead for example—and the drill operated through the hole in the jig. There is no marking off or "laying out," and no possibility of making any mistakes. Similarly in regard to the jaws of the crosshead. A gage or templet is put over the end, clamped in its place, the whole put into the planer together, and the surfaces reduced until the tool comes down to the gage. In this way, or by this plan, the matter of executing each piece exactly alike is reduced to a certainty. Every bolt, taper or straight, has its gage, merely a hole drilled in a block of cast iron, the exact length of the part the bolt goes into. Men don't run up and down stairs in the Baldwin Locomotive Works, trying bolts in holes in the frames, so anxious to make a good fit of them that they fail after all; but they save their own shoe leather and the company's time, and fit the bolts to the gages on their lathes; if they are right by them, they fit the holes the rimmers make.

"So all things work together for good." All things that possibly can be, are tested before they leave the works. The pumps, on which so much depends and which have so much to perform, are all tried before they are attached to see if their joints are perfect. Nothing is left to chance. Everything is looked after and seen to, and nothing is left to supposition. As our informant, Dr. Williams, remarked: "We can't run on reputation one day; we try every day to do better work than the day before." And he is right. A locomotive is a machine which will not build itself or run itself, but if not carefully made will soon show it in all its parts.

We specially noticed the boilers in these works, and can testify to their excellent and thorough construction. Every one is caulked inside as well as out, and we noticed, as we passed through the works, one man caulking the rivet heads in the bottom of the firebox frame. The engines made by this company are all "outside connected," that is to say, the cylinders are outside of the frames. This practice is exclusively American in its universal application for all kinds of traffic, and seems well adapted to our wants. It is safe to say there are no inside connected engines built in the country today.

Also it is interesting to note how opinions vary with experience gained. In 1838 a locomotive with cylinders 12½ × 16, weighing, loaded, 26,000 lbs., was believed to be as heavy as would be needed! It causes a tendency to smile now, in the mind of a railway man, to note this and the weights of even switching engines. The heaviest engines the Baldwin Locomotive Works build are sent to South America, or, rather, the railways of that country demand the heaviest, which have cylinders 20 inches diameter and 24 inches stroke. They have four pairs of drivers of 48 inches diameter, and a total wheel base of 21 feet 10 inches. The weight on drivers is 87,000 lbs. and about 9,000 lbs. on the pony truck, the total weight being 96,000 lbs. An engine of this class will draw 2,000 tuns, gross, on a level, beside itself and tender, and they have in actual use taken 150 gross tuns of cars and load up a grade of 145 feet to the mile, with sharp curves, at a speed of ten miles an hour and with a steam pressure of 110 lbs.; also 268 gross tuns and load up a grade of 116 feet to the mile with 120 lbs. steam and at a speed of one mile in 7½ minutes. Engines of this class can run around curves of 400 feet radius, and even less.

The force employed in these works now amounts to 2,800 men of all trades. The pay roll will average $14 per head.

It is also interesting to note that, where American engines are brought in competition with foreign ones, they are at once able to prove their superiority, not only in point of workmanship, but in design and practical working. Many instances might be cited of the truth of this assertion, but we content ourselves with only one, the Dom Pedro Railway of South America, where both English and American machines were employed, but the latter proved so superior that none others have been bought since 1863.

The thinker may well ask: "What becomes of all the locomotives?" There is one factory in Philadelphia which makes 450 annually. There are three more factories in Paterson, N. J., which do not turn out less than 500 more. At Taunton, Mass., there are two which may make 200 more. One in Boston produces, or could produce, 200 more, and one in Manchester, N. H., 200 more; in Providence, R. I., 200 more; in Schenectady, N. Y., 200 more: to say nothing of smaller concerns scattered all over the country, and the repair shops of the railways, which also make no small proportion of their own work—an average of at least 1,500 locomotives turned out yearly from the shops alone.

Preparation of Sewage and Stable Refuse.

Millions of dollars worth of valuable material yearly finds its way, from the sewers of our great cities, into the sea, serving no purpose except to contaminate adjacent waters, while sums, equally large, are expended by agriculturists for the regeneration of worn out soil by artificial fertilization. The collection of sewage presents no special points of difficulty, but its transportation to desired points is by no means readily accomplished. For this purpose an effective plan is greatly needed. One system, which we believe has recently been made the subject of a patent, consists in compressing the manure into cakes with dry peat, and covering the mass with soft clay or equivalent substance to prevent fermentation and evaporation. The idea seems to be a feasible one, though we have no record of its being successfully put in practice.

Other patents have been granted for the preparing and baling of stable manure. This substance, in order to prevent its otherwise too large accumulation, it is necessary to remove from city stables before the straw contained in it is in a sufficiently decayed state for fertilizing purposes. Consequently, the straw must be got rid of, and as it can be utilized for bedding for horses, or for the manufacture of coarse varieties of paper, it is suggested to winnow it out of the mass by means of a suitable machine. Then the residuum is compressed so as to exclude the air, to which the heat and steam of manure is due; and finally the whole is covered with a coating of clay, plaster, or cement. Handles of wisps of straw for convenience in carrying and packing may be compressed with and so attached to the bale. The cakes can thus be readily stored in vessels with sufficient air space between them to obviate all danger of heating, while the use of forks and shovels is necessarily avoided.

Edible Earths.

Dr. C. Schmidt has made analyses of the comestible earths of Lapland and Persia. One hundred parts of the substance obtained on the coasts of the White Sea have been found to contain

Water, left at 100°	0·269
Water, left at red heat	0·835
Aluminum	40·797
Oxide of iron	0·310
Magnesium	0·618
Lime	traces.
Soda	1·829
Potassium	9·845
Silicic acid, traces of fluorine, loss, etc.	45·506

The inhabitants of the country mix this earth with the flour from which they make their bread.

The edible earth found in Persia, and termed Gheli-Giveh, contains

Carbonate of magnesium	66·963
Carbonate of lime	23·634
Chloride of sodium	3·542
Sulphate of soda	0·298
Carbonate of soda	0·598
Hydrated magnesia	1·311
Oxide of iron	0·092
Aluminum	0·227
Silicic acid	0·765
Water combined at 120°	1·153
Water	1·423

ANTHRACEMINE.—This new base is one of the products of the action of nitric acid on anthracene. It appears as a very pale yellow pulverulent body, forming soluble and crystallizable salts with hydrochloric and sulphuric acids. Its composition is C_{28} H_{11} N.

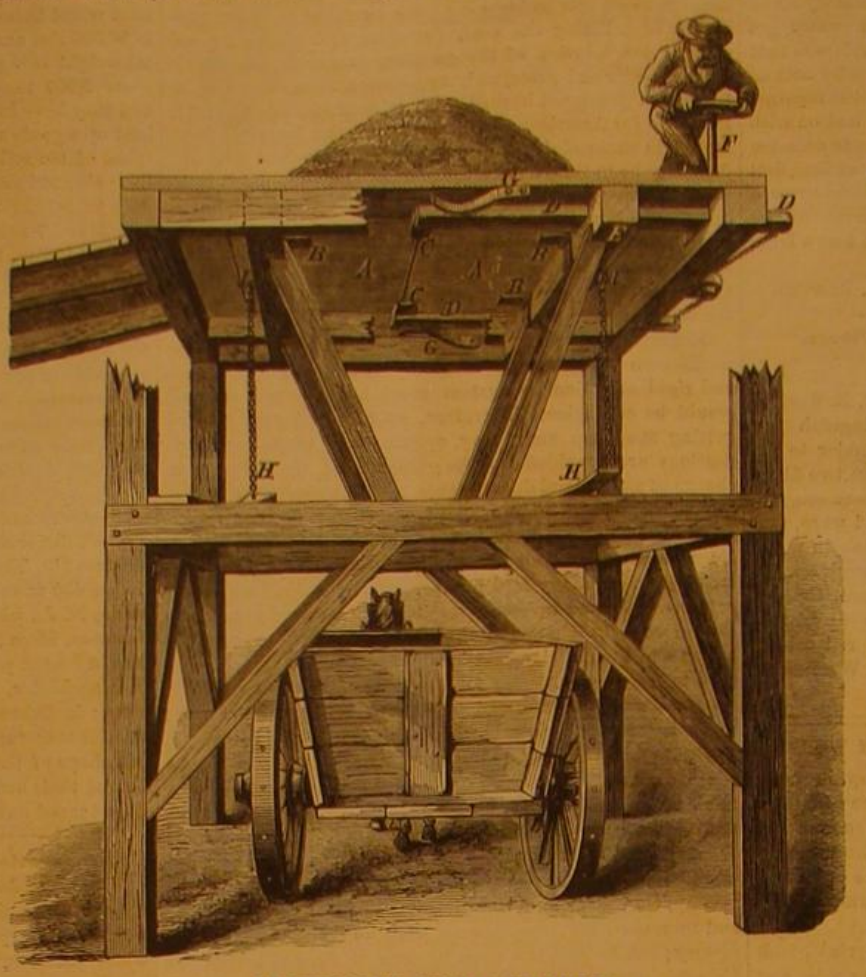
CART LOADER.

The object of the invention represented in our engraving is to obviate the hand labor of throwing the earth removed in grading down hills, excavating cellars, or making roads, into carts or wagons, and to substitute therefor a convenient means of discharging the scrapers or other first receptacles directly into the vehicle.

The frame of the device is of wood, and portions are broken away in the drawing to show parts otherwise obscured. A A are two trap doors in the upper platform, which are hinged at B, and which, when horizontal, are supported by props, C C. These props are attached to levers, D D, which are pivoted at E. To the outer ends of the levers are fastened chains which communicate with an upright shaft, F, surmounted by a hand wheel. G G are springs pressing against the levers, D, and serving to hold the props under the trap doors.

The earth is transported to the upper platform and then dumped, and the receiving cart is placed directly under the doors. The operator then turns the hand wheel so as to wind the chain around the shaft, F, thereby pulling aside the props, C. The weight of the load then pushes down the doors, falls through, and is deposited in the cart. The doors are then returned to their place by the action of the springs, H, through the chains attached to them, at I, and are thus kept closed unless opened by a superincumbent weight. As soon as the chains are removed from the shaft, F, the props will be re-applied under the doors by the springs, D. Any convenient means may be employed to transport the load to the upper platform, either by wheelbarrows or through suitable machinery.

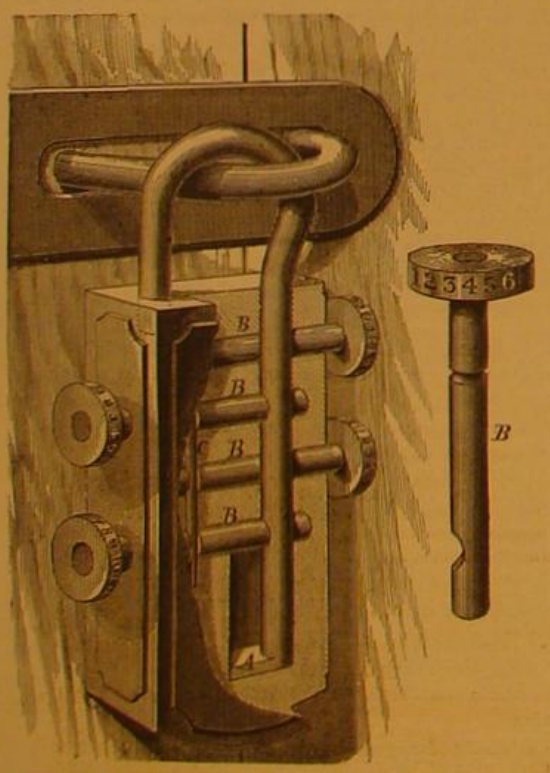
Patented through the Scientific American Patent Agency, February 11, 1873. For further information address the inventor, Mr. Jesse Atkinson, Cameron, Milam county, Texas.



ATKINSON'S CART LOADER.

COMBINATION PADLOCK.

Mr. Joseph Kittle, of East Bend, N. C., is the inventor of the new combination padlock, represented in our illustration. The device consists in a box and staple, the latter made with arms of unequal length, as shown. Upon the end of the long arm is formed a toe, A, which works in a recess in the body to prevent the staple being drawn out any further than is necessary to allow the short arm to be passed through the thing to be locked. B B are a number of rods which are inserted in transverse holes in the box in which they are swiveled in the vertical piece, C. In the side of the long arm of the staple, at points where it crosses the rods, B, when it is pushed in, are formed semicircular notches, which correspond with similar indentations in said rods.



When all the rods are turned so that their notches are toward the long arm, the staple is unlocked and may be readily drawn out as far as the toe, A, will permit. This, however, cannot be done unless the operator knows how to make the proper adjustment, for it is evident that unless each rod is placed in exactly the proper position, the staple will continue to be held. To afford a means of indication, a disk marked with numbers or letters is attached to the outer end of each rod, by turning which, so as to bring one of the marks which is opposite the notch in a previously known position, the rod may be correctly placed.

Patented through the Scientific American Patent Agency, Feb. 18, 1873.

A Lightning Catastrophe.

J. P. says: "The strangest effect of lightning that ever fell under my observation happened on March 31, 1873. About 4 P. M., the sky was covered with broken and detached clouds, somewhat charged with electricity, giving off occasionally what I will call randon shots, sounding like the firing of cannon; a few drops of rain fell at the time. I was walking in the field with a bundle of small apple trees under my arm, when a vivid flash of lightning occurred, producing, as I thought, a rattling noise on the twigs of the trees under my arm. I turned round, but saw nothing unusual. In a few seconds a heavy report of thunder took place from about a quarter of a mile distance, passing over head near to where I stood, but so high that I was quite sure it did not come to the ground. I was soon called to come to the house; when I got there I found a colored man, in my employ, in a kneeling position on the ground and unable to stand up. From him I learned that, when the flash took place, he was walking through the yard near a large spreading elm with a wooden pail (with iron hoops and a wire bale) filled with water in his left hand. He felt a strange sensation, and staggered round in a circle; unable to let go of the pail, he found that his fingers would not open. All this took place before the report. He staggered along for about twenty steps, and then set down his vessel he knew not how. His left side received the heaviest part of the shock; he was not able to work the remainder of the day, but next morning he had nearly recovered. From the observations of myself and others, it is clear that the electricity did not come to the earth. Am I right in supposing that there were currents of electricity ascending from the earth to the clouds, and that this man had become charged with the same and consequently received a shock when it left him? A similar thing has happened to others in cases when the lightning struck. Is it the case that ascending currents are active when lightning strikes the earth?"

The Canal Navigation Problem.

E. B. says: In your article on canal navigation, volume XXVIII, page 97, you speak of the desirability of improvements in the manner of working boats. I would suggest that the main propelling power be exerted by the screw in the stern, but that two smaller screws be placed at the bows working independently. By working one of the bow screws, faster than the other, or by working one forward and the other backward, the boat may be readily turned. Boats should certainly follow each other in trains when possible, as a dozen boats in a train would meet with very much less resistance than as many singly.

Water Lined Cupolas.

E. T. S. states that cupola furnaces with water linings have been used in California for smelting ores of the carbonate and oxide of copper with very economical results; but the decline in the price of copper put a stop to the business. The furnaces would slag up about four inches thick and remain so, requiring no other lining; and very little steam was made, except above the melted part of the charge.

MONSTER CANNON.—Herr Krupp is to send to Vienna two cannons, which are the largest yet produced at his factory. Both are of bronze; one is 22·1 feet deep, interiorly, 4·8 feet in diameter, and weighs 41·8 tuns; and the other is 13·2 feet in length, 4·9 feet in diameter, and weighs 50·5 tuns.

Colored Dresses—An Item for the Ladies.

It is not often that we find scientific items of any especial degree of interest to the members of the fair sex who may, perchance, glance over our pages; but now we believe we have got one which must be simply absorbing. Probably, madame or miss, you are the possessor of a summer dress, made from some white diaphanous material; and it may also be imagined that during your shopping you have inspected goods of similar nature, only of varying colors, from which you have purchased sufficient material to construct a number of those bewildering garments, in comparison with the intricacies of which the most elaborate works of modern engineering furnish no parallel. Now, a learned German professor has invented a plan whereby your single white dress may be changed as often as you desire to any color you may fancy, and this in your own laundry, so that hereafter the money which you would devote to several robes of varying hues may be entirely saved, while you may appear daily, if you choose, in toilettes of totally different complexion.

The process is very simple, and consists in merely coloring the starch used in the "doing up." Suppose a white dress is to be tinted a beautiful crimson: three parts of fuchsin, an aniline color which any chemist can readily procure for you, are dissolved in twenty parts of glycerin, and mixed in a mortar with a little water. Then ordinary starch, finely pulverized, is stirred in, and the thick mass obtained is poured out and dried on blotting paper. The powder thus obtained is used just the same as common starch, and so applied to the fabric. When the latter is dry, it is slightly sprinkled and pressed with a moderately warm iron.

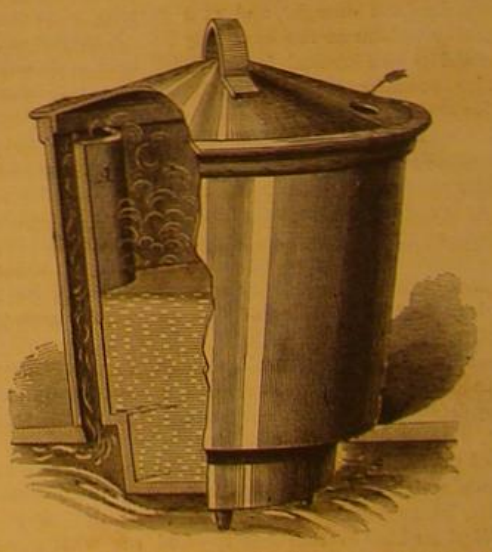
By means of other coloring materials, mixed as above described, any desired tint may be obtained. We should counsel, however, an avoidance of damp localities, and strongly deprecate going out in the rain, as we doubt the "fastness" of the dye, and would not be at all surprised to behold the garment shortly assume a rather streaked and zebra-like appearance.

Noisy Sewing Machines.

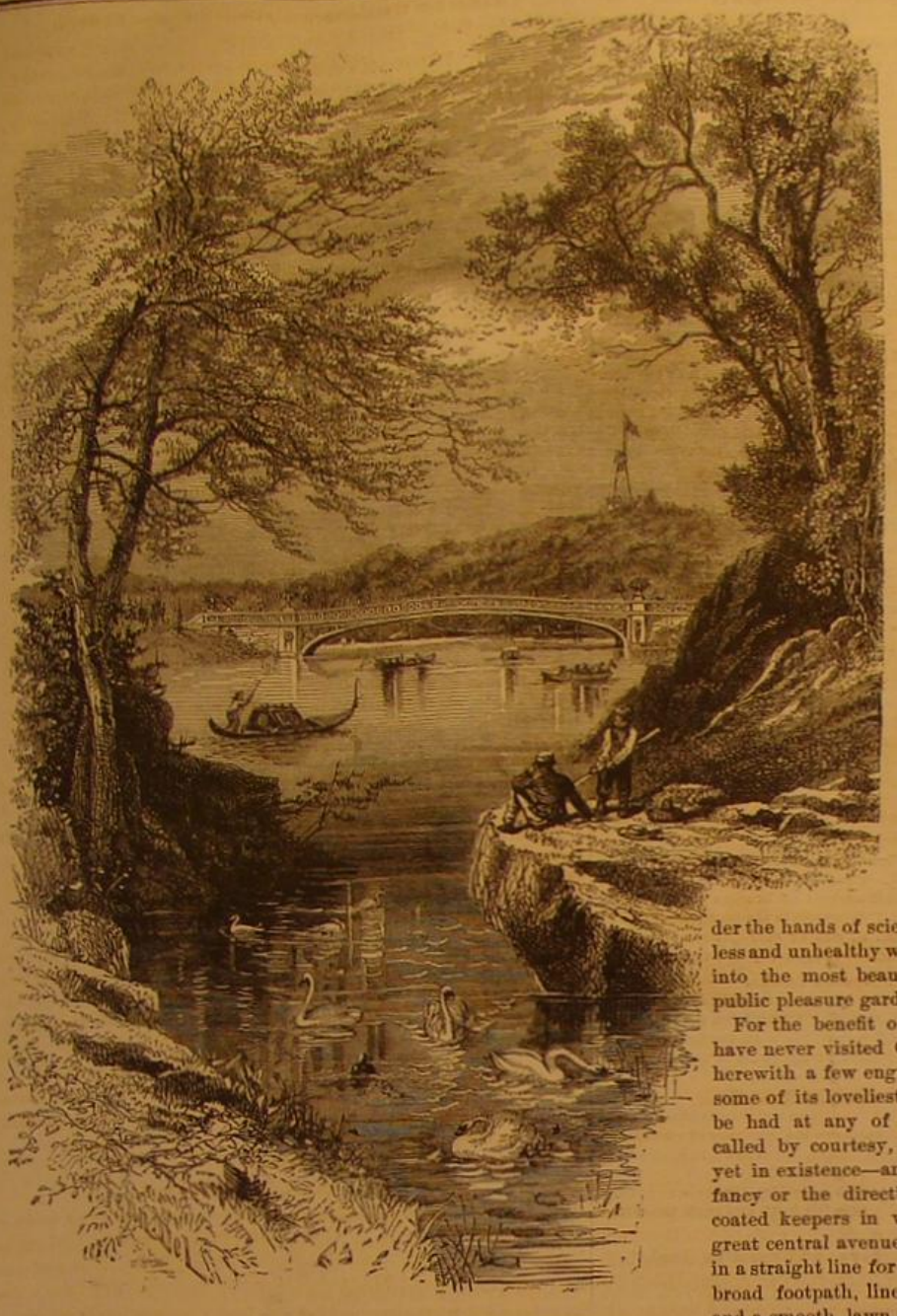
A. C. B. sends the following hint to the owners of sewing machines: Having a Wheeler & Wilson, which I thought made more noise than necessary, although it is one of the most quiet, I examined it and found that one half the noise proceeded from the recoil of the feed works after making the stitch. In five minutes I filed a dovetail in the end of the feed and inserted a thin slip of soft wood, which entirely kills the sound. If any one else wishes to reduce the rattling of their sewing machines to a minimum, let him try my plan.

CULINARY BOILER.

Mr. Israel Kinney, of London, Canada, is the inventor of the novel form of culinary vessel represented in our illustration. The object sought is to provide a means of conducting away vapors arising from the cooking article, so that they will pass into the stove and up the chimney, and thus not be disseminated through the house. This is effected by casting the side wall of the pot with a vertical recess, extending down from the top to the bottom, following the offset made by the pit. The outer edges of the recess, down to the plane of the offset for the pit, are formed with flanges to receive a sheet metal slide, A, which closes the recess and preserves the circular form of the vessel, and at the same forms a flue. The vapors rising are drawn down through the latter, and thence into the stove. This improvement is applicable to all vessels used in cooking. Patented August 27, 1872.



SACCHARINE MATTER IN MUSHROOMS.—A. Muntz says that mushrooms yield a sirup, readily crystallizable, which presents all the properties of the sugar obtained from the manna of the East.



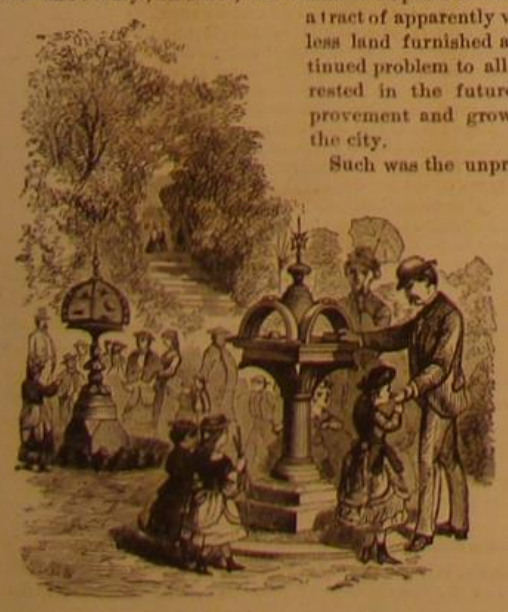
BOW BRIDGE, FROM THE NOOK ON THE SHORE OF THE LAKE, CENTRAL PARK, NEW YORK CITY.

It is not very many years since the central portion of Manhattan Island was a wilderness of swamp, relieved only by great masses of arid and jagged rock. The inhabitants, principally emigrants from the Emerald isle, lived in a state of primeval simplicity and dirt, in ricketty sheds and cabins, which at once did duty as dwelling houses and as stables for an occasional cow and innumerable pigs and goats. A more dreary and desolate neighborhood it would be difficult to find; pools of stagnant water bred myriads of mosquitoes, miasmatic diseases raged unchecked, vegetation was poor and scanty; in short, the ultimate disposal of so large a tract of apparently valueless land furnished a continued problem to all interested in the future improvement and growth of the city.



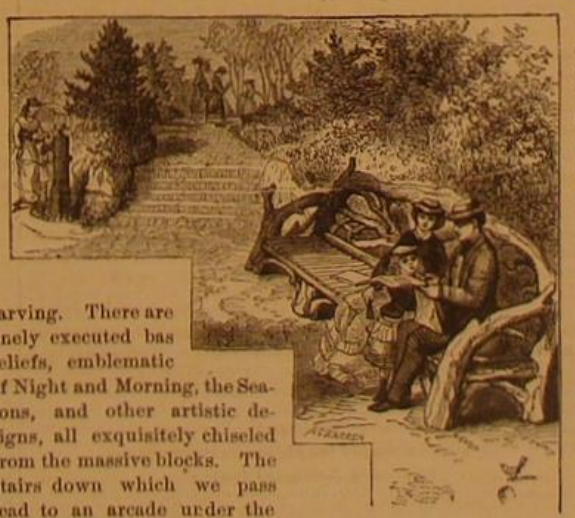
THE BOAT HOUSE.

Such was the unpromising material from which it was decided to produce a park which should rival the celebrated pleasure grounds of England, and overtop in magnificence the Parisian Bois de Boulogne. Engineers were engaged, the ground was surveyed, and the itinerant population driven from its fastnesses. For years an army of laborers made the great area, of 862 acres, a scene of continuous labor. Bogs and marshes were drained, beautiful lakes replaced fetid pools, substantial roads took the place of muddy cow paths, and graceful bridges were thrown across precipitous ravines. Then followed the landscape gardener, and the dry places became carpeted with velvety turf, the bare rocks covered with creeping vegetation; walks were laid out, trees and shrubs innumerable planted, rustic arbors of exquisite design built in romantic spots, and, finally, under the hands of science and of art, the valueless and unhealthy waste became transformed into the most beautiful, if not the largest, public pleasure garden in the world.



DRINKING FOUNTAIN AND BIRD CAGE

For the benefit of our many readers who have never visited Central Park, we present herewith a few engravings from sketches of some of its loveliest portions. Entrance can be had at any of the numerous gates—so called by courtesy, for no actual portals are yet in existence—and we can follow our own fancy or the directions of one of the gray coated keepers in wending our way to the great central avenue or Mall. Here, leading in a straight line for a quarter of a mile, is a broad footpath, lined with rows of tall elms and a smooth lawn. On Saturdays, during summer, an excellent band plays for several hours in the afternoon in a beautiful pavilion erected for the purpose, and thousands of people gather to listen. Leading from the Mall to the Lake Level is the Terrace, a fine architectural work of Nova Scotia stone, covered with elaborate



RUSTIC SEAT AND FOUNTAIN.

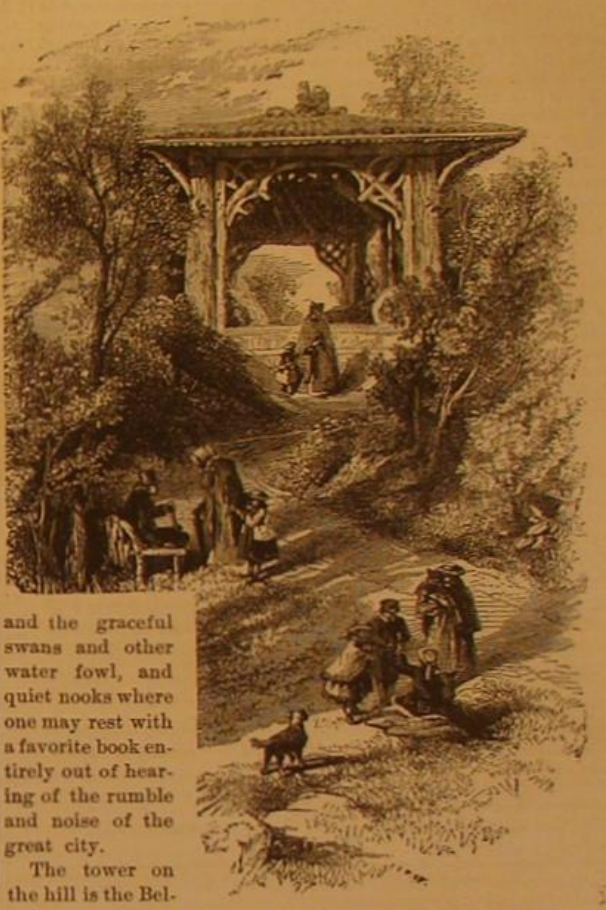
carving. There are finely executed bas reliefs, emblematic of Night and Morning, the Seasons, and other artistic designs, all exquisitely chiseled from the massive blocks. The stairs down which we pass lead to an arcade under the main Drive, the ceiling of which is inlaid with tile in mosaic work, the design and coloring beautiful in effect, and thence we step out on the Esplanade, a broad plateau on the shore of the lake. In the center is a great fountain, the bronze group belonging to which has not yet been placed in position.

The lake is of almost entirely artificial construction, and covers twenty acres; and to see its beauties we must avail ourselves of one of the numerous gaily painted boats which glide over its surface. Now we pass a bold jutting rock which changes into a grassy slope, spreading far up the hill, then a clump of willows, the overhanging bows of which extend far over the water; then we shoot by an ornamental boat house, with its steps leading down to the water's edge; perhaps we glide in among a flock of swans and ducks, that tamely crowd around to catch bits of bread that we may throw to them. Then as we skirt the shore we catch glimpses of romantic arbors half buried in the trees, and just before our row is over we run under Echo Bridge, the concave form of which indefinitely multiplies every sound.

The finest piece of architecture in the Park—we may add one of the most elaborate of its kind in existence—is Bow Bridge, shown in our larger illustration. It is made entirely of iron, and the span, in addition to being quite long, is of the beautiful bow shape indicated by the name. We pass over it to get to the Ramble where the paths are all curves, and crooks, and intricate windings, which we can follow, and retrace again and again, finding new beauties each time. There are vine covered arbors, from which occasional glimpses may be had of the lake



THE SPRING.



and the graceful swans and other water fowl, and quiet nooks where one may rest with a favorite book entirely out of hearing of the rumble and noise of the great city.

THE SUMMER HOUSE.

The tower on the hill is the Belvedere, now a granite and not a very prepossessing structure, which serves as an observatory. A splendid view can be gained, from its upper balcony, over the great Croton basins, the city and far across the Hudson and East Rivers to the shores of New Jersey and Long Island. Near the Fifth avenue entrance of the Park is the old Arsenal, but now the Museum. Here is a very fine zoological collection—which is at present in temporary quarters—comprising many valuable and rare living animals. Within the building proper are fine entomological collections, and a series of excellently prepared stuffed animals. The natural history of the United States may be well studied from the above, as well as a number of fossil remains from which plaster models of prehistoric animals will sometime be completed.

There are several fine statues at present in the Park, and it is expected that before long others will be added. The



ECHO BRIDGE.

Shakespeare monument is at the end of the wall, and close by it is a splendid group of an Indian hunter and his dog. There are also statues of Morse and busts of Schiller, Burns, and Humboldt.

Work is still in progress, and every year finds new beauties added to New York's great breathing place. That it is appreciated by the people, the crowds which throng every pathway on Sundays testify, suggesting indeed the thought that even this large expanse will ere long become too small, and another vast park will be needed to supply the want of our constantly increasing population.

NEW BOOKS AND PUBLICATIONS.

CASTLE'S UNIVERSAL INTEREST TABLETS. New York: Root, Anthony & Co., 62 Liberty Street. Price $2.

This is a neat leather case, containing three cards with interest tables printed on them. By manipulating the cards according to the printed directions, the interest on any sum for any length of time can be easily ascertained. Our book keeper has tested the tables, and he pronounces the system the neatest and quickest he has ever seen.

REPORT OF PROGRESS OF THE GEOLOGICAL SURVEY OF CANADA FOR 1871-'72. Montreal: Dawson Brothers.

GENERAL REPORT OF THE COMMISSIONER OF AGRICULTURE AND PUBLIC WORKS OF THE PROVINCE OF QUEBEC, for the Year 1871, and the Half Year ending June 30, 1872. Montreal: La Minerve.

The subjects of these two interesting and valuable reports are too large to be fully discussed in our columns; it must therefore suffice to say that the compilation of the books shows zealous and thorough research on the part of the officers of the Geological Survey and the Commissioner of Agriculture. Indications of thriving industries and a prosperous population are to be found throughout the agricultural report; and the cry is for more laborers, especially for farm hands.

Messrs. A. D. Mellick, Jr., & Brother, 6 Pine Street, New York city, have published an excellent book on the railway enterprises and real estate resources of New Jersey, which will be found valuable to all who think of locating near New York.

FLOWER OBJECT LESSONS, OR FIRST LESSONS IN BOTANY: A Familiar Description of a few Flowers. From the French of M. Emm. Le Maout. New York: William J. Read, 116 Fulton Street.

A little work likely to be useful to the teacher and interesting to the pupil. It is well suited for use in the well known *kindergarten* system, and will, we hope, help to popularize the knowledge of one of the most beautiful and accessible of scientific studies.

THE MYSTERY OF METROPOLISVILLE. By Edward Eggleston, author of the "Hoosier Schoolmaster," "The End of the World," etc. New York: Orange Judd & Co., 245 Broadway.

Here we have another pleasant, racy story of western life, from a writer who is thoroughly acquainted with the rough, hearty genuineness and the eccentricities of the border life in our States. Mr. Eggleston's fame as an original thinker and story teller was made by his first book: and the last work from his pen more than sustains his reputation. This story was written for *Hearth and Home*, wherein it first appeared.

DETAIL, COTTAGE, AND CONSTRUCTIVE ARCHITECTURE, containing Seventy-five Plates of Perspectives, Elevations, and Plans for Houses, Villas, Cottages and Country Houses. Published under the direction of A. J. Bicknell. Price $10. New York: A. J. Bicknell & Co., 27 Warren Street.

This is a handsome and elaborate volume, containing some hundreds of designs for houses in all styles, with drawings of all the necessary details. The value of this book to persons intending to build, and to country builders in places where architectural talent is not readily available, will be well understood from its title; and the engraving and printing are such as to make it an ornamental volume, worthy of the admirable examples with which the book is filled.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From March 21 to March 27, 1873, inclusive.

BOOT PEGGING MACHINE.—J. H. Reed, Boston, Mass.
BUNG AND BUNG INSERTER.—L. Van Laak, J. Gillespie, San Francisco, Cal.
COTTON PRESS, ETC.—B. G. Martin, New York city.
MAKING HOSE.—E. P. Richardson, Laurence, Mass.
MIDDLINGS SEPARATOR.—E. L. Lacroix, Minneapolis, Minn.
MIDDLINGS SEPARATOR.—G. T. Smith, Minneapolis, Minn.
NEEDLE THREADING DEVICE.—G. P. Farmer, Brooklyn, N. Y.
PRESSURE GAGE.—J. W. Stiles, New York city.
SAWING MITERS, ETC.—J. H. Carpenter, Paterson, N. J.
STEAM BOILER.—G. H. Babcock, Plainfield, N. J., S. Wilcox, Brooklyn, N. Y.
TREATING FIBER.—W. Shedd, Boston, Mass.

Recent American and Foreign Patents.

Improved Shutter Fastener.

Ellen D. Anderson, Frederick, Md.—The invention consists in combining a telescopic lock bolt with two notched brackets, arranged one near the inside, rear, and bottom end of each shutter, whereby the shutters may not only be securely locked together against the weather strip, or back against the house, but may be "bowed" at various intermediate points, to afford a larger or smaller opening and a greater or less degree of light and air.

Improved Explosive Cartridge Pile Driver.

Henry Vogler, Baltimore, Md.—This invention consists in a novel mode of relatively constructing the hammer and anvil of that class of pile drivers in which a cartridge is employed and wherein powder is caused to explode and be converted into a highly expansible gas between the anvil and the hammer. The resistance of the latter enables it to drive the former with great force against the pile. By the present construction of hammer and anvil, much of the expansive power escapes and is lost unless the cartridge chamber is made very deep, while this increase in the depth causes the chamber to heat very rapidly, to often set fire to the cartridge, and thus to cause the hammer to stick in the anvil. The present invention entirely obviates both these evils, as the gases cannot expand except in the direction of and against the hammer and anvil, while the cartridge chamber can be made so shallow as not to heat the chamber sufficiently to set fire to the cartridge.

Improved Roll for Rolling Railway Rails.

John W. Cooper, Hubbard, Ohio.—The invention relates to modes of constructing rolls so as to shape a compound rail made of two sections and locked together by a groove on one, into which the upper edge of the other fits. The invention consists in the mode of constructing the roll grooves so that the larger section of rail is brought into preliminary shape and subsequently recessed on the under side of head to receive the upper edge of the lesser section.

Improved Pea Vine and Corn Stalk Gatherer.

Absolan B. Sharp, Labadieville, La.—This invention relates to a rake adapted especially for gathering pea vines, corn stalks, and other plants cultivated on ridges, and it consists in the provision of a revolving rake-head carrying a series of teeths of unequal lengths, which are so arranged in relation to each other that the teeth operate or rake both in the furrows and on the ridges, a hinged check plate being provided or combined with the rake for holding the teeth stationary until a load is collected by the same, when, through the medium of a hand lever and connecting rods, the plate is disengaged from the teeth, for allowing the same to revolve to discharge the load.

Improved Nut Lock.

Edward Turner, Greensburgh, Pa.—This invention relates to that class of devices used to prevent nuts from being turned on their screw bolts by jarring or jolting, and thus allowing the latter to be loosened. The invention consists in one or more disks cut away on a portion of their circumferences sufficiently to allow a nut to be applied to or removed from its bolt, and of such a diameter between two opposite points of the curved part of their circumferences that the said curved part and the corners of the nut will rotate in circles that cut each other.

Improved Lamp Shade.

Wm. Simons, Charleston, S. C.—This invention consists of a shade formed of two like parts, approximating an ellipse in shape, and united at the ends so as to have the usual conical truncated form, and also leave notches in top or upper edge which adapts it to the fan shaped flame of a lamp or gas burner. The two parts may be readily detached to adapt the shade for packing and transportation.

Improved Medicine Chest.

Wm. H. Cutler, Buffalo, N. Y.—The object of the invention is to provides an improved case for containing medicinal preparations (more especially that known as carbolate of iodine) and instruments for inhaling the same; and to this end an oblong rectangular wooden block is bored longitudinally with two parallel holes, one to contain the bottle, the other the inhaling instrument. The cover of the case is of sheet metal, provided with a thumb piece, and with flanges fitting in grooves formed in the longer sides of the block, at the open end thereof. The case is cheaper and more durable than paper boxes heretofore used for the same purpose, and is capable of resisting pressure or blows, and also dampness.

Improved Chair.

Jacob Baughman and Bennet R. Chalk, Mt. Washington, Md.—The invention consists in improving the ordinary mode of applying spring backs to sewing machine chairs so that any old and ordinary chair may readily receive a spring back, and so that the back may be rigidly held at any point of adjustment.

Improved Carpet Stretcher.

David White, Normal, Ill.—This invention consists in applying a swiveled button and sustaining yoke to the jointed strips so as to lock the stretcher in any desired position and thereby enable the same person to do the stretching and tacking down.

Improved Umbrella Holder.

Abraham Oberndorf, Jr., Baltimore City, Md.—The invention consists in providing the lower end of an umbrella handle with means whereby it may be easily and conveniently hung to the vest or other part of the clothing.

Improved Brush Socket.

Philipp Wagner, Morrisania, N. Y.—The invention relates to the construction of a bridge for sheet metal sockets of brushes (mainly paint brushes), so as to secure strength and cheapness in the manufacture. The invention consists in the employment of ribs or corrugations on the side edges whose subjacent concavities receive the side edges of the socket.

Buoying and Stopping Leaks.

John W. Cooper, Hubbard, Ohio.—The invention consists in a flat, flexible, and inflatable bag secured to the gunwale, passing down the side of the vessel, up through certain tubes, and connecting with the deck, whereby said bag may be adjusted to cover a breach at any point in the side of the vessel.

Improved Cotton Picker.

Enoch Taylor, Memphis, Tenn.—This invention consists in brushes fixed to vertical cylinders and revolving inwardly so that the balls of one side of each stalk with which the rotary brush comes in contact will be deprived of the ripe cotton. It also consists in the arrangement of mechanism for operating the cylinder from the wheels and in guides that reach out from the side and in advance of the machine to catch, hold, and guide the cotton stalks up to the brushes.

Combined Adjustable Pinchers and Grappling Tool.

Simon B. Dexter, Mason city, Iowa.—This invention relates to a tool or instrument which may be used as a wrench, pinchers, or grapple for raising or carrying weights. The jaws, by means of a series of holes, are made adjustable to adapt them to articles of different size. A shank rod is connected by means of a fork on the end thereof, with the fulcrum pin of the pinchers. This rod extends back and passes into the handle, and on it is placed the wedge shaped slide consisting of two rods which pass through eyes at the ends of the pincher handles. At the back end of this slide is a screw which allows the handle or other appliance to be firmly attached to the slide. As this slide is moved back and forth on the rod, it will be seen that the handles of the pinchers and the jaws will be made to move nearer to or further from each other, the variations in this movement depending upon the angle of the slide rods with the shank rod. When any article is secured between the jaws, it is pinched or griped by pulling upon the slide or handle, and is loosened therefrom by a contrary movement. This feature adapts the tool for grappling for articles in wells or under water, as well as for carrying heavy articles or hot pieces of iron in foundries and similar places.

Improved Composition Sidewalk.

Charles H. Howard, Batavia, N. Y.—This invention has for its object to construct a sidewalk or pavement without having to haul loads of stones, bricks, gravel, or other matter to the locality of the proposed walk or pavement, which matter is usually embodied in the composition of walks, and used in place of the soil originally there contained. After the grade has been established, the earth to a depth of three or four inches and to the width of the proposed walk is thoroughly worked over and made very fine. A quantity of magnesia and carbonate of baryta, mixed together, varying in proportion with the nature of the soil found on the ground, is introduced and mixed with the earth. After the chemicals above mentioned have been properly incorporated in the soil, silicate of soda (soluble glass) is added, and the earth then replaced in its bed and properly smoothed on the surface. When the mass is almost dry, it should be covered over with a coat of chalk and magnesia mixed in water glass. This walk is cheaper than stone, will not rot like planks, and can be very rapidly made.

Improved Artificial Stone.

Phylander Daniels, Jackson City, Mich.—The object of this invention is to furnish an artificial stone or pavement which combines strength and durability, and offers, by its fireproof qualities, protection against the danger arising from the too rapid spread of fire. The invention consists in the use of a solution of glue, isinglass, soluble glass, and concentrated ley, which is applied to a mixture of sand, Portland cement, and pommeled glass. This mixture is well dampened with the solution till it forms a pasty mass of the consistency of mortar; and may be formed and well tamped into molds, where it will soon harden, to be taken out and exposed to the air to dry. It may also be laid in the form of a fireproof pavement, or any other suitable purpose.

Improved Harvester.

Thomas Y. Woolford, Romney, W. Va.—This invention belongs to the class of machines so constructed as to be adjusted for use as reapers or mowers, and as front cut or rear cut machines. To the outer end of the hub or central part of the drive wheel is attached a pulley to drive the reel when the machine is adjusted as a reaper. The main driving wheel revolves loosely upon the end of the axle and is made to receive the master wheel which is attached to the axle. The master wheel is made with an inwardly projecting rim, upon the outer surface of which are formed notches, upon which take hold spring pawls, attached to the inner side of the rim of the drive wheel. Upon the inner surface of the rim of the master wheel are formed teeth, into which mesh the teeth of the pinion wheel placed upon the end of the shaft. In the outer side of the gear wheel is formed a slot to receive a cross head formed upon the end of a shaft so that the said gear wheel may carry the said shaft with it in its revolution. By this construction, by moving the gear wheel inward sufficiently to remove it from the crosshead of the shaft, it will revolve loosely upon said shaft. The gear wheel is moved back and forth upon the shaft to throw it out of and into gear by a lever, which is pivoted to the frame and extends forward into such a position that it may be conveniently reached and operated by the driver with his foot. The shaft extends across the frame, revolves in bearings attached to the side bars of said frame, and to it is attached a gear wheel, the teeth of which mesh into the teeth of the small gear wheel attached to the driving shaft. Another shaft is placed a little below and in the rear of the axle, and to its end is attached a balance wheel which serves also as a crank wheel for the bar that drives the sickle bar. The shoe, to which the inner end of the finger bar is detachably bolted, and the various parts connected with it, can be readily adjusted to adapt the machine for a front or rear cut.

Improved Clasp Button.

Andrew Flatley, Brooklyn, N. Y.—This invention has for its object to furnish an improved detachable clasp button for connecting the ends of collars. The invention consists in a clasp button provided with spiral wire fasteners upon the inner side of its two parts to adapt it to be conveniently attached and detached.

Improved Car Coupling.

Aaron K. Kline, Readington, N. J.—This invention is an improvement on the patent granted, to the same inventor, March 5, 1872; and consists in a drawhead having a rear piece backwardly inclined on its top surface to receive and hold the coupling rod when not in use.

Improved Bag Tie.

John Bannihr, Hempstead, and Daniel H. Rhodes, Baldwinsville, N. Y.—This invention consists of two parallel plates connected together along one edge. A lever is pivoted to the connecting plate at one end and fastened to it at the other end by a hook. The string is fastened by passing it through a hole in each of the parallel plates above the connecting plate and under the lever. The latter is then pressed down upon the cord, drawing it down between the plates and wedging it fast, the lever being then fastened by the hook.

Improved Die for Forging Hoe Plates.

Lovell T. Richardson, Auburn, N. Y.—This invention relates to dies which are used in steam, water, or other power hammers for plating planters' hoes from the blanks before they are rolled out. Part of the face of the lower die is the arc of a circle transversely, and one fourth of its length is a flat or plane surface. The face of the upper die is beveled on its corners so as to leave a flat tapering surface.

Improved Waist Belt.

John H. Vogt and George Dietzel, New York city.—This invention consists of a waist belt for ladies' wear, which is woven of a fancy warp of silk cord for the front, a black or binding warp of gimp or strong thread for the body, fine silk warps for the borders, and a weft of gimp. The cord for the warp and the gimp for the weft are coarse and heavy, so as to produce a substantial article of a sufficient stiffness for a belt woven with open meshes.

Improved Fireproof Building Block.

William T. Van Zandt and Lucien A. Tartiere, New York city.—This invention consists in the use of asbestos and plaster of Paris in combination with saw dust, coke dust, cinders, sand, or other suitable material, to form fireproof blocks or bricks for walls, roofs, ceilings, floors, and partitions, the material being made plastic with water and shaped in molds.

Improved Sample Fastener.

Charles Mason, New York city.—The object of this invention is to supply to the trade a device by which goods may be quickly placed on show cards or boxes, and taken off again, avoiding thereby the inconvenience of the present mode of applying them, and saving time and labor. The invention consists of a wire bent in triangular shape, with ends overlapping each other, and acting like springs, one end being applied to show cards or boxes, the other to the article to be exhibited.

Improved Wood Fence.

Daniel G. Temple, Farmersville, La.—This invention has for its object to furnish an improved fastening for securing pickets and other upright boards or planks to the horizontal bars of the fence. In putting up the fence, bolts are passed through bars midway between the pickets. A wire is passed through a hole in the head of the bolts or around a groove or neck formed upon said bolts. A second wire is passed along a bar upon the side opposite the pickets, and the ends of the bolts or spikes are bent down or clinched around the said wire.

Improved Toy Puzzle.

Benjamin F. Ellis, Newton, Pa.—This invention consists of a puzzle comprising two or more U shaped bows of wire, with a ring formed in each end, a cross bar for each bow passing through the rings, and having a similar ring at each end, the two being connected together by the large bow passing through the rings of the cross bar of the small bow. With these bows and cross bars is a large ring made in two semicircular parts, which in working out the puzzle is to be worked on and off the small bow through the rings and over the ends of the bows and cross bars.

Improved Window Sash Ventilator.

John C. Bates, Cold Spring, N. Y.—The invention relates to the well known mode of ventilating houses through air inlets and outlets in the window sashes, and consists in employing two slides, relatively apertured with respect to each other and to the sash bar, so as to admit either a direct or indirect draft.

Improved Rotating Hook for Sewing Machines.

Andrew Aird and John Aird, Troy, N. Y.—The object of this invention is to substitute for the present brush loop check, applied to the rotating hook of Wheeler & Wilson sewing machines, a device which does the same work with great regularity, rapidity, and security, avoiding the insufficient working of the brush check and the annoyance resulting therefrom. This invention consists in a reciprocating hook placed inside of the rotating hook and in connection with and regulated by a cam in such a manner that the loop is straightened and held until the rotating hook is near the needle ready to take up a new loop.

Improved Hose Port Holes for Partition Walls.

Henry Woodman, Boston, Mass.—This invention has for its object to furnish an improved device to enable the firemen to introduce their hose nozzles into a closed room and flood it to extinguish a fire without its being necessary to break into the room, saving much time, and preventing the fire from making so much headway. The invention consists in the box flaring in both directions. The mouths of the box are closed with doors hinged at their lower edges, which are provided with spring catch locks which can be opened upon the outer side only with a key, but may be unlocked from the inside by drawing back the bolt of the lock with a stick. In the partition are formed two or more holes, each of which is provided with a door, which doors are placed upon the opposite sides of said partition and are hinged at their outer edges to the sides of the box, and are provided with springs to hold them closed. When it becomes necessary to use the device the door is opened; one of the spring doors is then opened, a stick or other article is inserted through the hole in the partition, and the other door is opened by drawing back the bolt of its lock by means of a projection upon the inner end of said bolt. The nozzle of the hose may then be inserted through one of the holes in the partition. One of the holes in the partition may be used to look through while the hose nozzle is inserted through the other, the flaring mouths of the box enabling all parts of the room to be seen, and the stream of water to be directed to any desired point. When the room has been flooded, or the fire extinguished, the hose nozzle may be withdrawn and the door closed, the spring door closing itself as soon as the hose nozzle is withdrawn.

Improved Furniture Castor.

Cevedra B. Sheldon, New York city.—The invention relates to castors for furniture and other purposes, and is an improvement upon the subject matter of a patent granted to the same inventor, April 1, 1873, the general idea being unchanged from the device therein described, but the particular means by which the same is carried out being made much more simple and less expensive to the manufacturer as well as to the public. Its movable balls will, equally with those of the former patent, prevent sliding friction, and insure a distribution of strain, requiring, however, much fewer balls, and but one set of them, while the whole structure can be manufactured at considerably less cost.

Slatted Flexible Support for Mattresses and Car Seats.

Collin Pullinger, Philadelphia, Pa.—The invention consists in two thicknesses of cloth, or other flexible material, placed one upon the other and united together at suitable intervals to form pockets into which are placed wooden or other slats.

Improved Cotton Press.

James P. Derden, Bastrop, La.—The object of this invention is to improve the means now in use for pressing cotton, hay, and similar commodities, and it consists, first, in a rectangular shaped base frame, upon which stands an upright frame of triangular form, consisting of two uprights, the lower ends of which are connected by a cross timber, upon which one end of the base frame rests. A screw is revolved in the end piece of the base frame. This screw has no longitudinal motion, but is simply revolved by means of a pulley on the end thereof, and a belt from the motive power. The screw presses through a truck frame as through a screw nut. As the screw is revolved, this truck frame travels back and forth. Truck wheels revolve on axle arms of this frame, and traverse on top of the base frame. There is a lever whose fulcrum is at a point near the top of the upright triangular frame; this lever is connected with the truck frame by a bar. The follower is suspended from the short end of the lever by a bar by means of a slot and pin, which allow it more or less play. The connecting bar is inclined to an angle and the follower is raised. If the screw is revolved so as to remove the truck frame outward and bring the bar to a right angle with the lever, it will be seen that the follower will be forced downward with inward power. The truck frame and the bar form a toggle or knee joint to operate upon the lever, while the toggle joint is actuated by the screw.

Improved Floor Clamp.

John J. Foster, Belmont, Texas.—The invention consists in improving the construction of flooring clamps. To the side edges of the rear part of a bar or plate, are secured two uprights by bolts, that pass through the said uprights and through the said plate. The upper parts of the uprights project above the plate, and are connected by bolts. The lower parts of the uprights project below the plate to straddle the timbers to which the flooring or ceiling is to be attached. The bolts are made longer than the width of the plate so that the uprights may be placed wider apart or closer together to adjust them to the width of the sleeper or other timber upon which the clamp is to be placed. Upon the upper side of the plate is placed a sliding plate which is made longer than, and is secured to, said plate by a hand screw which passes through a longitudinal slot. The hand screw is especially designed for locking the plate in place to hold the flooring or ceiling board in place until secured. In the upper side of the rear part of the sliding plate are formed teeth, into which mesh the teeth of the pinion wheel, the journals of which work in bearings in the upper parts of the uprights, said journals being made long so that they may not be drawn from their bearings when the uprights are spread apart. Upon the projecting end of one of the journals of the pinion wheel is formed a head to receive the lever for moving the sliding plate forward and back. To the forward end of the sliding plate is secured a plate to rest against the board or other timber to be moved, and which may be secured to said sliding plate by a set screw. Hooks are pivoted to the uprights to hook upon the opposite edge of the sleeper to prevent the device from slipping while being used.

Improved Street Sweeper.

Orson W. Kellogg, Fond Du Lac, Wis.—The invention consists in the improvement of street sweeping machines. The frame is pivoted at one end on the axle so as to swing or oscillate thereon, and its other support is the wheels which are directly under the brush shaft, and gage the brush to the ground. These wheels are mounted in the curved bars, which are fitted adjustably to the frame, so that the latter can be shifted as to hight to adjust the pressure of the brush on the ground. The dust pan is pivoted at one end of a rod just in advance of the brush, and the other end drags along the ground to receive all the dust lifted by the brush, and conduct it up to the endless elevator. This pan is divided vertically at the center in two parts, so as to conform to the uneven surface of the ground better than it would if made wholly in one piece. Near the lower end the pan is connected by cords with the frame, so as to be raised by the said frame when it is raised. The endless elevator runs from a roller up into the dust box, over another roller, and discharges the dust on the bottom. The roller has a hand crank for lowering and raising the bottom for unloading the dust; and mechanism for holding the bottom closed. Both the brush and the endless elevator are geared at each end with one of the truck wheels. The elevator, by belts and pulleys which turn independently of each other, and the pinions of the brush and pulleys of the elevators, are connected to their respective shafts by gearing which engages only when turning forward, so that in turning corners, when one truck wheel runs slower than the other, the shafts being turned by the outside one, having the greatest motion, will overrun the driver on the other side and be independent of it. A rake is provided for loosening up the matters caked on the pavement in advance of the brush.

Improved Distilling Apparatus.

Gaspar Hunziker, Summit, Miss.—The condensers consist of the vertical pipes in pairs, connected by return bends at the top, connecting with the large horizontal return pipe at the lower ends, the pairs of vertical pipes being connected together at about the middle by pipes, and arranged in sections of about three pairs. Pipe connections are made between each section, with the upper portions extending up into or through a cask to each section, the first section being connected to the kettle, and the last section with the final condensing coil in the tank by pipes. These tanks of the sectional condenser are connected together. The tank has a supply pipe extending to an elevation considerably above the kettle, and the condenser to receive the liquor to be distilled from an elevated cistern or tank high enough to force the liquor through the condensers and into the kettle. A rectifying flask is introduced in the connecting pipe between the last two sections of the condenser; and a flavoring flask is provided from which the distilled liquor passes from the last section of the sectional condenser to the coil in the tank. A small quantity of water is put in the kettle through a funnel, to protect it from the heat, and generate steam for heating the apparatus up to the working condition. The cock in the reservoir is then opened, and the liquor to be distilled is allowed to fill the tank, and, finally, flow into the kettle upon the sprinkler, by which it is divided into fine particles so as to be heated to the best advantage by the vapors which it comes in contact with. The vapors rise up into the condensing pipe within the tanks, the condensing begins in the first section, and whatever is condensed flows down into the return pipe to return to the kettle for being redistilled, while the vapors continue to be acted on in the other sections to which they flow by the cooling medium, by which the separation of the heavy vapors and watery substances is continued, increasing the strength of the alcoholic vapors, as required, using more or less of the sectional condensers, which will have such pipe connections and cocks as may be needed to pass the vapors through the number required. At the same time, after the heavy vapors and watery substances are mainly separated the volatile portions are passed through rectifying and flavoring substances, and thus the necessity for special apparatus to pass the distilled liquor through these substances is saved.

Improved Wrought Iron Blind Hinge.

William H. Goodrich, Utica, N. Y.—This invention relates to wrought metal hinges, which are not liable to fracture in use; and consists in the peculiar relative construction of parts by which the whole hinge is enabled to be constructed of wrought metal. The upper portions of the parts of the hinge are bent over at right angle to form flanges. In the forward part of the flange is formed a hole to receive the conical pintle of the other part. The rear part of the flange projects to serve as a stop to prevent the blind from swinging back against the wall, and also for the catch to lock the blind open. To the forward part of the flange of the other portion of the device is secured a conically enlarged pintle riveted to the leaf, and that fits into the hole before mentioned. Upon the rear part of the flange is formed a catch, the edges of which are made inclined or curved to catch upon the stop to lock the blind open. Upon the forward edge of the lower part of the second portion is formed a catch to serve as a stop by striking against the flange to prevent the blind from being raised from its hinges. In the edge of the flange is formed a notch, for the catch to pass through when raising the blind from its hinges.

Improved Cutter for Harvesters.

William McKeever, Staunton, Va.—The invention consists in a new mode of locking cutters to the cutter bar of a harvester so that each blade can be readily removed without taking off the others. It also consists in a novel mode of connecting the cutters with the cutter bar so that the latter can be reversed and the same cutter bar and blades be made to answer for a right or left handed machine. It also consists in a new mode of fastening the series of cutters together upon the cutter bar.

Improved Nail Plate Feeder.

Samuel K. Paden, Pulaski, Pa.—The invention relates to that class of nail plate feeders which vibrate laterally to bring the plate at the proper angle to the movable cutter. It consists in applying a pair of horizontally and intermittently rotated friction disks at the junction of the hopper and feed guide so as to advance the nail plate to the knives at the proper times and to the proper extent. It also consists in connecting the shafts of these friction disks, which are arranged in oblong bearings, with a spring peculiarly arranged to hold them to the plate yieldingly. It also consists in applying, at the front end of a vibrator, a hinged bearing arm, which is pressed down upon the nail plate by a spring whose tension may be adjusted. It also consists in a peculiar train mechanism for rotating the friction disks intermittently and to the proper distance. It also consists in a novel combination of instrumentalities to enable the nail plate to be turned at the proper angle to a movable knife and to be fed forward by a single movement of the vibrator. It also consists in the application to nail plate feeders of means whereby the vibration is allowed to move some distance before the friction disks begin to rotate so as to allow the movable cutter time to rise above the nail plate. It also consists in simple and convenient means of moving the front end of a nail plate a short distance out of the hopper as soon as its predecessor has passed from the hopper and grippers. It also consists in regulating the bevel or taper of the nail by means of the conveyance of two levers which determine the amount of oscillation of the plate.

Improved Magazine Fire Arm.

George D. Luce, New Orleans, La.—This invention relates to improvements in magazine fire arms; and consists in the construction and arrangement of loading, firing, and cartridge-ejecting mechanism. The hollow sheet metal stock constitutes the magazine chamber and contains a magazine of four tubes, arranged parallel with each other, connected together and mounted on a pivot at each end, so as to be turned to present the cartridges to the passage, through the base block, for being delivered into the carrier. The tubes of the magazine have a coiled spring in the lower end for pushing the cartridges into carrier. The magazine is provided with a thumb bit at the lower end for turning it by hand. A receiver or frame incloses the loading, firing, and cartridge-ejecting mechanism proper, and is formed of a continuation of the stock so shaped as to be cylindrical in its upper and rear portion, the barrel screwing into it, while its two sides are parallel below the barrel. The left side is, however, bent outward to form a tube through which the cartridge shells are ejected. The guard lever is pivoted to these plates and is allowed to move a certain distance before pushing the retractor forward. A stud pin with a friction roller on it is arranged on one side of the guard lever, to work under the hammer to throw it back, to be caught by the trigger when the guard lever is thrown forward for extracting the shell and introducing a new cartridge. The said guard lever also has mechanism to cause it to raise the breech plate to open the breech for the discharge of the shell and the introduction of a new cartridge; after which suitable means cause the breech plate to fall and close the barrel. The retractor has a notch into which the flange of the cartridge falls before being pushed into the barrel, in which it lies after being discharged, ready for being pushed back by the retractors into the hollow carrier, when the guard lever is pushed forward. The retractor also has a notch at the lower rear corner, which, as soon as the shell has been pushed back into the carrier, engages with devices so that the further movement of the guard lever pulls the rear end directly downward to swing the carrier down in front of the passage to receive another cartridge, as shown in broken lines. The cartridge is forced in by the spring of the magazine, and forces the shell out through the discharge tube, the flange of the shell being at this time released from the notch of the retractors by the swinging out of said cartridge with the carrier as the latter is swung down in front of passage. A rounded stud on the retractor is provided, so as to cause the retractor to spring down and escape past the flange of the cartridge when the guard lever is pulled back, in case a cartridge may fall of being discharged, and be forced back into the barrel with its flange in advance of the projection, which may occur when the last cartridge is fired, on account of there being none in the magazine to force it out of the carrier, and which might injure, or perhaps break the retractor; but this will not happen if the muzzle of the gun is held down so that the cartridge will fall out of the carrier by its own weight. It is only in case this may be forgotten or neglected that the shell can thus get back into the barrel, and even then the flange will not be in advance of the notch except in case the shell happens to move forward in the carrier before it is raised up to the barrel.

Improved Medical Compound.

Herman Themel, Esconawba, Mich.—The object of this compound is to purify the blood, and is composed of Indian rhubarb, gentian, galangal root, wormwood and saffron, macerated together in alcoholic liquor. A table spoonful is the quantity recommended as a dose by the patentee.

Improved Furnace for Heating Iron Bars, etc.

Joseph Pardoe, Worcester, Mass.—Two fires are arranged, one on each side of the furnace hearth, and are fed alternately with fuel, so that the gases from the fresh coal of one fire will be consumed by the heat from the incandescent coal of the opposite fire. The iron is placed lengthwise of the hearth, so that the flame and heat pass between the bars and lengthwise thereof, instead of first striking the sides of the bars, as in ordinary furnaces. The iron, besides being placed parallel with the draft, may by this arrangement be cut in longer pieces than where it is placed transversely of the course of the flame. By having two fires arranged in this furnace the iron may be introduced through the right and left hand doors alternately, and kept in two separate piles, one exposed to fire of the fresh fuel and in the process of gradually heating, and the other exposed to the heat of incandescent fuel, and ready to be withdrawn and rolled.

Improved Hot Air Register.

Edward A. Tuttle, Brooklyn, N. Y.—This invention consists of an extension of the hot air pipes of furnaces and the like a considerable distance above the floor, through large holes adapted to allow the air to circulate around the pipes as a protection against fire. The valves are placed on the top of the pipes so that the falling of the sweepings and other matters into the pipes is effectually prevented, and the whole is enclosed in an ornamental guard or screen of open metal work, which protects the pipes and hides them and the opening through the floor from view.

Improved Yarn and Cloth Beam and Whip Roller.

George Lawrence Garsed, Wilmington, Del.—The object of the invention is to remedy the tendency in the wooden yarn and cloth beams and whip rollers of looms to shrink and become warped at their junction with the pulleys, and thus to allow the pulleys to lean at an oblique angle thereto. This has the effect to cause the yarn to be wound unevenly on the yarn beam and to create, when unwound, an unevenness of tension which produces a want of uniformity in the cloth.

Improved Hand Car.

Daniel M. Hunt, Southampton Mills, Pa.—The invention consists in an improved mode of connecting the hand lever with the crank shaft. The frame or truck of the car supports a top frame work. The two wheels at one end are mounted upon the axle, which also carries a pinion. Into this pinion meshes a toothed wheel which is mounted upon a crank axle that hangs in the lower part of the frame. A rod connects the crank of the axle with a walking beam that is pivoted to the top of the frame. The beam is provided with handles at the ends, so that when it is, by the occupants of the car, oscillated on its pivot it will impart rotary motion in the desired direction to the wheel, and thence to the axle to propel the car. The crank shaft is hung in its bearings in such manner that it can slide thereon, and is by a joint connected at one end with an elbow lever which is pivoted to the under side of the frame. By swinging the lever in one direction the shaft will be moved in its bearings to carry the wheel out of gear, while, when the lever is swung in the other direction, the wheel will be thrown into gear with the pinions.

Improved Paper Feeding Machine.

Miguel Piedra, Jersey City, N. J.—The operation of feeding paper to a swift printing press, requiring considerable manual dexterity, is generally performed by hand labor. This invention of Mr. Piedra's, by substituting very ingenious and doubtless effective mechanism, is therefore destined not only to cause considerable economy in the wages of extra hands but to increase the capabilities of the presses in connection with which it may be used, and insure better register. The paper to be fed by this apparatus is in the form of superposed sheets placed upon a table at the back part of the machine. This table is made up and down adjustable, either by being hinged at its back end or secured by a vertical slide, and is especially made up and down adjustable at its forward end. A hollow cylinder is so arranged that, when it arrives at its backward position, a pipe pendent therefrom will arrive over the pile of papers resting on the table. At this moment a plunger is drawn out of the cylinder, and a vacuum, or at least a refraction of air created therein, and at the same time the paper is, by the elevation of the table, raised into contact with the cup shaped lower end of the pipe and a valve simultaneously opened. Therefore the vacuum in the cylinder will be applied against the upper sheet on the table, and will suck the same against the lower end of the pipe. The cylinder at this time makes its forward motion, and takes the upper sheet forward with it until after it has reached its most forward position. The plunger is, by suitable means, violently thrown into the cylinder to discharge the sheet from the end of its pendent pipe. The backward motion of the plunger causes a spring lever to shut the valve. The motion imparted to this lever is, of course, simultaneous with the entering of the plunger into the cylinder, and consequently the valve is shut at the same time that the plunger enters the cylinder; the paper being therefore discharged from the end of the tube by the shutting of the valve as much as or rather more than by the expulsion of air from the cylinder. The cylinder now resumes its backward motion, and the operation aforementioned is repeated until the paper on the table has been entirely removed, in successive sheets. The mechanism herein described is not intricate, and is stated to be easily kept in repair. The means of feeding the paper is certainly the most advantageous that can be devised, because it dispenses with all the griping devices by which the sheets are more or less injured.

Improved Wheel for Vehicle.

Hiram Pitcher, Fond Du Lac, Wis.—The invention consists in the peculiar mode of combining and arranging the hub with a sleeve and axle made fast together. The hub is made in two parts screwed together. The axle passes through a sleeve, the outer end being square, which fits the outer end of the sleeve, so that the latter forms the arm or wearing surface of the axle. The wearing surface of the sleeve is at each end thereof, between which is an oil chamber. The hub forms the box, the two parts of which have each a bearing for the sleeve, and a flange for supporting the spoke. There is a collar on the axle. An interior flange works against a collar on the axle and against the end of the sleeve. A screw nut on the end of the axle bears against the end of the sleeve. A cap screws on to the outer part of the hub, in which is a square orifice for introducing a plug wrench for turning it on or off. Through this cap oil is introduced to the oil chamber. A washer is made fast to the spokes. The ends of the spokes rest upon the inner part of the hub, but the flanges are equal in diameter, and support the spokes. The spokes entirely fill the space between the flanges so that the washer rests upon solid wood. The wheel is thus formed without mortises in the hub or tenons on the spokes. Each part of the hub has a polygonal section, by means of which they are readily separated with a wrench.

Improved Low Water Indicator and Alarm for Boilers.

Mark Ellwood, Girard, O.—This apparatus indicates the quantity of water in a steam boiler, and gives an alarm by blowing a whistle in case of low water. When the boiler has a sufficiency of water it cuts off the steam from the pumping engine, and stops thereby the supply of water. The frame, to which the actuating part of the apparatus is attached, is suspended by means of bolts from the shell of the boiler. The apparatus consists of two sections, one being inside and one outside of the boiler, the former being the actuating part and the latter the indicating and alarm part. A float is supported in position by the vertical guides which connect the upper plate with the lower plate of the frame inside the boiler. On one end of a lever is a sector wheel which engages with a vertical sliding rack. The other end of this lever is connected with the bottom of the float by a rod, and also has a counter weight, which is designed to balance the rack so that the float, as it rises and falls with the water in the boiler, will cause a corresponding motion in the rack, with but slight friction. A rod, the lower end of which is attached to an arm on the lower end of the rack, passes up through a tube into a dial chamber on top of the boiler, and has upon its upper end an index pointer. This pointer passes over the face of the graduated dial plate, and its position, being governed by the action of the float and consequently by the hight of the water in the boiler, will indicate, by means of the marks and figures on the plate, the quantity of water in the boiler. The entrance of the steam into the pipe connecting with the whistle is governed by the action of a valve which is on the lower end of a rod actuated by an arm on the upper end of the rack. The arm slides freely on the valve rod, and when it strikes the collar the valve is lifted from its seat, steam enters the pipe and the whistle is blown, thus giving the alarm for low water. A pipe connects the boiler with the pumping engine. When there is a sufficient supply of water this pipe is closed by a cone valve on top of the float. When the water in the boiler falls the valves fall with the float, and the pumping engine is again supplied with steam.

Improved Grain Measure and Register.

Royal B. Clark, Lyle, Minn.—This invention has for its object to furnish an improved machine for measuring grain and registering the amount as it comes from the separator. The hollow cylinder is supported by legs, of such a length that bags to receive the grain may be conveniently hung upon the discharging spout upon the lower side of said cylinder. With an opening in the upper side of the latter is connected a hopper to receive the grain, and which should have a glass plate inserted in its side to enable the attendant to conveniently see when the measure is full. An inner and smaller cylinder is pivoted to the cylinder by a shaft, by which it is revolved. The inner cylinder comes close up to the upper side of the outer cylinder, and consequently close to the hopper, leaving a space between the lower sides of the two cylinders to allow the grain to flow out freely through the spout. The inner cylinder is divided into two equal compartments, and upon the opposite sides of the partition are formed openings to receive the grain from the hopper. Each compartment contains exactly half a bushel. One end of the shaft projects and works in a small frame attached to the end of the outer cylinder, and to which the wheels of the register are pivoted. To the end of the shaft is attached mechanism to prevent the inner cylinder, and consequently the wheels of the register, from turning back, and also gearing which actuates a second shaft to which a lever is pivoted. To the side of the lever is pivoted a lever pawl, the inner end of which is bent inward, passes through a hole in the lever and enters a hole in a wheel. A number of holes is formed in this wheel to receive the end of the pawl, at such a distance apart that the movement of the wheel through the space between two of said holes will give a half revolution to the inner cylinder. The cylinder shaft connects with gearing which actuates the fingers on the dial plate of the register. Upon the dial plate are formed two circles of division marks, to the outer one of which one finger points, and to the inner one of which the other finger points. The teeth of the gear wheels are so arranged that the first finger may move one space upon its scale of division marks at each semi-revolution of the measuring cylinder. The second finger moves through one space upon its circle of division marks at each revolution of the first finger, so as to register the number of bushels counted. The machine is designed to be placed at the side of a grain thrasher or cleaner so as to receive the grain from an elevator connected with said thrasher or cleaner.

Improved Extension Attachment for Stove Pipes.

Samuel Johnson, James Creek, Pa.—This invention has for its object to furnish an improved attachment for stove pipes, by the use of which the stove pipe may be conveniently lengthened and shortened to adjust it to the place where the stove is to be set up. To the lower part of the length of pipe that slides into the other is attached the lower end of a bar that is slotted longitudinally. The end of the bar that is attached to the first pipe is made with an offset to raise the body of the bar away from the pipe. The other or free end of the bar has an inwardly projecting flange formed upon it to rest against the side of the pipe and steady it. To the lower part of the side of the other length of pipe is attached a screw, which projects through the slot of the bar to receive a hand nut, so that by tightening the said nut the bar will be clamped and the adjacent lengths of pipe will be held securely in place; and by loosening the said nut the lengths of pipe may be readily adjusted as required.

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Notes & Queries

E. B. H. asks how to galvanize sheet iron.

E. M. D. asks how old zinc can be made pure for use in a battery.

A. F. V. wants to know the best and quickest mode of kiln drying lumber.

E. J. C. asks: What is the preparation and process of burnishing gilding on china.

D. P. asks: How can I toughen horse hair so that it will not be brittle?

G. G. F. asks how to remove slight scratches off the face of a looking glass.

T. Y. S. asks how to bleach China grass. It can be made as white as snow.

R. R. asks: At what speed should a band saw run to cut saw logs best?

S. H. H. asks how to remove the rough back off the shell of the pearl oyster.

A. S. asks if it is possible to draw wire from a gold dollar to reach the length of a mile? If not, what length can it be drawn to?

W. W. C. asks: Is there anything that will make leather stick to iron and form a water tight joint for hydraulic rams?

C. H. R. asks for a recipe for an elastic polish or varnish that will give a patent leather finish, or one that will resemble it. It should bear bending and not break.

A. F. S. asks for the precise method by which gold fish are made to spawn. "I have a pond in which I have kept the same gold fish for over three years, and up to the present time they have not multiplied."

W. S. asks: 1. What will remove black ink from writing paper without injury? 2. What is the easiest way to make a hole in a watch spring, without taking the temper out?

J. R. C. asks: What is the best kind of material for a float for petroleum? "I want something that will float freely on the oil and that will not become affected by it."

C. M. D. asks for a rule for measuring painter's works on iron bridges; for instance, a bridge 800 feet long x 100 feet high x 20 feet wide on top. Are the sides, length, and hight measured as lattice work or once through?

R. R. asks: 1. What is the best time of the year as regards health to go to the Isthmus of Panama, and what sanitary course should be pursued?

C. J. F. says: I have a flat roof covered ten years ago with pitch and gravel. It now begins to leak a little. I have been thinking of scraping off the loose gravel and then applying a coat of Rosendale cement, say half cement and half sand. What do you think of it? Will it crack?

R. R. asks: If somebody buys a tract of land with a watercourse through it, and pays tax on the whole tract, water and all, has he a right to close up the creek with a dam, or must he let other people from below float their saw logs through his land? The logs could not float if the man had not dammed the creek some.

A. F. O. asks: What is bichromatized gelatin? How is it prepared, and what are its properties and uses? 2. How can I make a quickly drying cement that will resist the action of boiling alcohol, or with what varnish can I cover ordinary cements to accomplish the same object? 3. Is there any work in which are minutely described the manipulations of thermometer making, especially blowing the tubes and graduating the scales?

G. H. H. asks: Why is it that, in putting the finger on either the in or outside of the closed eye, a dark spot will appear on the opposite side of the ball in daylight, and a bright, luminous spot about the size of a gold dollar in the dark? It is an experiment which all can try; perhaps thousands have noticed it before; but what is it that appears so bright where all else is dark, because of a little manipulation of the closed eye and lid by the finger?

D. S. says: On page 52 of your current volume in answer to P. S. K. Maiers, you direct him to break stones into small pieces and then to mix sand (sharp grit), etc. I have no stones on or near my place, and I wish to know whether river gravel which I have in abundance (from the size of a goose egg to fine sand) would answer instead. Also, will it make a sufficiently strong cellar wall, and if so, would cement mixed with lime be better for a cellar wall than cement without the lime?

J. G. K. asks: 1. Where can I obtain the exact standard measure of the American foot or yard? Is there any place or office in the city of New York where such a standard or model measure is kept open for the public? 2. Could some correspondent give me some practical details concerning the system of irrigation as practiced by the Mormons in Utah, and also about irrigation generally for agricultural and gardening purposes? 2. Is there not a kind of oak with edible acorns which may be used as food, or are acorns actually used as food? If so, where and how? I wish to know the botanical or other name and some characteristic description of such oaks and where they grow.

M. E. P. says: Can there be any such thing as a steam boiler that is absolutely safe? I do not claim to be an engineer myself; but suppose a boiler should be made in the usual manner except that the safety valve should be set on the top of another larger safety valve. For instance, the whole top of the steam dome might form a valve, fitted and made steam tight and arranged with a sufficiently long lever and heavy weights to stand an internal pressure of say one hundred pounds to the square inch, while the small safety valve was set to blow off at eighty. Would that be practicable? Or would several smaller ones attached to one boiler be of any use?

E. A. S. says: Nearly two years ago I tore up an old coal chute, that had been built for eighteen years, and found the sleepers and cross trees as sound as when first laid. The timber was laid in our common sand, and some of it was round, just as cut in the woods, with the bark on, and this was as sound as the rest. There were pine, hemlock, spruce and oak. The slack coal had worked through the cracks, and water had leaked through and formed a crust about six inches through. We had to use a pick to break through the crust. The earth was saturated for about two feet down and looked like iron ore. Could slack coal and sand be used to lay Nicholson pavement, and be cheaper and better than the old process? And would it last till it wore out, without regard to the kind of timber used? I claim that this can be done, and, if so, the discovery of the same.

Answers to Correspondents

Owing to the illness of one of our editors, the replies to several of our correspondents relating to chemical subjects have been delayed, but will shortly be given.

F. A. S. will find particulars of cupro-ammonium on p. 177, vol. 28.—P. H. H. and J. C. C. will find directions for hardening taps and dies on p. 91, vol. 28.—G. T. S. can repair his leaky tin roof by following the directions on p. 139, vol. 28.—W. V. C. and M. C. M. will find the directions for polishing wood, given on p. 72, vol. 26, sufficient for the purpose.—W. H. G. will find the subject of preserving eggs practically discussed on p. 107, vol. 28.—C. R. asks how to brown gun barrels. Answer: Read the articles on pp. 154 & 266, vol. 26.—W. M. will find the process for bluing steel described on p. 10, vol. 25.—W. P. B. and J. P. C. will find ample directions for repairing rubber boots on p. 155, vol. 26.—J. A. E. asks how to join heavy gum belting. Answer: Read the two articles on p. 27, vol. 28.—G. R. and others will find the Gramme magneto-electrical apparatus described and illustrated on p. 410, vol. 26.—F. F. will find practical directions for making an Æolian harp on p. 330, vol. 26.—M. B. will find a recipe for a pickle for tempering mill picks on p. 106, vol. 25.—E. K., F. T. J., and W. H. W. will find the subject of whitewashing fully discussed on p. 122, vol. 24.—A. K. will find a recipe for transparent cement on p. 41, vol. 27.—M. C. M. will be able to mount chromos, etc., by following the directions on p. 154, vol. 27.—T. E. C. will find directions for porcelaining iron ware on p. 149, vol. 28.—M. T. B. will find the power of steam boilers fully discussed in the last few numbers of the SCIENTIFIC AMERICAN.—H. J. W. should read J. J. B.'s reply to W. D. O. on this page.—A. W. P. will find a recipe for marine glue on p. 202, vol. 28.—O. J. P. will find full directions for making and applying liquid bronze on p. 90, vol. 26.—R. S. W. asks for a covering for a flat roof. Answer: Consult our advertising columns.

E. C. M. is informed that the information on the regeneration of bone black is derived from the accounts published, by the inventors of the process, in Europe. It is not an extract from another publication.

J. L. L. asks what we mean by a saw of 16 gage. Answer: The blade of the saw is the thickness of No. 16 wire, according to the wire gage in ordinary use.

P. P. H. asks if any metal expands and contracts with various degrees of heat, as do mercury and alcohol. Answer: Yes; read S.'s letter on page 362 of our current volume.

P. P. H. asks if mercury can be kept in an iron vessel without affecting the latter. Answer: Yes; mercury is generally sold in cast iron flasks.

A. says: The following account of a boiler disaster appears in a Sacramento (Cal.) daily journal of March 25, 1873: "Last evening the residents were startled by a loud explosion, which was immediately followed by an alarm of fire. It became evident that some remarkable freak of steam had taken place, for an immense boiler, rent and torn by an explosion, lay across Second street, while an enormous hole in the third story of a brick house immediately opposite told of the terrific force with which it had been hurled. Investigation disclosed the fact that the boiler belonged to the Sacramento foundery of Wm. Guttenberger, 105 and 107 Front street, which had exploded with such force as to send it entirely through the end of the shop in which it was situated, across the alley, through a large yard, demolishing the fence on its road; then rising through the air, it passed entirely through three rooms and both front and back walls of a brick house before it had reached its lodging place in the middle of Second street. At first sight it seemed impossible that such an occurrence should have taken place without loss of life, and search was at once commenced amid the ruins for the injured, but none were found. It seems that the workmen had all left the foundery some time before, banking the fires and leaving everything apparently safe, and that all the occupants of the injured house were down stairs at the time. It is supposed that the explosion was of such a nature as to give a circular motion to the boiler in its flight, which, combined with the immense velocity, caused it to cut its way clean through all obstructions. The partition walls, furniture and brick walls were as completely and cleanly cut through as could have been done by the tools of a mechanic, while the boiler shop is a complete wreck of broken timbers. The most plausible theory of the cause of the explosion is that the fire got under way after the workmen had left, and thus generated steam sufficient to cause the accident. It was, however, impossible to arrive at any conclusions last night, and it will require removal and examination of the *debris* to-day to get at any accurate idea of how it occurred. A casual examination of the boiler shows that in some places it was very much worn and thin, some of the pieces left in its track being but little thicker than sheet iron." On going to the spot, immediately on reading the above, I found the boiler, as it lays on the street, to be about 10 feet long by 42 inches in diameter, 30 flues about 2 inches diameter. The front end is blown off and gone; one side of the boiler, from one end of the flues to the other, has been forced in by some cause, as if some great pressure had been applied to the outside. The flues are all forced close together at the center, while the ends of most of them remain in their proper places. Now what I wish to know is: How is it possible for the front end of a boiler to blow off and the balance of the boiler to follow with such force in the same direction? In this instance, the boiler was set facing the east; the front part is gone and the bottom we find about 300 feet east of where it was set, having struck the ground with the back end of the boiler first, showing that it must have made at least one half of a revolution endwise. I would as soon expect to see a cannon, when fired, go in the same direction as the ball, as to see a boiler follow up the end that is blown off. But perhaps you can give a satisfactory explanation of this mystery. Answer: We are quite as much at loss to account for this remarkable circumstance as is our correspondent, and hope that he will continue his investigation until he can give us more complete data upon which to base an opinion. Is there no mistake in the description given of the relative position of the boiler before and after the explosion, or some peculiarity of setting?

E. R. D. says: I have a ½ horse power oscillating engine; how large a boiler shall I want and what thickness should the iron be? The boiler is to be heated by a stove; will a barrel setting over the boiler, with a pipe running down into it, do for a feeder? Answer: We should make a tubular boiler having about a square foot of grate surface and 20 feet of heating surface. It would probably be 20 inches in diameter of shell, and should be made of iron about an eighth of an inch thick to carry 100 pounds steam. A properly constructed plunger feed pump should be attached to the engine. We should not approve of the barrel arrangement.

J. H. C. asks what per cent of the water supplied to a hydraulic ram can be returned to the point from which it fell? Does a ram give as good results under a given head of water as a turbine wheel? Answer: See article on page 257 of this issue.

L. & D. W. C. ask: How can we ascertain the quantity of power transmitted by belts of different widths, and pulleys of various diameters and speed? Answer: See the editorial columns of this issue.

W. H. C. asks: Would a pressure of steam hold up a column of cold water under the following circumstances: Suppose I have a tank of cold water 3 feet high connected by a ¼ pipe to my boiler above the water line (the tank also sitting above the water line), what pressure of steam, if any, would hold the water back; or would the cold water condense the steam and the difference in temperatures create a current and allow the water to run in the boiler under any pressure, the steam taking its place? Would the same result take place (the tank being closed and able to sustain the pressure of the steam in the boiler) if the tank were full as if half full? Or would the same result take place if the water in the tank was at a temperature of 30° as at 200°? Answer: A pressure of one and a half pounds would equilibrate that of the column of water. In the case supposed, the water, if cold, and if the pipe conducting it to the boiler were large enough, might condense the steam. If that were to occur, the water in the tank would then flow into the boiler with the same rapidity that it would issue from the pipe were the pipe led into the open air and a hole made in the top of the tank. The steam could only take the place of the water when the pipe was made of sufficient size to allow the steam to bubble directly up into the tank. With heated feed water, condensation of the steam would not be likely to

happen, and the arrangement has, in that shape, been used as an automatic feed, with some success.

D. G. says: We have a new kind of a pump lately introduced into this (mining) district; this pump was originally intended for a 14 inch pump, plunger and bucket combined, the object of which is to discharge one half the water on the down stroke and the other half on the up stroke, thus making what is claimed to be a balance pump, with a great saving in power in working in deep mines. The parties who use this pump discarded the bucket and changed the plunger to a 12 inch one, which makes the pump now a 12 inch plunger pump. The builder of this pump has discovered an advantage in discharging the water through the jack head over pump barrel, and a saving of ten feet travel of water, over the old fashioned plunger pump. This pump we call B and the former, A. We place the two pumps in a shaft, 200 feet deep; the foot valves are on a level with one another. Now the best talent in the county claims that the water in B will travel 10 feet further than it does in A, in other words that B raises a column of water 200 feet in hight, while A only raises a column 190 feet, and spills water 10 feet in advance of B. I claim that the water in B does not travel any further than it does in A, that they both pump against a column of water of the same hight, and that A does not discharge water 10 feet in advance of B. Will you give us your highly valued opinion? Answer: We are inclined to agree with our correspondent on this point. We think, with him, that if, by any contrivance, water is raised from one level and discharged into a reservoir at a level 200 feet above, no modification of the machine will be able to make the lift anything less than 200 feet. We differ from the said "best talent" holding opposite views, and should prefer to accept the opinion of some of the intelligent apprentice boys who read the SCIENTIFIC AMERICAN, rather than subscribe to the views of said "best talent." Any two pumps, pumping against equal heads, will require the same power to do their work, provided frictional resistances are equal.

J. K. says: We have a steam mill for sawing logs, planing matching, etc.; our feed water is hard and causes a great deal of scale on the boiler. Now we have contracted for a new boiler of 30 horse power and wish to know what arrangement we can make to condense the exhaust steam to use for feed water. Answer: We presume that the most satisfactory arrangement will be found to be the usual condenser and air pump, which can be attached by any competent constructing engineer. There are one or two forms of "siphon condenser" in the market which are less expensive, however, and are said to perform well.

J. M. says: I have charge of a nest of three 42 inch boilers, 22 feet long, with 2 fourteen inch flues in each; the shells are made of ¼ inch iron and the flues are made of iron of the same gage. They have been in use for 12 years, and I inspected them this week; the scale that is deposited on them is no thicker than a sheet of writing paper and is black and glossy; there are no leaks and they appear to be in as good condition as though they were only two years in use. I am expected to press them to 65 lbs. per square inch. I have had charge of boilers for the last sixteen years and I have read the SCIENTIFIC all that time; but as this is the first time that I have had to deal with boilers with large flues, I wish you to give me information in regard to what you believe would be the highest safe strain that I could carry, and whether the shell or the flues will stand the most pressure before giving way. Will you tell me how to compute the strains on flues in plain arithmetic, as I have no knowledge of algebra? Answer: The shell of the boilers described, if perfectly sound and of good iron, is safe at the pressure of 65 lbs., and the steamboat law has generally allowed 110 lbs. on boilers of that size and of ¼ inch metal. The flues, if in equally good condition should collapse at about $806{,}000 \times \frac{1}{4} \times \frac{1}{4} \div 22 \times 14 = 163{\cdot}5$ pounds. One quarter of this pressure, or 40 pounds, is generally named by engineers as the limit of pressure to be carried, and we, ourselves, should object to carrying more than one sixth, 28 pounds. The flues will, therefore, give way first, under the conditions assumed, and should not be subjected to more than 40 or 45 pounds, although they may stand four times that pressure. The weak spot in large numbers of boilers is the flues, and, as our correspondent probably knows quite as well as we do, many accidents occur from collapsing flues. To determine the strength of any flue, made of good iron, well put together, and perfectly cylindrical: Divide 806,000 times the square of the thickness in inches by the product of the diameter in inches and the length in feet.

D. says: Suppose a party owes me. I sue and get judgment entered up against him, and the sheriff reports "no property, except letters patent in the defendant's name for a valuable invention" (cannot say if it is his own or purchased). Can I have said letters patent attached and sold at sheriff's sale? Answer; A patent cannot be taken and sold under an execution in an ordinary action for debt in which judgment has been recovered.

P. L. asks: Would sleeping always with your head to the north tend to magnetize the metallic constituents of the fluids and solids of the human body? If so, would it increase nervousness? Answer: Persons having the "iron constitution" might be so affected.

P. L. asks: How can you construct a pump that will draw water from a well that is 45 or 50 feet deep? Answer: Use a common lift and force pump, the latter placed in the well, say, 25 feet above the water.

L. W. C. asks: Can you give me an explanation of how Chas. G. Page (or his heirs) could take out letters patent in 1868 on electrical instruments which, according to history, were discovered by Professors Henry, Wheatstone and Morse, as early as between 1836 and 1842? Also, could that patent be enforced and thereby close opposition telegraph companies? Answer: The Page patents were granted by special act of Congress. Their validity has not yet been determined by the Courts.

N. B. D. says: I wish you could tell me what is the matter with my magnet. The cores are made of soft iron, about ¾ inches at one end and ⅝ inches at the other, and are 6 inches long; they are joined at the smaller end by being screwed into a small piece of iron and are wound with about 600 feet of fine covered wire. When I attach the wires of a local battery to them, they have scarcely any attractive power. My magnets are considerably larger than those on my sounder, but do not possess any attractive power. Can you tell me where the trouble lies? Answer: Your mistake may be in the connection of the terminal wires of the two spools forming the electro-magnet. If the two spools are wound in one direction and slipped on the cores, at the end furthest from the armature, connect either the two outside, or the two inside, terminal wires with each other. If we had your magnet here, we would correct your mistake, if not too great, without cost.

W. M. E. sends a mineral and asks what it is. Answer: The mineral sent is iron pyrites, or fool's gold. Of no value.

A. M. R. says: 1. What proportion of the weight of a car and load is the measure of adhesion of a 33 inch chilled cast iron wheel and an iron rail? 2. Of brakes with shoes of cast iron 4 x 12 inches, what proportion of car and load must be applied to the brakes to make the adhesion of wheel to brake equal to wheel on rail? 3. All things being equal, what is the measure of difference of adhesion between a rolling wheel and a sliding wheel on an iron rail? Answer: From fifteen to twenty per cent when dry, about ten per cent when greasy, and about five per cent for very light loads on a very greasy rail. 2. The friction is about the same as the preceding, and the same proportion of weight should be applied, rather less if it is desired that the wheels should not slide without turning. 3. Rolling friction of trains on a level being about one third of one per cent, the ratio of rolling to sliding will be 45 or 60 to 1 for dry, 30 to 1 for greasy, and 15 to 1 for very light weights and a very greasy rail. The *sliding* friction of a rolling and a sliding wheel are about the same.

W. H. C. asks: 1. How can zinc lining in bath tubs be kept bright, or brightened when tarnished? 2. Is there a durable paint or varnish for stoves, to be used in place of black lead? Answers: 1. Use elbow grease and whiting. 2. There is nothing equal to first quality finest ground black lead for stoves.

N. N. says: 1. I have a fire box boiler 18 feet by 42 inches, containing 5 seven inch flues, 3 near the center and 2 nearer the bottom. At about 2½ or 3 inches from the outside shell, a crack has occurred in one of the bottom flues, near the lower side where the flue joins the boiler head, on the under side of the flue and next to the adjoining flue. How can I instruct a blacksmith to repair the break? 2. The flues, from burning light wood, are incrusted with a thick coating on the fire surface of each, apparently deposited from the smoke; how can I remove it? It materially interferes with making steam, being a non conductor of heat. 3. What will precipitate cellulose from its cupro-ammonium solution? 4. What is celluloid? Answers: 1. Take a piece of boiler plate large enough to cover the crack completely, with width enough to allow room for flange through which to bolt. Fit very carefully, working it hot and finally bolt it in place with ⅝ inch head and nut bolts, making the joint tight with a cement of red and white lead and oil. 2. Make a scraping tool for the purpose and remove it with that, if it cannot be detached by a stream of water, or by a brush. 3. Precipitate by neutralizing with excess of hydrochloric acid. 4. From the Latin *cellula*, little cells, and *loid*, like.

W. A. P. says, in answer to S. P. S. who asked what are the diameters of English locomotive drivers: Their express locomotives have a single driving wheel on each side, the diameter of which differs on different railroads. I enquired concerning them while in London last summer, and was told that the largest on the London and Southeastern Railway were about 9 feet in diameter; those on the Midland railway from 8 to 8½ feet; and on the London and Northwestern railway and others, they varied from 6½ to 8½ feet. Those on the L. & N. W. railway are chiefly from 7 to 7¼ feet in diameter. Their freight locomotives have driving wheels of less diameter; but from what I saw, I should say that they were generally larger than those used on freight locomotives in this country.

J. J. B. says that W. D. O.'s question as to the commencement of the day is a perfectly legitimate one, and the answer is very simple: By the common consent of nations, the 180th degree of longitude from Greenwich is the starting point (or line) for each separate day in turn, and consequently this is the line sought for by W. D. O. When a ship going west crosses this line at noon on Friday, she crosses over to noon on Saturday, and *vice versa*; when a ship going east crosses this line at noon on Saturday, she finds, after she is across the line, that it is only Friday noon. This arrangement is, of course, purely artificial, but I believe is universally adhered to.

G. L. B. says, in answer to E. M. B.'s question on calculating speeds and diameters of pulleys: Multiply the diameter of the pulley (in inches) by the speed that it runs and divide by the diameter of the driven pulley. The answer will be the speed of the driven pulley. He says that machines come to him marked to run at so many revolutions per minute. Let him multiply the diameter of the pulley by the speed that it is marked to run and divide by the speed that his line of shafting runs, and the answer will be the diameter of the pulley required in inches.

J. C. H. says, in answer to T. G. who asks for directions to make a solid emery wheel: Take coarse emery, 2 lbs., Stourbridge loam, 1 lb.; mix to a thick paste and press into a metallic mold, then dry and bake or burn in a muffle to a white heat.

S. T. W. replies to S. L. D. who asked for a method of transferring pictures to glass: My method of transferring pictures is to use balsam of fir and alcohol; varnish the glass, place the picture face down upon it and then, instead of letting it dry for 24 hours, immediately commence rubbing off the back with water and forefinger; of course it requires a little more care, and it should be rubbed very lightly the closer you get to the picture. When allowed to dry for 24 hours, the paper absorbs a portion of the varnish, which prevents its being rubbed down thin, while the other way, with care, will secure a much finer and quicker job.

A. O. says, in reply to J. B. M., who asked what is the result produced by hardening cast steel in water strongly impregnated with salt, and what would be the difference if sal ammoniac were used in place of salt: All substances which increase the conductivity of heat of the water produce also a higher degree of hardness in the steel. This is the case with salt and sal ammoniac. The percentage of calcareous matter exerts no certain influence; so we can explain why the ancients considered certain rivulets and wells especially suitable for hardening steel. For this reason, according to Pliny, steel works were often erected in their vicinity, and at a distance from the mines. There are now used nitric acid, potash, nitre, prussiate of potash, crystals of tartar, etc. The English file cutters add 1 part of oil of vitriol to 30 or 40 parts of water. In some cases where no fresh cold water is at hand, such additions may be very useful, but they may in general be dispensed with.

A correspondent replies to T. E. B., who asked how to remove clinkers from the inside of a stove: Throw three or four oyster shells in the stove, while the fire is hot, and leave them there. They work like a charm.

A. H. M. says, in reply to J. C. C.'s query about cleansing feed water: If you will place your heater and filter above your pump a foot or two, so the hot water will flow to it, and then insert a small pipe in the suction close to the pump, of sufficient hight to extend above the head of hot water, leaving the upper end open for the steam to escape, I think you will be able to force your hot water without cooling it again, and thus you will not lose the advantage of heating and filtering.

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

S. H.—It is galena, the ore of lead.

J. W. T.—It is a siliceous rock, containing either carbonaceous matter or oxide of manganese: analysis would be necessary to determine.

A. H.—It is calcareous marl.

G. C. S.—They are pyrites and mica.

J. F. S.—The specimens contain neither cobalt nor nickel, but considerable iron.

J. A. C.—The metal is lead; but is J. A. C. sure that it came from the dark colored rock sent?

D. H. W.—It is not gold, but iron pyrites.

E.—It is yellow ocher, which is useful as a coarse paint and for polishing. If there is an abundance of it, it should not lie idle.

W. P. H.—The specimen is interesting as being a relic of the superstitious arts practised by the "medicine men" of Africa. We cannot think of any drug, certainly one with which the negroes are acquainted, which would produce the symptoms mentioned. If any other correspondents of the SCIENTIFIC AMERICAN know of the use of the "Hoodo," or anything similar, among the negroes in the Southern States, we wish they would communicate.

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 Atlantic Disaster. By C. D. O.

On a Plan for an Underground Telegraph. By W. F.

On the Solarity of the Magnetic Needle. By H. S.

On a Railroad Accident near Memphis, Tenn. By A. C.

On a Hydraulic Ram. By J. P.

On Professor Haeckel's Opinion of the Embryo State of Man. By J. L.

On Trying Circles with a Square. By G. B. D.

On Moonites. By W. L. D.

On Double Action Friction Gear. By J. B. H.

On Clarifying the Water of Kansas City. By H. R.

Also enquiries from the following:

J. G.—G. W. S. & Co.—C. E. B.—J. J. E.—J. H. W.—W. J. S.—A. K.—R. D. B.—H. A.—G. G. S.—E. M.—J. D.—F. S. J.—E. F. O.—F. R.—W. G.—J. H. W.—J. S. M.—W. H. C.—T. C. J.—A. H.—J. B.—B. A. C.—A. C.—H. J. N.—R. W. S.—C. D. F.—G. M. E.—A. M.—J. S.

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.]

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March 25, 1873,

AND EACH BEARING THAT DATE.

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Water wheel, B. Ruof	137,242
Water wheel, J. E. Stevenson, (r)	5,341
Water cut off, rain, J. W. Wetmore	137,268
Whiffletree attachment, A. Soursin	137,103
Windmill, G. A. Swartz	137,111
Window shade clip, F. Muller, (r)	5,338
Wrench, etc., S. B. Dexter	137,129
Wrench heads, forming, L. Chapman	137,052
Wrench heads, forming, L. Chapman	137,053

APPLICATIONS FOR EXTENSIONS.

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

24,598.—HARVESTING MACHINE.—Mc C. Young, Jr. June 11.
24,665.—PROTECTING IRON SURFACES.—T. Selleck. June 18
24,685.—TILL ALARM.—E. B. White. June 18.
24,700.—HARVESTER.—L. and J. Miller. June 18.
24,772.—KEG.—J. Wilson, C. Green, W. Wilson, Jr. June 25.

EXTENSIONS GRANTED.

22,790.—CRACKER MACHINE.—J. Fox.
23,445.—PAPER FOLDING MACHINE.—C. Chambers, Jr.
23,596.—PYROTECHNIC NIGHT SIGNAL.—M. J. Coston.
23,436.—WRINGING MACHINE.—S. A. Bailey.
23,525.—BEDSTEAD FASTENING.—L. W. Buxton.
23,491.—ROPE LAYING MACHINE.—W. Pittman, W. C. Boone.
23,530.—BURNISHING MACHINE.—Le Roy S. White.

DESIGNS PATENTED.

6,512.—CARPET.—A. Cowell, Kidderminster, Eng.
6,513 to 6,517.—CARPETS.—O. Heinigke, New York city.
6,518 to 6,520.—CARPETS.—H. Horan, Newark, N. J.
6,521.—CARPET.—R. Hoskin, New York city.
6,522.—CARPET.—J. Humphries, Kidderminster, Eng.
6,523.—PENCIL.—E. S. Johnson, Jersey City, N. J.
6,524 & 6,525.—CARPETS.—L. G. Malkin, New York city.
6,526 & 6,527.—FLOOR CLOTHS, ETC.—C. T. and V. E. Meyer, Lyon's Farms, N. J.
6,528.—INKSTAND.—W. F. Muller, New York city.
6,529 to 6,532.—CARPETS.—E. J. Ney, New York city.
6,533.—CARPET.—H. Nordmann, New York city.
6,534.—CARPET.—J. H. Smith, Enfield, Conn.
6,535.—BOOT JACK.—E. J. Steele, New Haven, Conn.
6,536.—PICTURE FRAME.—L. Steinkilper and L. Welker, Williamsport, Pa.
6,537.—DOOR LATCHES, ETC.—A. Wunder, New Haven, Ct.

TRADE MARKS REGISTERED.

1,176.—PETROLEUM PRODUCT.—J. Chandler, Pioneer, Pa.
1,177.—WHISKY.—S. H. Engelke, St. Louis, Mo.
1,178.—MEDICAL PREPARATION.—R. Hoyt, New York city.
1,179.—CIGARS.—Kerbs & Spiess, New York city.
1,180.—CIGARS.—Kerbs & Spiess, New York city.
1,181.—WHISKY.—J. J. McClelland, Austin, Texas.
1,182.—COOK STOVE.—Bussey, McLeod & Co., Troy, N. Y.
1,183.—SUGAR LEMON COMPOUND.—Preston *et al*, Boston.
1,184.—GOLD FOIL.—S. S. White, Philadelphia, Pa.
1,185 & 1,186.—SOAPS.—J. B. Williams & Co., Glastenbury, Conn.

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On appeal to Commissioner of Patents	$20
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Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

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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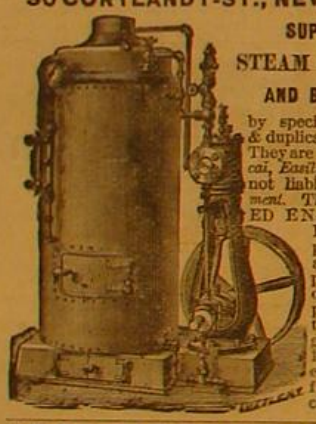


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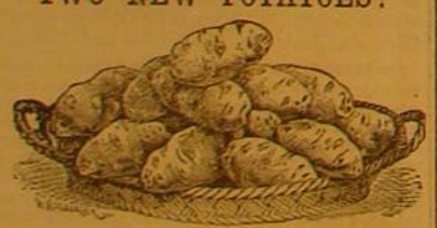
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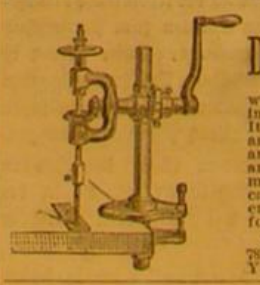
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SCIENTIFIC AMERICAN

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

Vol. XXVIII.—No. 18. [NEW SERIES.] NEW YORK, MAY 3, 1873. $3 per Annum, IN ADVANCE.

IMPROVED PLANER BAR.

We live in an age of condensation—an era in which the all-absorbing question is not to produce an indefinite number of entirely novel ideas, but to combine, condense, or, to use an apt vulgarism, "boil down" the knowledge we at present possess, into the very smallest compass in order to make space for future acquirements. That oft quoted individual, who confers a benefit on mankind by making two spears of grass spring up where but one grew before, would fail to comply with the modern requirements of a public benefactor; the problem is now not to produce two blades but a single small one, having the combined value of half a dozen.

We are led to this thought by an examination of the ingenious device which forms the subject of this article and the accompanying illustration. It is one of those inventions which indicate the result of long experience in the practical use of machinery, a crystalization, in fact, of ideas gathered while watching the hard metal yield before the cutting blade, and now presented, probably in the simplest form compatible with efficiency, to supply the place and perform the duty of more extended, costly, and elaborate mechanism.

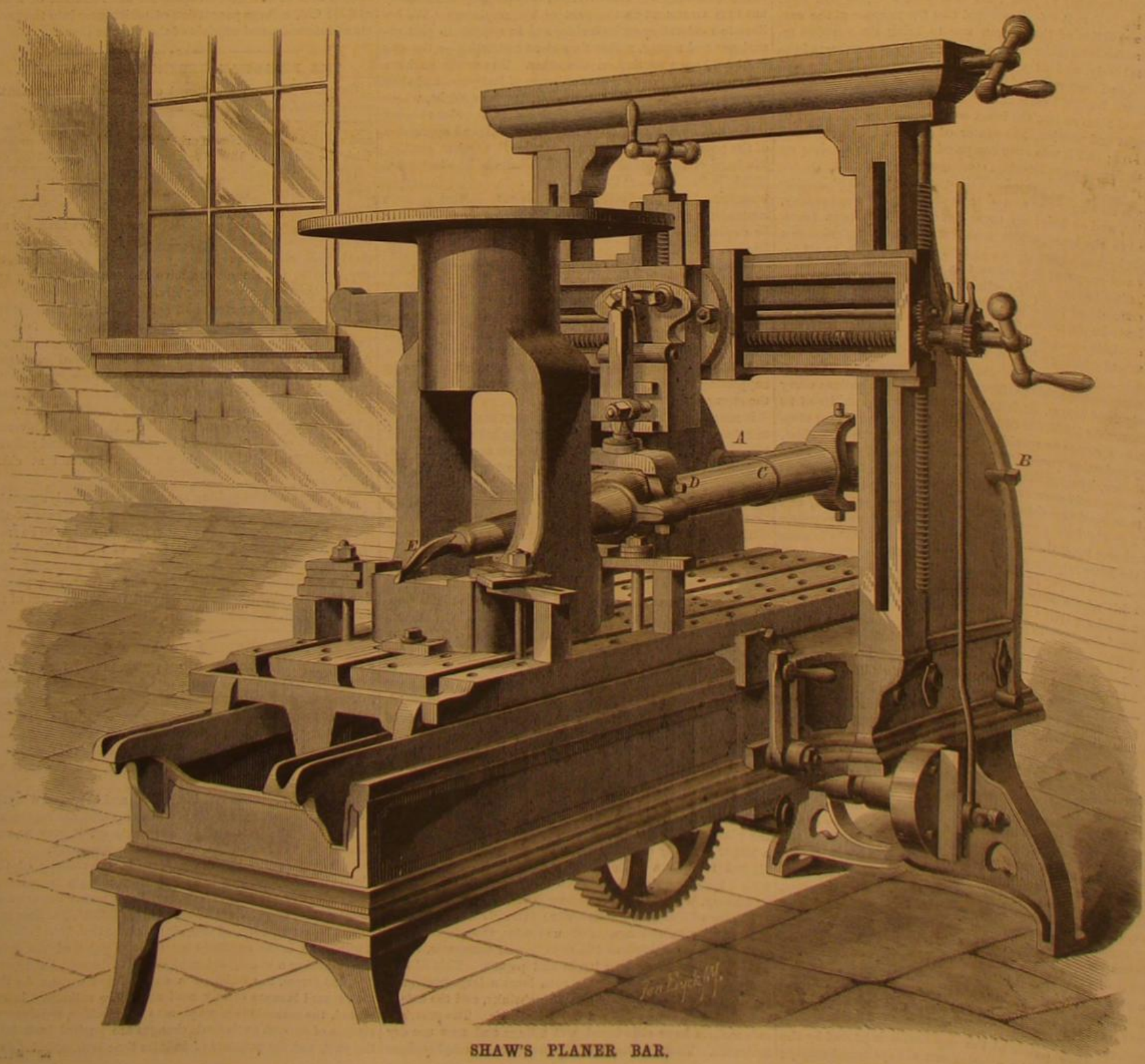
In brief, the device is a planer bar; its object, to reach through work on planing machines, and thus serve to perform a large proportion of the labor of slotting and shaping apparatus, at, of course, a materially decreased expense. It consists of a heavy shaft, A, at the rear of the planer, which rides upon centers, B. On this shaft the bar, C, is pivoted; so that by this mode of connection a universal joint is obtained, and the outer end of the bar rendered capable of motion in all directions. Near the center of the bar is a pivoted box, D, from which a pin projects, which is securely fastened to the tool post and carriage. The bar is therefore subject to the movements of the latter, and is regulated by the ordinary feed motion of the planer. At E the tool end is represented as operating on the inside of a wide casting.

It is claimed that the ability of the device to reach through work is unlimited, and that it will plane one third the length of the planer; while its action being of an end thrust character, it will cut all that the machine is able to pull without chattering. Our illustration presents so enlarged a view of the invention that any further details here are unnecessary to insure its comprehension.

Patented February 18, 1873. More extended information may be obtained by addressing the inventor, Mr. T. Shaw, 913 and 915 Ridge avenue, above Vine street, Philadelphia.

A Large Steamer.

A new steamer, belonging to the French transatlantic line, has lately arrived at New York; her name is the Ville de Havre. Her length over all, from stem to stern is 423 feet; breadth of beam, 49 feet; depth of hold, 45 feet. She has three cargo and two passenger decks. The hull was built by Andrew Leslie and Co., of Newcastle, and the engines by Maudslay, Son and Field, of London. The nominal horse power of the engines is 1,200, capable of working up to 3,900. There are four cylinders, two 80 inches and two 38 inches in diameter, with a stroke 4 feet 6 inches. The diameter of the screw is 19½ feet. The steam is supplied by 6 boilers, heated by 32 furnaces, and the average consumption of coal is 55 tons per day. Her gross tunnage is 5,086, and she can carry at least 3,200 tuns of cargo. She is bark-rigged, has two funnels, eight boats, and four winches, the latter being used for hoisting cargo, sails, etc. The wheel house and steering apparatus are on the main deck, and are connected by telegraph with the officer on the bridge, nearly 300 feet distant. The passenger accommodation of the Ville de Havre is as follows: 190 first class, 120 second class, and 500 steerage passengers. The first class saloon is amidships, extending from side to side, the dimensions being 52 by 46 feet. The sides are of marble, and several oil paintings, a piano, library, etc., adorn the apartment. In the center there is a double stove, which thoroughly heats the room, and steam pipes run throughout the ship, making each room comfortable in the coldest weather. The ladies' boudoir adjoins the saloon, and is decorated with paintings, and the lounges are covered with blue velvet. The state rooms are large and airy.



SHAW'S PLANER BAR.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year $3 00
One copy, six months 1 50
CLUB RATES { Ten copies, one year, each $2 50 — 25 00
Over ten copies, same rate, each — 2 50

VOL. XXVIII., No. 18. [NEW SERIES.] *Twenty eighth Year.*

NEW YORK, SATURDAY, MAY 3, 1873.

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THE CIRCULATION OF THE BLOOD.

For thousands of years, the hearts of animals had been beating before it was discovered that the purpose of the continuous action of that organ was to bring the supplies required for interstitional repair to the remotest members of the animal body, and at the same time to carry off the waste which had been replaced by fresh material. For thousands of years, human hearts had been beating, and, misled by superficial observation, the heart was supposed to be the seat of thought and passion, the center of good and evil, devotion and love; and it was even compared by poets to an altar on which flames were burning, etc.

But modern biologists have changed all this. The human heart is no longer the seat of the noble feelings of generosity, charity, and of love; all these functions have been transferred to the brain, while the heart has been degraded to a simple hydraulic apparatus, in fact, to a machine to all intents and purposes equivalent to a pump.

If, after having fully realized the stupendous change in our estimate of this noble organ, we make it our task to investigate its operation, our admiration and delight concerning its exquisite construction compensates us fully for the disappointment which at first we may have felt when poetry had to make room for reality. During the life of a man, this little pumping machine performs some 104,000 pulsations every twenty-four hours, 37,000,000 per year, and, in a life of 80 years, nearly 3,000,000,000 of pulsations without ever stopping, as a stoppage would be at once fatal to the individual. Every pulsation projects six ounces of blood with a force which has, by experiment, been determined to be equivalent to a hydrostatic pressure of eight feet, which is equivalent to a power of three foot pounds for every pulsation, and 72×3 or 216 foot pounds per minute; estimating the power of a strong man at 4,320 foot pounds per minute, it is seen that the little muscle which we call the heart exerts at every contraction a power equal to one twentieth part of the power which his whole body is capable of exerting; but then this power works night and day without his will, even without his knowledge, while man can only work one third of the time. The whole amount of blood propelled by the heart is 27 lbs. per minute, 1,620 lbs. per hour, 38,000 lbs. per day, 14,000,000 lbs. per year, 1,000,000,000 lbs. in a life time. Are we not then justified in asserting that there is nothing lost to the eye of the intellect, by the transfer of the heart from the domain of imagination and speculation to that of positive science?

The heart, with the regular musical rhythm of the contraction of its four chambers, the never failing opening and closure of its admirably constructed valves, sends the blood, which is a most mysterious metamorphosis of the food consumed, through the arteries, which by their elasticity equalize the rhythmical impulses into a steady current, when the blood reaches the capillary vessels; here the blood is propelled further by capillary action, by the forces of endosmose and exosmose; the blood thus reaches every recess, either in muscle, skin, nerve, or even bone, and, replacing every organic molecule which has become obsolete, carries the latter through the veins towards the liver, kidneys, and spleen to be purified, and lastly to the lungs to undergo the main purification, the throwing off of all gaseous matter, especially carbonic acid and the absorption of the vital oxygen. Then it returns to the heart, to be again and again propelled through the body.

The absorbing power of the capillaries is proved by the fact that after death the arteries are always found empty; this deceived the ancient anatomists, who therefore considered them as air ducts, wherefore they gave them the name of arteries; when the heart stops beating, this capillary absorption goes on till the arteries are emptied. For the beating of the heart the stimulus of the oxygenized air is necessary, as proved by vivisection of animals, which shows that when, by the opening of the chest, the lungs collapse the heart at once ceases to beat; if, however, respiration is restored by an artificial periodical inflation of the lungs by air, the pulsations of the heart are at once resumed, and may thus be kept up for a considerable time.

With our present knowledge of all these positive facts, it appears surprising that it is only two hundred years ago that the circulation of the blood was first discovered by Harvey, and that it was only after opposition and discussion of many years duration that it was accepted by the doctors.

INJUSTICE TO WORKMEN.

It will be remembered that, some issues back, we animadverted quite severely upon a very unjust form of receipt and contract which had been adopted in the Joliet Iron and Steel Works, of Joliet, Ill., and to which, we explained, the workmen were required to subscribe before receiving their wages. In reference to the matter, we have been favored with a letter from the superintendent of the above establishment, from which we learn with much pleasure that the objectionable features of the document, as published in our columns, have been abandoned. We may add that we felt confident that the Joliet Iron and Steel Company would not upon reconsideration of the subject seek to enforce such arbitrary obligations upon their men, and we are much gratified to note that the well meant advice of the SCIENTIFIC AMERICAN has been so promptly acted upon. The new form of contract and receipt, though of exactly the same date as regards month and year as that previously laid before our readers, is of entirely different tenor, and is free from the provisions to which we took exception.

In this connection, we would counsel employers generally against the adoption of any measure which might form a pretext for the complaints of that disorganizing element which finds its way into every workshop. The times are rife with strikes and rumors of strikes; and if such unfortunate proceedings are to be averted, it is only by conciliatory but firm treatment on the part of the employers. We believe in moderation on both sides and in appeals to past experience and reason, rather than stern restriction on the one hand and open mutiny on the other. The workmen have not recovered from their severe losses of last year, and they stand ready to seize upon any cause, however slight, which will give a shadow of justice to their claims, in order to bring up the old arguments of tyranny of capital and oppression of the poor, and risk thereon the issue of another conflict. We have often alluded to the evil results of the last great strike, both in the stagnation which it caused in many branches of industry and the hardships it entailed on both contending parties: we earnestly trust that no means will be omitted to spare us the repetition of its unfortunate lessons.

FIREPROOF SAFES.

The disastrous conflagrations of Chicago and Boston have made it evident that the only method of ensuring the preservation of valuables, when buildings burn, is to prevent the fall of the safes into the cellars below, where the fire generally rages longest and most fiercely. This is done by supporting the safes upon masonry or by embedding them in the strong walls of the building.

It must be admitted that the ordinary movable safes are unreliable in great fires. Heat any safe hot enough, maintain the heat long enough, and its contents are sure to burn. Nevertheless, the movable safe is a most useful thing, and its employment has become a necessity in almost every branch of business. People must have them, and a question, interesting to thousands, is, which is the best safe?

Theoretically considered, that is the best safe which contains the most water in its filling; for the more water present, the more steam we have in case of fire, and nothing burns within the safe while the filling gives off steam at 212° F.

Theoretically, then, the best filling for any safe is pure water. But in practice it is found very difficult to make a water-filled safe proof against leakage, which is likely to be occasioned by rust, freezing, or the tremendous shock of a fall from an upper story to the cellar at the critical moment during a fire.

The best water safe in the market to-day is one in which but very little of that liquid is used, the principal portion of the space reserved for filling being packed with cement.

Next in theoretical value to pure water as a filling, are solidified fillings which hold an abundance of water, to be given off in the form of vapor when the safe is subjected to fire.

Probably the best filling of this kind is composed by mixing plaster of Paris, gelatin, and water. This filling holds a larger quantity of water than almost any other. But it is alleged to emit a bad odor, and to produce a dampness within the safe quite injurious to the contents. Safes with this filling, we believe, are not now made.

Plaster of Paris and water were formerly used quite extensively for safe fillings. But such safes, though excellent when new, are subject to the objection of dampness, badly mildewing and damaging books and papers. This filling, like other wet cement fillings, soon loses a large portion of its water by evaporation, the filling shrinks, and the safe is rendered less secure than a dry filled safe. The principal safe makers have abandoned wet fillings and now use dry materials. The favorite safe fillings at present employed are cement and dry plaster, with which are mixed sundry chemicals containing water, such as common salt, Glauber salt, alum, etc. Safes thus filled are always dry, and, if well made to begin with, are not likely to deteriorate by age in respect to fire-resisting qualities. In thousands of cases of fire they have proved reliable wherever placed in a building, and may ordinarily be depended upon to preserve their contents.

Since the Boston fire, we have given some attention to the real merits of various safes, with a view of supplying our own office with the best article in market, and have accordingly made selection of a dry filled alum safe, from the celebrated establishment of Marvin & Co., 265 Broadway, N. Y. The filling is of plaster and alum, the walls being nine inches thick, or fifty per cent thicker than the safes ordinarily made, and of far greater resisting capacity for fire. This safe is very large in its exterior dimensions, but small within, and is in every respect a splendid example of workmanship. The Marvin safes are shipped to all parts of the world, and have the highest reputation for excellence and reliability.

THE CASE OF PHELPS, DODGE & CO.

Our readers will be happy to learn that the great metal house of Phelps, Dodge & Co., of New York city, have this week published a statement which completely exonerates them from any complicity or attempt to defraud the revenue, in their extensive importing business. They have, however, unwittingly and unintentionally, infringed on a complicated tariff law, whereby it was held that, during a period of five years, covering an importation of over forty millions and a payment of over eight millions in duties, they had paid short to the extent of some two thousand dollars, and had so made themselves subject to a severe penalty. This fact, so extraordinary that it seems difficult to believe, is, however, fully confirmed by a letter from the late U. S. District Attorney, Hon. Noah Davis, present Judge of the Supreme Court of New York, and so makes the supposition of willful and systematic fraud utterly absurd and impossible. It is not to the credit of our national laws nor to the honor of the country that such trivial infringements of a complicated statute, unintentionally made by an old and honorable house, should be held as sufficient cause for the infliction of a fine of $271,000, a large proportion of which goes into the pockets of informers and officials of the Custom House.

THE BROADWAY UNDERGROUND RAILWAY.

Governor Dix, on the recent occasion of his signing the underground railway bill for this city, availed himself of the opportunity to express sentiments on the subject of cheap and quick transit in New York, which are fully in accordance with the broad and liberal views, progressive opinions and earnest philanthropy which have characterized his long and honorable official career. He was extremely anxious, he said, to see a rapid transit railroad in New York for the accommodation of the industrial classes, more than for any other interest; and wished it so that they might secure good and wholesome homes out on the suburbs of the city, and at the same time have the means of going and coming from their work rapidly.

He therefore suggested that, before affixing his signature, the bill should be amended by reducing the rate of fare between the hours of 5 and 7, morning and evening, to 8 cents. As these are the hours when the great majority of passengers ride, the reduction was a matter of public importance. The Governor's amendment was adopted by an almost unanimous vote of both branches of the legislature, and at once became a law. So now the city of New York, thanks to Governor Dix, will be provided with a first class underground railway, which will furnish the people with rapid transit at cheap fares.

In this era of wire-pulling and rings, it is doubly agreeable to find an official, in the high position of Governor of this State, who is the servant of the people, and who so truly represents and looks to the interests of the public. With General Dix as their executive, the people may rely on a fearless administration of the law and unwavering promotion of every plan having for its end the furtherance of the public welfare.

A NEW READING OF AN OLD RECORD.

The early writers of human history accounted for every diversity in the conditions and characters of nations by some marvelous, generally supernatural, occurrence. Gods and demigods came among men revealing new religions; establishing new arts and customs; leading great conquests and migrations: the present always marking an age of decadence, when great things were no longer done, and the gods remained aloof.

The modern historian finds the god and demigod a myth. To him a thousand years of slow development are represented in the reputed life and achievements of, it may be, one person, and the miraculous is crowded out entirely.

A similar change has taken place in the reading of the history of man's habitations. The early geologists saw traces everywhere of terrible cataclysms, paroxysmal liftings and engulphings of continents; creations, distinct, peculiar and complete, were supposed to spring, full bodied, into being at a word, and be as suddenly cut off; the quiet of the later ages marking a wholly different order of things, the repose of spent forces, the quiet of a consolidated earth. As the rock record is more closely read and more rationally interpreted, the marvelous gives place to the familiar, the circumstances of current geological changes are pushed back into the past, and the patience of infinite time is substituted for

the imagined haste and violence. The carboniferous period, for example, has hitherto been considered as a period of frequent oscillations of the earth's crust, each stratum of sandstone or lime rock marking the submergence and destruction of a coal swamp, each layer of coal the completed life of a new one.

A more critical study of the upper coal measures west of the Alleghany mountains has led Professor John J. Stevenson, of the Ohio Geological Survey, to give the facts of that coal basin a very different interpretation, and one more in harmony with the modern view of geological changes. Instead of attributing each coal bed to a distinct and independent swamp, he regards all the upper coals in Ohio as the offspring of a single bed (coal VIII) which remained in existence as a flourishing swamp from the beginning of the epoch until its close.

The grounds for this new reading of the upper coal records are treated at length in a paper read before the Lyceum of Natural History of New York, and printed in advance of the Ohio report.

From a careful study of the conditions which prevailed during the deposition of these measures, as shown in the relations of the coal beds to each other, and the changes in the intervening strata, Professor Stevenson finds evidence of a series of gradual subsidences, separated by intervals of repose, during each of which a lid of coal was formed over all or a part of the basin. That these subsidences could not have been paroxysmal is witnessed by the fact that the common source of the upper coals, the great Pittsburgh marsh, crept up the bank as the shore line sank, maintaining its integrity throughout the entire epoch. "Thus it is that, although giving origin to so many subordinate seams, the great coal bed diminishes in thickness when followed west from the Ohio, or east from the immediate valley of the Monongahela."

That the Pittsburgh marsh had its origin on the east, and advanced westwardly, is, in Professor Stevenson's estimation, highly probable. "We have an ample evidence in the sandstone and shale, which at the east separated it from its limestone, that a delta was there forming and pushing out to the west, so that on the east the conditions requisite for the formation of coal would first exist." At each interval of retarded subsidence or repose, the shore marsh "pushed out seaward upon the advancing land," thus giving rise to the successive coal beds—offshoots of the parent bed, separated from each other by wedges of rock, marking periods of more rapid subsidence and more abundant deposits of sand and mud.

CODEINE.

This substance, which is also called *codea*, is beginning to find use in medicine, and some description of its properties as well as the method of its preparation may be of interest to some of our readers. Codeine, like morphine, narcotine, and several other alkaloids, occurs in opium. It was discovered by Robiquet in 1832. These alkaloids exist in opium in combination with certain vegetable acids, principally meconic acid. To obtain the codeine, it is first necessary to remove the meconic acid. An aqueous infusion of opium is evaporated to a sirup and mixed with a solution of chloride of calcium, which precipitates the acid as meconate of calcium, leaving the hydro-chlorate of morphine and hydrochlorate of codeine in the solution, from which they crystallize if left to rest. These crystals are dissolved in water, and the solution, after purification with animal charcoal, is precipitated by ammonia, which separates the greater part of the morphine, leaving the codeine in solution. The filtered liquid is evaporated over a water bath to expel the excess of ammonia, the morphine salt remaining in the solution being at the same time precipitated; the saline solution is concentrated and precipitated by caustic potash, and the precipitate of codeine is washed, dried, and dissolved in ether, whence it is deposited in crystals. From 100 lbs. of opium only 6 or 8 ozs. of codeine is obtained. Codeine is more soluble in water than morphine; it is also soluble in alcohol, ether, and ammonia, but it is quite insoluble in potash. It has a strongly alkaline reaction, restoring the blue color of reddened litimus, and precipitating the salts of lead, iron, copper, cobalt, nickel, etc.

The physiological effects of codeine resemble those of morphine in many respects. According to Robiquet, a dose of 0·3 or 0·4 of a grain produces in 24 hours, especially in an excitable person, a sensation of comfort and repose and a refreshing sleep, and a dose of from 1·8 to 2 grains produces heavy sleep with a feeling of intoxication after waking, sometimes also nausea and vomiting. More than 3 grains in 24 hours cannot be taken without danger of serious consequences.

THE PROBLEM OF THE COMING TRANSITS.

At the unequal but regularly recurring periods of 8, 122, 8, and 105 years, the planet Venus comes between the earth and the sun in such a position as to appear as a black disk crossing the sun's face. These phenomena are called her transits. The last occurrence of the sort was in June, 1769; the next will happen in December, 1874. Eight years later, that is, in December, 1882, the phenomenon will be repeated, after which there will be no more until the year 2004. Since these transits of Venus afford the best and most exact means of determining the distance of the sun—the fundamental measure on which all other astronomical magnitudes beyond the moon depend—they naturally rank among the most important phenomena that science has to deal with. The application of transit observations to the solution of the problem of the sun's distance presupposes a knowledge of the general proportions of the solar system—knowledge which astronomers did not possess at the time of the transits preceding the last pair, namely, those of 1761 and 1769. These were the first to be made use of for this purpose; and as befitted such important events, the whole civilized world combined to make the most of the opportunities they afforded. The instrumental and other means of observation at the command of the astronomers of the past century, however, were very much less varied and delicate than those of to-day. The observers themselves were unacquainted with the nicer difficulties in the way of exact observation; and as a natural consequence the results they obtained fall far short of the uniformity and exactness which modern science considers indispensable. And since more than a century must elapse before the problem can again be attacked under equally favorable conditions, it is appropriate that our astronomers should be making every preparation for the completest and exactest observation that can be made of the transits to come off in 1874 and 1882. As announcements are made from time to time of the appropriation of large sums of money, by the leading governments, for the fitting out of transit expeditions, the question is often asked: "What is it all for?" and: "How can the sun's distance be found that way?"

Perhaps a few simple illustrations may help to make plain the character of the problem to be solved by means of the transits, and the nature of the observations on which the solution will depend.

Suppose that in a photographer's gallery two cameras are placed side by side facing the screen commonly used as a background for pictures. It is obvious that an object, say a small ball, hung between either camera and the screen, and looked at through the instrument, will appear to rest against the screen. It is equally obvious that the ball will not cover precisely the same spot on the screen when looked at first through one instrument and then through the other, since the bearing of an object depends wholly on the point of view. Just as the finger, held between the face and the wall, appears to be shifted from side to side when viewed first with one eye and then with the other, so the apparent position of the ball will be, the amount of the displacement depending partly on the distance between the points of view, and partly on the position of the object between the point of view and the background. If it hang midway, its apparent positions on the screen will be just as far apart as the instruments are; if nearer the screen, the distance will be proportionally less; if nearer the instrument, it will be greater. The exact amount of the displacement can be calculated, provided the relative position of the object is known, and the distance between the cameras. Suppose, for example, the ball to be two yards from the line of the cameras, and the screen five yards further, these spaces representing approximately the distances of Venus from the earth and from the sun, as determined by Kepler's third law. So placed and viewed through the two instruments, the distance between the apparent positions of the ball on the screen will be to the distance between the cameras as five is to two, that is, they will be exactly thirty inches apart. The angle which this line of thirty inches subtends when viewed from either instrument can be directly measured; hence the exact distances from the camera to the ball and from the ball to the screen can be ascertained by a simple calculation.

Substituting two widely separated observers for the two cameras, Venus for the ball, and the sun's disk for the screen, we have, roughly, the elements of the problem of the transit and substantially a method for its solution. The astronomical problem, it is perhaps needless to observe, is complicated by a thousand conditions which make it quite another affair than the simple problem we have sketched. The distances to be measured are immensely great compared with the longest base line to be had on the earth; the angles to be measured are extremely minute, so that an error of a hundredth part of a hair's breadth will materially alter the result; the object whose position is to be observed is constantly in motion, and at a rate which is different for different points of view: so are the observers: while a multitude of other circumstances combine to make their observations delicate and uncertain; but these do not change the primary elements of the problem.

In our illustration we have assumed our planetary substitute to be at rest. It is clear that, if it were in motion, say diagonally upward from left to right, its displacement when seen from two points could not be measured unless the observations were made at precisely the same instant, or unless the rate of the ball's motion were known, and the exact time between the taking of the observations. The same condition holds in the observation of a transit; and since the points of view must be thousands of miles apart to give any considerable difference in the planet's apparent positions on the sun's disk, it is extremely difficult to ensure that observations shall be simultaneous, or separated by precisely known intervals. Some less exacting method must be adopted. Fortunately there are two ways of obviating the difficulty: the first is known as Halley's method, the second, hitherto untried, involves the use of photography. For convenience and simplicity, let us notice the latter first. If, instead of taking two simultaneous observations or pictures of our moving ball, we suppose there be taken two independent series of them, as the ball passes across a circle drawn on the screen to represent the sun's disk. By combining the two series, it is evident that we will have two parallel lines of spots traversing the circle, each marking the apparent path of the ball's transit as seen from its particular instrument. The distance between these two lines will measure the ball's displacement, which is the required term.

This relatively simple means of determining the displacement of Venus, as seen from different stations, will be employed during the coming transits, and excellent results are expected from it. Its application is beset with many serious difficulties, but they are not matters for consideration here.

We shall return to this subject in our next issue.

SCIENTIFIC AND PRACTICAL INFORMATION.

BLUE DYE DERIVED FROM CARBOLIC ACID.

The carbolic acid is mixed with 8 or 10 parts stannate of soda, to which is immediately added concentrated sulphuric or hydrochloric acid. By using the former, a yellow substance is obtained, soluble in tartrate of soda and in the alkalies. By the addition of a large proportion of acid the mixture becomes reddish brown and all the carbolic acid dissolves. Combined with a large amount of water, the solution becomes red and brown flakes, soluble in alcohol, are deposited.

These flakes give to alkalies a blue coloring matter, which is not precipitated either by water or alcohol. It has not been isolated, except on the fabric. The red watery solution treated with alkalies becomes green on account of the formation of the blue dye and a yellow substance. If a fabric of oiled cotton be plunged therein, it is rapidly colored orange, which tint, like the liquid, passes to green when acted upon with alkalies; but if the dyed material be finally left to the action of water, it becomes a sky blue, which is almost unalterable by chlorine and the hypochlorites.

SULPHOVINATE OF SODA.

This salt, which has long been known to chemists, seems now about to acquire a practical interest from its introduction into medicine as a mild purgative. The following method of its preparation is given by Limousin in the *Chemisches Central-Blatt:* Mix carefully 2·2 lbs. of pure sulphuric acid, of specific gravity 1·715, and an equal weight of alcohol of 96°, in such a manner that the alcohol is all the time in excess, the mixture being kept cooled by some artificial process, or by a current of cold running water. The mixture is kept 4 or 5 days at a temperature of 70° to 75° Fah., and then dilated with 4 or 5 quarts distilled water. The solution is now to be saturated with pure carbonate of barium suspended in water, about 4 ozs. being required. The point of saturation is reached when no effervescence is caused by the addition of a fresh quantity of the carbonate. The sulphate of barium formed is now allowed to settle, and the supernatant liquor decanted and filtered. To this solution of sulphovinate of barium, a solution of from 2 to 2·5 ozs. of pure carbonate of soda in 4 quarts of distilled water is added. As soon as no further precipitate is formed and the solution becomes neutral, it is decanted and filtered; the filtrate is evaporated in a water bath until it has a specific gravity of 1·33, and then allowed to crystalize. About 2·2 lbs. of pure crystalized sulphovinate of soda is formed, which, when dissolved in distilled water, should give no precipitate, either with chlorine of barium or sulphuric acid.

According to Limousin, the dried, crystaline salt neither effloresces or deliquesces in the air. When heated to 248° Fah., it is decomposed with sulphate of soda and alcohol, but can be kept for a year or more without decomposition. The crystals are hexagonal plates, containing 10 per cent of water of crystalization, and are very soluble, in water which at 64° Fah. dissolves its own weight of the salt; they are also soluble in dilute alcohol and glycerin, slightly soluble in absolute alcohol, and insoluble in ether. The salt tastes slightly bitter, with a sweet after-taste, which renders it pleasant to take. The dose for an adult is, according to Blache, 6·5 drams, and for a child, half the quantity, taken in sirup or sugar water.

OXALIC ACID.

The commercial oxalic acid is frequently rendered impure by the presence of oxalate of lime and oxalate of potash. When it is desirable to remove these impurities and prepare a perfectly pure article, it can be done in the following manner: Crude oxalic acid is dissolved in the least possible quantity of hot absolute alcohol, in which the salts of lime and potash are insoluble, and then filtered. In a few hours the oxalic acid crystallizes out nearly pure, and the mother-liquor may be employed for making oxalate of ammonia or for dissolving a fresh portion of the crude acid. The crystals thus formed are allowed to drain and are then dissolved in boiling distilled water, which removes any adhering oxalic ether, and leaves the acid perfectly pure.

To prepare pure oxalate of ammonia, the alcoholic mother liquor is diluted either with fresh water, or with the aqueous mother liquor, from the oxalic acid crystals. It is then heated to boiling and neutralized with ammonia. In this operation, much oxamid and oxamethan are formed, but they can be easily decomposed by acidifying the salt solution and boiling for a considerable time; after which it is filtered, and the filtrate rendered slightly ammoniacal and allowed to crystallize. By recrystallization, the salt is obtained pure and white.

DEATH OF BARON VON LIEBIG.

It is with profound regret that we announce the death of Justus von Liebig, which took place at Munich on Friday, April 18. He was born on May 12, 1803, in Darmstadt, and his long and honorable career and his great achievements in chemical science are known and valued in all parts of the world. We shall shortly give an account of his life and labors, and of their influence on the progress of knowledge in the nineteenth century.

ACCORDING to Dr. Böttger, an excellent marking ink can be obtained from the anacardium nut (*a. orientale*). The juice, it appears, contains an oily matter which becomes black on exposure to the air, and is proof against all known detergents and decolorisers, acids and alkalies, cyanide of potassium, and chlorine. If linen be marked with this natural ink, and then moistened with a little ammonia, the black becomes very intense and is perfectly permanent.

American Locomotives in Russia.

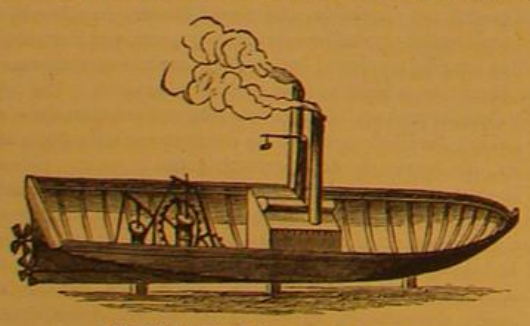
The *Chronique de l'Industrie* says that "a series of experiments have lately been made between St. Petersburg and Lausane with an American Baldwin locomotive, burning anthracite. With a train of ten carriages, the engine ascended the heaviest grades at a speed of 40 miles per hour, and consumed during a run of 82 miles about a tun of coal." Our locomotives are evidently destined to be of great utility in Russia, particularly in the southern portion of the country, where large numbers of anthracite mines are being worked, and where wood is quite rare.

A late number of the *Journal de St. Petersbourg*, recently received, says that since the completion of the line of Voronege—Rostow, to the province of the Don, there has been considerable activity manifested in altering the locomotives so as to make them suitable for the consumption of anthracite. The above periodical adds "it is well known that in Europe this class of engines is not made, and that America alone produces them. The locomotives on the Voronege—Rostow line were manufactured by Baird and Co., of Philadelphia."

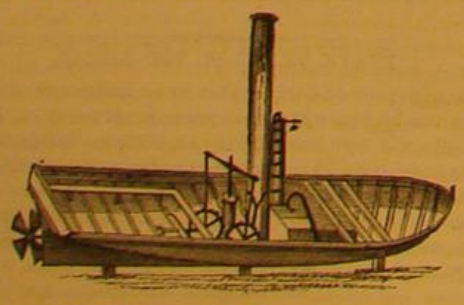
EARLY HISTORY OF STEAM NAVIGATION---THE FIRST SCREW PROPELLER.

Among the many objects of interest to the engineer or mechanic that are to be found within the walls of that admirable institution, the Stevens Institute of Technology, at Hoboken, N. J., there are none which are calculated to arouse a greater degree of professional curiosity than the quaint old machine which is depicted in our engraving. Three years before Robert Fulton's steamer, the Claremont, plowed its way up the Hudson, this engine and boiler, in the hands of Colonel John Stevens, had solved the problem of steam navigation, and had demonstrated the efficacy of the screw propeller. The experiments, though successful, were made but upon a small scale, and knowledge concerning them was confined to a limited circle; so that when Fulton, aided by Chancellor Livingston, a former coadjutor of Colonel Stevens, applied steam to the propulsion of a large vessel, and similarly when, thirty years later, Sir Francis Pettit Smith obtained an English patent for the invention of the screw propeller, and at once proved its powers in a sea-going ship, Stevens, the original inventor, was unknown or forgotten, and to Fulton and Smith the honor and fame of the discoveries were awarded.

The original boat in which the engine was used has long since gone to decay, but the machine itself is still in a good state of preservation. As late as 1844 it was placed in a vessel modeled on the lines of the first boat, which, in the presence of a committee from the American Institute, it propelled at the rate of eight miles per hour. This second vessel is yet to be seen at the Stevens Institute, and we add sketches of the two boats first built by Colonel Stevens, in 1804 and 1806. One is a perogue, some fifty feet in length, and the other a large craft, called the Phœnix; with the former he "attained very considerable speed," and with the latter he made a successful trip to Albany in August, 1807, only a few days after the voyage of Fulton's Claremont.



STEVENS' FIRST STEAMBOAT. 1804.



STEVENS' SECOND STEAMBOAT. 1806.

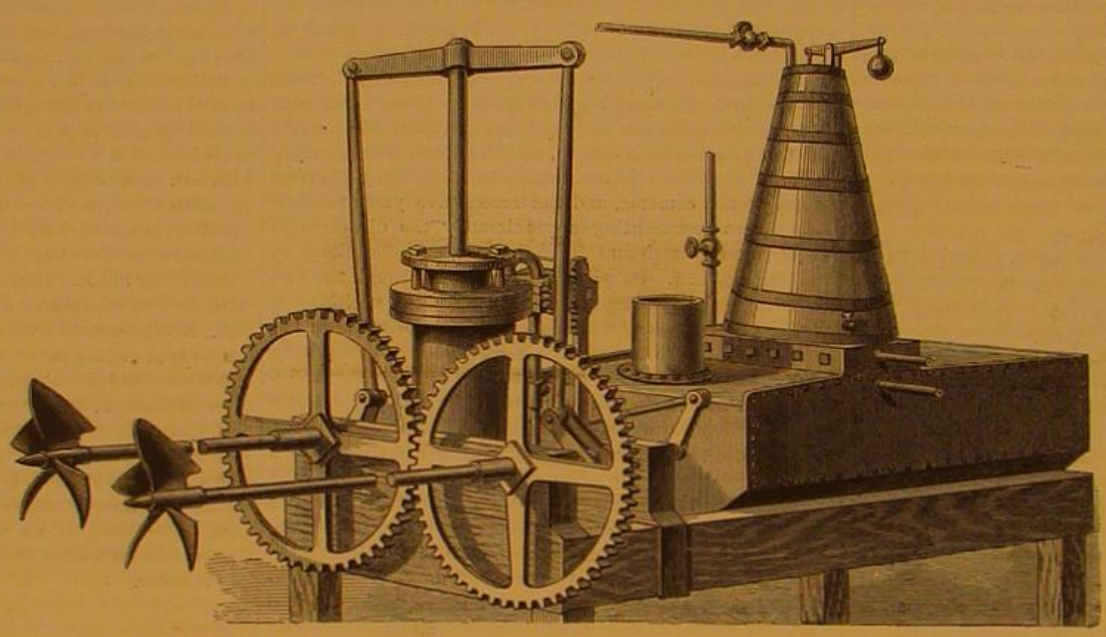
Colonel Stevens began his labors in 1791, and by careful study succeeded in mastering the theory and practice of the steam engine. With this knowledge as a basis, he made further investigations which resulted in the inventions above alluded to, the first practical tests of which proved so satisfactory that he at once set about developing his ideas in order to devote them to the public good.

Colonel Stevens was the father of the late Edwin A. Stevens, the founder of the Stevens Institute of Technology. During the war of the Revolution, he served in a variety of civil and military capacities, and afterwards, in 1787, became the owner of large estates in New Jersey. Our engraving, an excellent likeness of this distinguished man, is taken from a bust in the possession of the Institute. He



COLONEL JOHN STEVENS.

was noted for his enlarged liberal and progressive ideas, which were greatly in advance of the times in which he lived. In 1812 he not only proposed a railroad between Lake Erie and Albany, but made actual surveys for a line from Philadelphia to New York, and this at a period, it will be remembered, before such a thing as a railroad was known. He proposed a high bridge across the Hudson river from Hoboken to New York, and, besides, made a large number of other inventions and suggestions, the soundness and value of many of which have since been fully demonstrated. Colonel Stevens died at Hoboken in 1838, at the advanced age of nearly 90 years.—*Science Record for* 1872.



BOILER, ENGINE, AND TWIN SCREWS OF STEAMBOAT BUILT BY JOHN STEVENS. 1804.

Novel Conservatory.

Amongst the various objects about to be exhibited at Vienna, our attention has been directed to a conservatory, constructed by Mr. E. Lloyd, horticultural builder, of Grantham, Lincolnshire, England, a description of which is given in the *Ironmonger*:

The style of the conservatory is of a Gothic character, and the whole building, both externally and internally, presents a light and elegant appearance. A wood sill forms the base of the building, and may be either secured by bolts and nuts to wood sleepers, or on a concrete bed in which the bolts are imbedded. The rafters are about six feet apart, and are constructed of two flitches of wrought iron, with a flitch of wood between, well bolted together, the iron on each side being slightly raised above the wood to form a channel for the water, there being no copping used to cover the meeting styles of the sashes. The rafters and mullions are formed in one piece to the sectional form of one half the building, the ends of the mullions being flanged at the ends and bolted to the sills, and the ends of the rafters secured in a similar manner, with this difference, that both ends of the rafters meet together at the apex of the roof, and are bolted together through the ridge. The ends are constructed of extra strength, so as to require no framework, and the whole of the building is strongly braced together by light round wrought iron rods passed through the rafters, the rods have threads on at one end, with washers and nuts, by which the whole building is strained tightly together, and rendered rigid by the iron tubing.

The bottom panels are formed of wood secured to the standards at one end with iron pins, and at the other by a brass bolt, the mullions being drilled to receive the end of the bolt. The top edge of each panel is beveled, and a molding fixed on the inside edge to form a stop for the ventilating sashes. The gutter plate is of wood, beveled externally on top edge to the pitch of the roof sashes, and bolted through the mullion or standard. The front sashes are hinged to the gutter plate, and made to open separately with brass stay fastenings and pins. The roof sashes are made in six feet lengths, and hung with hooks to the iron gas tubing, and secured externally by an iron button screwed into the top of rafter between each sash. The glass ventilators, or top sashes of roof, are hinged in a similar manner to the upright side sashes, and are made to open separately with iron levers, pulleys, and cords; but it is intended to hang them both in future in the same way as the other sashes herein described. The sashes are all grooved, and the glass fixed without putty in a manner recently patented by the manufacturer. A moveable wood slip is fixed on the bottom rail of each sash, by which the lower end of each square of glass is secured from slipping, and protected from breakage. The doors are made folding, and are grooved for the glass on the same principle as the sashes. The gutters are of cast iron and secured by bolts and nuts to the gutter plate and upright mullions, the down pipes from the gutter forming a column at each corner of the building; the ridge has ornamental cresting in cast iron, and at each end is fixed an ornamental wrought iron fernial. The ends have a molded coping and facia, and a projecting corbel at the eaves, concealing the end of the gutters.

The building is so extremely portable and simple in construction that two men of ordinary capacity can fix and glaze the building ready for use in a week.

Pine Tree Products.

The pine forests of Europe are utilized to a considerable extent. There are two establishments near Breslau, in Silesia, one a factory where the pine leaves are converted into what is called "forest wool" or wadding; the other an establishment for invalids, where the waters used in the manufacture of this pine wool are employed as curative agents. Two cases of these products were shown at the last Paris and Havre Exhibitions, which contained various illustrations in the shape of wool for stuffing mattresses and other articles of furniture (instead of horse hair), vegetable wadding and hygienic flannel for medical application, essential oil for rheumatism and skin diseases; cloth made from the fiber; articles of dress, such as vests, drawers, hose, shirts, coverlets, chest preservers, etc., and other useful applications.

For the preparation of the textile material, an ethereal oil is produced, which is employed as a curative agent, and as a useful solvent. The membranous substance and refuse are impressed into blocks and used as fuel; from the resinous matter they contain, they produce sufficient gas for illuminating the factory in which the manufacture is carried on. We have seen garments for sale in this city said to be made from the spines of the pine, and recommended for the cure of rheumatism.

BALE TIE FASTENER.

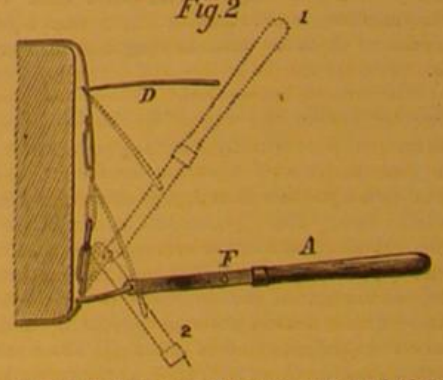
We illustrate herewith an improved invention for fastening bale ties, which, it is claimed, saves much labor and accomplishes the work in a few seconds of time.

A, Fig. 1, is a lever made forked and connecting, as shown,

Fig. 1



Fig. 2



with a bifurcated plate, near the outer end of which is formed a slot, C. D is a hook plate, having at its broad end a slot, E, and terminating at its other extremity in a hook. The various parts are made of suitable strength for the purpose intended and, with the exception of the handle of the lever, A, are of metal.

Fig. 2 shows the apparatus as applied to a bale. The hook plate, D, is attached to the one end of the band by slipping

the latter into the slot, E, and the forked plate, B, is fastened to the other end by means of its slot, C, in a similar manner. When thus secured, the lever, A, is raised or turned toward the bale until the hook of the plate, D, will enter a hole, F, on the lever. The parts then assume the position shown in the dotted lines of Fig. 2, marked 1. The lever, A, is then carried over until it is placed as indicated by the dotted lines, 2, thus drawing the ends of the band together, so that they may be fastened. The length of the lever, A, of course, renders but slight power necessary, so that the labor can be readily and quickly performed.

Patented December 10, 1872. For further information address the inventor, Mr. R. S. Sayre, Stilesborough, Bartow county, Ga.

STEVENS INSTITUTE LECTURES.---SUNLIGHT AND ITS SOURCE.

BY PRESIDENT HENRY MORTON.

The spring course of lectures at the Stevens Institute opened on Tuesday, April 15, with a brilliant lecture by the President of the institution. The substance of the lecture may be described briefly as follows:

For the purpose of measuring lights of different brilliancy, the light of a candle serves as a standard of comparison. An ordinary gas flame is equal to the light of fourteen to eighteen candles, a fact we do not generally appreciate until the gas gives out and we are obliged, as in New York city lately, to substitute candles for it. While the shadow of a gas flame is much more sharply defined and more opaque than that of a candle, it is surpassed by that produced with an oxyhydrogen lamp, the latter by a magnesia burner, this again by the lime light, and so on, until we finally come to the electric light, the most intense artificial illumination we are able to produce. All these lights were exhibited by means of the shadows of objects they cast upon the screen, and it was stated that the brilliancy of the electric light was equal to that of five hundred and seventy-two candles. The intensity of sunlight, however, is so very much greater than the latter that it would take a body many times larger than the sun, composed of incandescent carbon points, to give us the same amount of light.

Next to this brightness of the sun, the whiteness of his light strikes us as a prominent characteristic. Now, this whiteness is due to a harmonious blending of lights of all colors in proper proportion, as is seen in the spectrum, where a ray of white sunlight is broken up by a prism into its component colors. By reason of its composition it has the property of exhibiting all colors with equal effect, a property not shared by colored lights. The lecturer exhibited a large burner in illustration of this fact. It was covered with disks of green, blue, and purple, purposely selected on account of their dullness by gas light. When illuminated by the electric light, they became very brilliant. When light of any color other than white is passed through a prism, its spectrum is not continuous but composed of alternate bright colored and black bands. These vary with the source of light, and are so characteristic as to enable us to tell what substances give the light. A piece of brass burned in the electric arch showed upon the screen the bands due to its components, copper and zinc. This is the principle of spectrum analysis. Now, on examining the spectrum of sun light, we notice that it is full of dark lines. Kirchoff was the first to indicate the connection between these and the bright lines produced by the vapors of burning substances. He observed that some of them, for example nickel, iron, and hydrogen, produced bright lines exactly coinciding in position with certain black lines in the solar spectrum, and he concluded that these substances were present in the sun. But why should they produce black lines in this case? It is because light passing through vapors is deprived of certain portions of its rays, which are absorbed by these vapors. This was beautifully shown by causing the spectrum of the electric light to be formed on the screen, and then interposing the vapor of sodium to its passage; a black line was immediately produced in the yellow part of the spectrum, and this line corresponds to the sodium line in the solar spectrum. Transparent solutions similarly blot out portions of the light by absorption. Some substances produce a great number of lines: iron, for example, about 200. These have been carefully studied. Mr. Rutherfurd, of New York city, who, in appreciation of his eminent services to science, has been recently elected a member of the Royal Society, has produced beautiful photographs of these lines, and Dr. Draper has obtained unparalleled photographs by means of diffraction plates.

This apparatus, represented in Fig. 1, consists of a series of prisms, by which the light entering from the right is made to pass twice around the prisms, and is finally photographed in the solar camera on the right. These photographs, extending far beyond the visible spectra, have never been equaled.

The lines in the solar spectrum are the means by which we can recognize the substances of which the sun is composed.

When examined with the telescope, the surface of the sun presents a mottled appearance, likened by Nasmyth to overlapping willow leaves, and by Father Secchi to rice grains. Pictures of their drawings were exhibited upon the screen, as was also a photograph taken in the $\frac{1}{500}$ of a second during the total eclipse of August 7, 1869, at Ottumwa, Iowa, just as the "nose of the moon touched the sun's disk."

The spots on the sun gradually travel over its surface, appearing foreshortened as they approach the edges. Over and near them are sometimes visible very bright clouds or faculæ. An ingenious apparatus, invented by Professor Morton, enabled him to represent the passage and the foreshortening of a solar spot over the surface of a disk representing the sun. It consisted simply of an image of the spot upon a rotating glass cylinder placed before the lantern and having before it a screen with a circular hole. The spots also change their shape, and photographs have been taken by Mr. Rutherfurd and others of the same spot in different phases. Some of these were exhibited on the screen.

When the edge of the sun's disk is examined by means of the spectroscope, red hydrogen flames of different shapes are observed. These have been the subject of considerable study. A society of Italian observers, composed of Father Secchi, Respighi, Tacchini, and others, have mapped out simultaneously, at different stations, the whole edge of the sun's disk; but the most remarkable observation ever made of them is the following by Professor Young. He observed

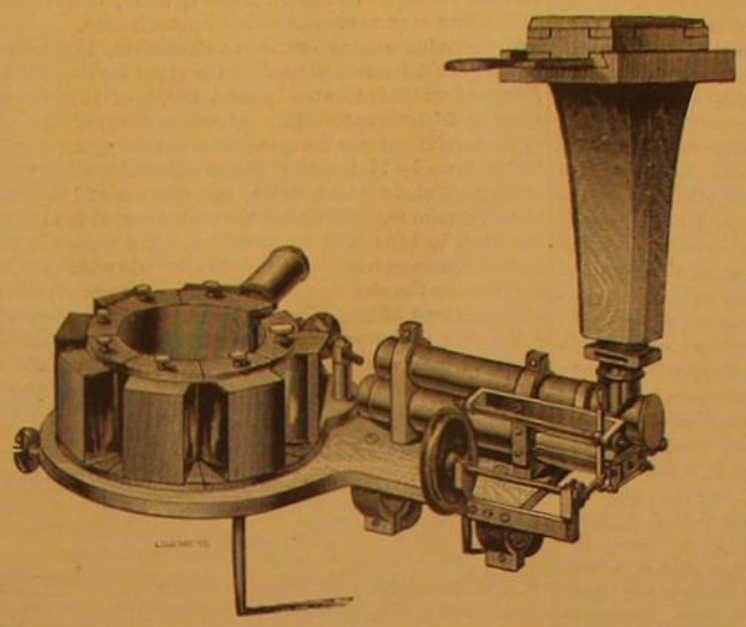


FIG. 1.—DR. DRAPER'S APPARATUS

a large flame, much resembling a grove of trees, for some time, when his duties called him away for about half an hour. When he returned, he found that the flame had been blown literally to shreds, some of which were ascending at the enormous rate of 166 miles a second. Their velocity at starting must have been double or triple.



FIG. 2.—SOLAR FLAMES.

Fig. 2 represents some solar flames, two of them in contact with the sun's disk, and one separated from it. It is supposed that the interior of the sun is in a liquid state under enormous pressure, and that from it the flames burst through the surface with a terrific explosion. The lecturer represented them by means of the apparatus represented in Fig. 3. A glass tank placed in the lantern is filled with a red solution below and cold water above. The coil of wire seen in the engraving is heated by means of a battery, and causes

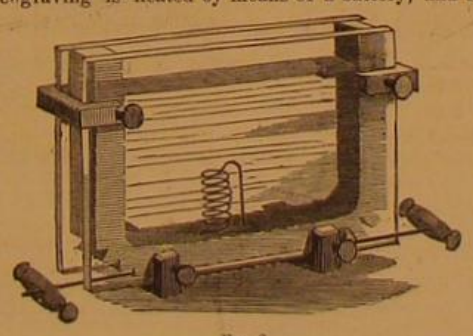


FIG. 3.

the red fluid surrounding it to ascend. The effect is strikingly like that of the red solar flames. Formerly these could only be observed during total eclipses, at the moment the sun's disk was totally covered by the moon. Thus the corona of red flames flashes out with the appearance shown in Fig. 4. This was beautifully shown in its natural colors by placing behind the perforated screen, of Fig. 4, hydrogen tubes, represented in Fig. 5, through which the electric spark



FIG. 4.

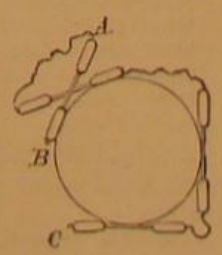


FIG. 5.

was caused to flash. This ingenious experiment elicited much applause. Proctor's theory is that the heat of the sun is maintained by the enormous heat generated by the impact and combustion of meteoric bodies constantly attracted into the liquid mass of the sun. Such impact would cause a grand explosion, carrying with it the propulsion of liquid and gaseous masses thousands of miles upwards, and would account for the solar spots and the flames rushing out from the edge of the disk. Bodies leaving the sun with a velocity of 300 miles a second would get beyond his attraction and never return. Some of these strike the earth in the form of meteorites, and prove their solar origin, according to Graham, by the hydrogen contained in them. The fact that most meteorites fall in the day time, more especially at noon, when the sun is towards us, tends to confirm this opinion.

THE WONDERS OF THE EGG.

[A RECENT LECTURE BY PROFESSOR AGASSIZ.—CONCLUSION.]

In the radiates, the lowest type of the animal kingdom, the eggs are mostly microscopic. I shall have more to say of them hereafter, and of other modes of reproduction common to this type. Before entering upon this part of my subject I wish to make a broad experimental statement about all eggs and all animals. These eggs, whether of vertebrate, articulate, mollusk, or radiate, appear at some time or other to be identical in structure. At least, no investigator has ever been able to detect any essential difference in them. They are all formed in an organ belonging to the maternal being, known as the ovary. In some animals this organ is very simple. Whatever its structure, however, whether complex or simple, there is a spot in the female organism known as the ovary, in which eggs are formed, from which new beings may be developed. But before the egg developes into the new being, it must be fecundated. For what I have said thus far with reference to absolute identity of egg structure throughout the animal kingdom refers only to the egg as egg, before the process of fecundation takes place. There is an organ in the male organisms, corresponding to the ovary in the female organism, in which sperm cells are formed, the contact of the contents of which with an ovarian egg is an indispensable condition for the growth of a new being. There are no animals known in which these corresponding organs do not exist.

Reproduction in the vegetable kingdom is based on similar structures with similar relations to one another. These two conditions, essential to the maintenance of types, should be well weighed by any one who would approach the problem of the origin of life.

Before showing you the structure of the egg proper, as it exists in all animals before it takes upon itself any individual character, I will say a word on other modes of reproduction, in order that you may have before you the whole subject, and that I may not be limited in my comparison to the ovarian eggs and fertilizing cells, but be able to include budding and self division among the reproductive processes.

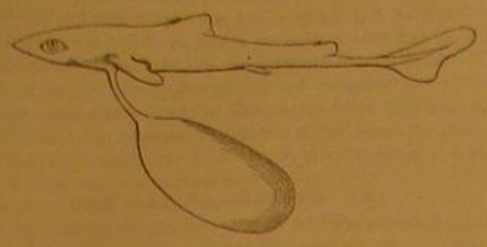
With radiates, especially among the hydroids, multiplication by buds and by self-division is common. An individual such as I sketch on the board (hydroid), puts out a bud from the main trunk. This bud grows into an individual similar to the parent, and it gives rise in its turn to a number of buds which go on multiplying in the same way till a large community is formed. In other instances, such buds may drop off, and become free, independent individuals. Sometimes again, new individuals arising in this way differ from the parent, and only in their offspring reproduce a being resembling the one from which they sprang. Many hydroids, and even some of the acalephs, multiply by a still more simple process—that of self-division. The primitive stock breaks up transversely at regular intervals by constriction, and each such part, when thrown off, becomes a new individual, while the parent remains unimpaired in its vitality.

Certain worms, also, multiply in this way, dividing into parts, and each part building itself up into a new and perfect being. Instances are also known of longitudinal division leading to the same result. Not only is it true that there are other modes of reproduction besides that of eggs, but it is also a fact that the antagonism between male and female, on which the whole process of multiplication and increase among animals seems to rest, is not always necessary for the production of a new individual.

There are cases in which the germ is formed, and passes through all the changes until it reaches the adult condition without being fecundated at all. We owe this discovery to Liebold, who followed the whole history of the unfecundated egg in species of moths, with an ingenuity and perseverance which leave no possibility of doubt as to his results. There are also cases which exhibit an essential difference in the product of a fecundated egg and of one which has not been fecundated. Upon such difference rests, for instance, the whole economy of the bee community. All the eggs laid by the queen bee prior to copulation produce males, and these males are what are called drones. The working bees are undeveloped females, and are the product of fecundated eggs. What is called the queen is the result of a special training of one of these imperfect females. The workers choose one of their number, and, by peculiar treatment and mode of feeding, etc., develope her into a perfect queen, whose office it is to multiply the community. There are also some butterflies which produce perfect male and female individuals from non-fecundated eggs.

The young shark is favored at his birth with what seems to be an egg. It is, however, a bag of nourishment, sup-

plied by the maternal parent, which keeps him in food until he is able to set up in business for himself.



THE YOUNG SHARK

What now, we would ask, is the significance of an egg? Is the egg itself an individual? Is it a new being? I think as we go on we shall be brought to the conclusion that the egg is the new being, endowed with an individuality, that is with a typical character so distinct that never since the world began did the egg of any one animal produce an animal differing from the parent in essential features, or the seed of any plant produce anything differing essentially from the plant which bore it.

Whatever phases an egg passes through, however much it transiently resembles the adult condition of some animal lower than itself in the same type, it never ends by producing anything but the kind of animal from which it arose. There is not a solitary instance on record of a deviation from that ever recurring cycle of development which shows a succession of specifically identical individuals as the result of reproduction, whether through eggs, budding or division. There are no other modes of multiplication known.

An egg does not necessarily lead to the formation of one single being. The egg of the natica, for instance, often divides to form several individuals, though it may also develope as one being. In many instances, however, the natica egg, beginning as one yolk, breaks up into two, four, or more, one primitive individuality thus dividing and transmuting its peculiarities to a generation more numerous than itself. This is not the case when double birth takes place in higher animals, in the mammalia for instance. Each individual is in that instance the growth of a separate egg. So in monstrosities in the quadrupeds, where double heads and the like abnormal developments occur; they come from the merging of the eggs together. The multiplying of individuals in one egg seems more like the process of reproduction by self division, as in hydroids and worms; only in the latter it is a kind of reconstruction of lost parts, while in the former it is the primitive egg growing into several beings. The more we examine these various processes of multiplication among animals, the more are we impressed with the fact that the maintenance of kind, the fixedness of features in the organic world, is their primary object and inevitable result. At least, that is the conclusion to which all my own studies in embryology have brought me.

The reproduction of individuals does not go on constantly. It is periodical, and this periodicity varies in different animals. Some animals require a long development of themselves before they produce eggs. Others lay eggs very early in life. Fowls begin to lay the first year after their birth. Fresh water turtles do not bear young before their tenth or eleventh year, sometimes not till their twelfth. In our common black and yellow dotted fresh water terrapin, and in the painted terrapin, the eggs require four years of growth before they are laid. Take a seven year old turtle of this kind; it will contain only very small eggs, all of uniform size. An eight year old turtle of the same kind will have two sets of eggs, one larger and one smaller. One of nine years will have three sets, the oldest set being the size of a small pea. A turtle of ten years will have four sets of eggs, and in that year she will lay for the first time, and give birth to the most mature set.

Other animals require but a few weeks to bring their eggs to full maturity. In our common jelly fishes, for instance, with rose colored ovaries, the eggs begin in May. In July they are all laid and the young begin their independent life. The season of laying differs greatly in different animals. Some lay their eggs in spring, others in midsummer, others, as the trout family, salmon and the like, in autumn.

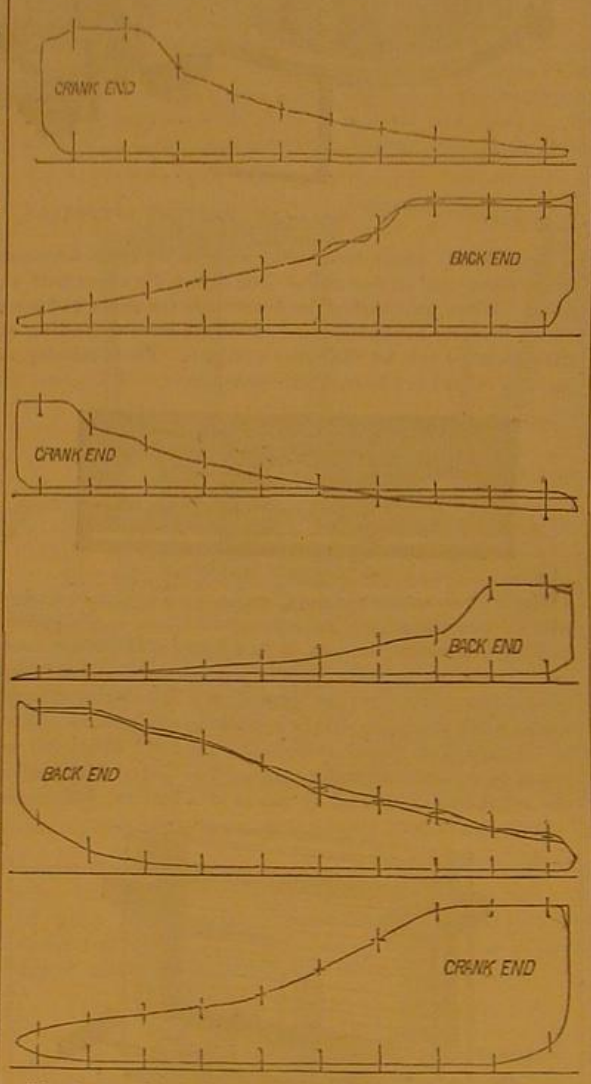
The irregularity of number is another astonishing feature of this problem of reproduction. It would seem that some kinds of animals require a far greater number of individuals for the maintenance of the type than others. Some animals multiply by hundreds of thousands—nay, by millions. Others bring forth a single new being, or at the most two or three at a time. Some animals bear but once and then die. Others, more tenacious of life, bring forth new broods for a long period of years. These various conditions, of growth, duration, and ripening, these extraordinary differences in the power of multiplication and reproduction, are no doubt a necessary part of the economy of the whole animal kingdom. There is nothing variable or capricious about it, and we must not forget that whoever would account for the origin or successive introduction of the different types of organized beings which have followed one another upon earth must include in his explanation the whole scheme by which characteristics are continued and transmitted.

Before closing, and as a preparation for my next lecture, I will show you what is the ovarian egg. (Drawing on the blackboard.) It is microscopic in many animals; but whatever its size, it consists of an outer bag filled with a semi-transparent fluid which is somewhat oily, and an inner bag also filled with a transparent fluid, which is chiefly albuminous. The difference in the character of the two fluids gives greater translucence to that which fills the inner sac. Within the inner bag there is a spot or dot, sometimes several of them, more or less distinct. In this condition all the eggs I have shown you, all eggs born of whatever living creature, are alike.

TRIALS OF THE ELLIS VAPOR ENGINE.

We have already laid before our readers descriptions and engravings of the Ellis vapor engine, an invention based upon the utilization of the latent heat of exhaust steam to produce power by the vaporization of bisulphide of carbon, and have noted the large reduction in cost of steam power, principally due to the economy of fuel incident to its use. We have now to present further proof of the efficiency of the system as indicated by the results obtained from its employment in the works of Messrs. Poole & Hunt, of Baltimore, Md., a firm at present engaged in its manufacture.

The driving engine of the establishment, the exhaust steam of which serves to produce the vapor for the Ellis engine, and which is assisted by the latter, is of 14 inches cylinder by 24 inches stroke, has an automatic cut-off and runs at 86 revolutions per minute. The vapor engine is of 10 inches bore by 14 inches stroke, with double slide valves cutting off at six tenths stroke, and operates at 176 revolutions per minute. Both machines are connected to the same line shaft by belts from the fly wheels. The vapor engine is run without a governor and with the throttle wide open, the governor on the steam engine regulating the speed satisfactorily. About 36 horse power is required to drive the works, a fact shown by the accompanying indicator cards, taken by Mr. J. D. Isaacs, mechanical engineer, which, we are informed, average about the same as and are fair samples of a large number.



The first pair of diagrams, at the top, were taken from the steam engine while it was doing all the work, with the following data:

Boiler pressure, per gage	50 lbs.
Mean effective pressure indicated	23·25 lbs.
Mean back pressure indicated	1·85 lbs.
Number of revolutions per minute	86
Total horse power indicated	37·316
Scale of indicator	1/40

The middle couple are also from the steam engine, but were taken while it was being assisted by the vapor engine, the latter using its exhaust:

Boiler pressure	36 lbs.
Mean effective pressure	8·7 lbs.
Mean back pressure	1·38 lbs.
Number of revolutions per minute	86
Horse power indicated	13·964
Scale of indicator	1/40

The last pair shows the work of the vapor engine produced entirely by the exhaust of the steam engine and assisting the latter:

Vaporizer pressure	45 lbs.
Mean effective pressure	22·4 lbs.
Mean back pressure	2·45 lbs.
Number of revolutions per minute	178
Horse power indicated	22·1088
Scale of indicator	1/30

These cards show that about the same power is required to do the necessary work at all times: the steam engine, when performing the whole labor, indicating 37·3 horse power, or the combined steam and vapor engines, 36·06 horse power. It will be noticed that, when assisted by the Ellis engine, the steam engine indicated only 13·96 horse power, while the vapor produced by the heat of its exhaust gives 22·1 horse power. In other words, the important result is gained of but 38·7 per cent of the work being done by the steam engine, while the remaining 61·3 per cent is accomplished by the vapor machine, through the medium of heat which is otherwise allowed to go to loss. In the present instance this ratio was effected when the steam was worked in the most economical manner, and expanded to the atmospheric pressure; while the vapor was used in a wasteful engine in which its terminal pressure averaged nearly 10 lbs. Had it been expanded to the same extent as the steam, still better results would doubtless have been attained.

A letter from the Haskins Machine Company, of Fitchburg, Mass., forwarded to us by the inventor, states that the system has been introduced into the works of that corporation with every success. The machinery of the establishment is operated by a 6 by 9 steam engine under a pressure of 65 lbs. With the exhaust from this engine, the bisulphide of carbon is boiled and with its vapor a second engine, of 8 inch cylinder by 11 inch stroke, is actuated. The power is not only applied to the immediate use of the factory, but is conveyed by means of a 254 foot wire cable to a neighboring establishment. For this service the company receives a sum about equal to that which it costs to produce the steam for the steam engine, so that that which would otherwise be clear waste is here turned into gain. It is further stated that the vapor engine, when once in complete order, worked with literally no stoppages other than were desired, and that the total leakage, for a period of over four months, was less than one gill per 24 hours. At the expiration of the whole time in which the machine was in continuous use, about eight months, the manufacturers, desiring to replace it with one of newer and more improved form, sold it for cost price, a careful examination of all its parts by the purchaser proving that no portion had become deteriorated or injured.

As regards the bisulphide of carbon employed in the boilers, we learn that the Vapor Engine Company have erected works for its manufacture and are prepared to furnish it to consumers at one dollar per gallon. The same concern also supply the vapor engine with their fixtures, etc., in all sizes, and guarantee that a combined steam and vapor machine will give a certain horse power with half the fuel required to produce the same power with the steam engine alone.

In view of the above facts, indicating such large advantages, it seems that the introduction of the vapor engine is a matter of considerable importance from an economical point of view. It is clearly extravagant to consume 3 lbs. of coal per horse power, when, as the inventor claims and as experience appears to prove, by a simple change in the system of utilizing its heat, one and a half pounds may be made to perform the same work.

For a more detailed description of the vapor engine the reader is referred to page 31, Vol. XXVI. of our journal, or for further particulars, to the Vapor Engine Company, No. 154 Tremont street, Boston, Mass.

Mining Industry in Russia.

Russia is the richest country in the world in mineral wealth. The government official report of the mines now being worked enumerates them as follows: Gold, 1,126 (principally in Siberia); platinum, 6; silver and lead, 26; copper, 71; iron, 1,283; zinc, 6; cobalt, 1 (in the Caucasus); tin, 1; arsenic, 2; chromium, 1; coal, 193; rock salt, 4; naphtha and petroleum wells, 772. The metallurgical establishments are: 2 mints, 2 founderies for gold, 10 for silver, 39 for copper, 164 blast furnaces for iron, 214 works for iron and steel, 4 for zinc, 1 for cobalt and 1 for tin. The mines and founderies employ a total of 154,197, the precious metal industries, 69,186, and the salt works, 40,000, making a grand total of 263,383 persons, and utilize the work of 482 steam engines and 2,223 hydraulic and turbine wheels, aggregating 56,255 horse power.

The Wreck of the Atlantic.

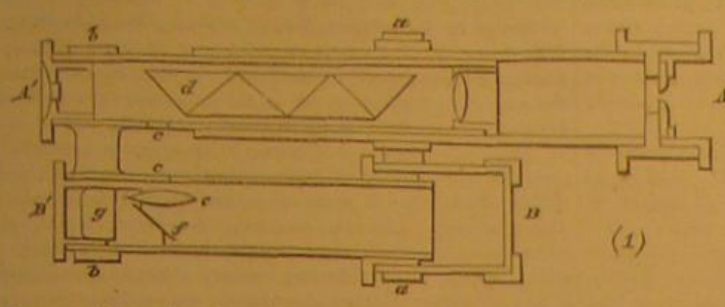
G. L. K. calls attention to the small proportional number of the light houses, beacons and buoys on the costs of British North America, and suggests the use of the calcium light on shore for this purpose, as well as the employment by ships of some explosive (giving a pyrotechnic light, of some pre-arranged color, if possible). He states that a calcium light on Morris Island was a sufficient landmark, during the war, for a number of blockade runners, and the report of the siege guns served the enemy equally well.

PROFESSOR PARTRIDGE, Professor of Anatomy of the British Royal Academy, is dead. Three men—body snatchers—once brought the body of a boy to him for sale. The professor suspected from the appearance of the corpse that a murder had been committed for the purpose of selling the body. He caused their arrest. One of them turned State's evidence, acknowledged the crime, and all three were hanged. The skeleton of the informer is now in King's College Museum—a present from Professor Partridge.

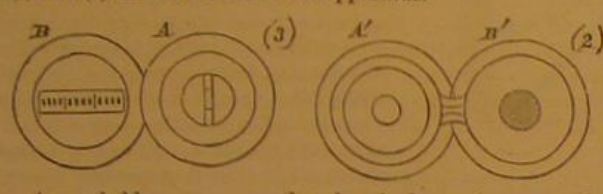
THE DANGERS OF OCEAN TRAVEL.—A correspondent, C. D. O., suggests that the propeller shafts of ocean-going ships should be so constructed that they could be disconnected in case the engines broke down, and levers and gearing applied, in order to drive the vessel by manual power. The labor of the six or seven hundred men, usually on board one of these ships, would be available for this purpose, and the vessel would never be left to the mercy of the waves by the break down of the engines or the failure of the supply of coal

IMPROVED SPECTROSCOPE.

We are indebted to the *Chemical News* for the accompanying ingenious arrangement of a micrometer scale in connection with a pocket spectroscope, by H. R. Procter. The device consists in attaching to the side of the instrument, A A', a brass tube, B B' (the first slide of a miniature toy telescope



will answer) braced to the tube and draw tube of the spectroscope by double rings of bent copper plate, *a a b b*. The ring, *a*, slides on the main tube of the spectroscope by a collar of soft leather interposed between them. A' is the eye piece, and at A is the slit. B is the scale, shown at (3), consisting of transparent lines on an opaque ground and illuminated by the same light as that of which the spectrum is observed. The image of this scale is reflected in the thin silvered glass diagonal mirror, *f*, and is magnified by the lens of short focus, *e*; thence it passes through two small holes, *c*, about one eighth inch in diameter, drilled opposite to each other in the tubes, and is finally reflected from the prism, *d*, to the eye. The end, B', of the telescope tube is closed, and the lens, *e*, and mirror, *f*, are cemented in a piece of cork. (2) and (3) are end views of the apparatus.



As probably every one that has had occasion to use the pocket spectroscope has felt the want of a means of determining the exact nature of the lines viewed, this ingenious attachment will be found very useful. It raises the apparatus, in fact, from a toy to an instrument of some scientific value, and, if the scale be correctly constructed and adjusted, furnishes a very handy arrangement for use in localities such as blast furnaces, Bessemer works, etc., to which the transportation of a large spectroscope might be attended with inconvenience.

Correspondence.

[For the SCIENTIFIC AMERICAN.]

Collection and Reduction of Photographic Wastes.

Not less than half a million dollars' worth of gold and silver is annually consumed by the photographers of the United States; and that fully one half of this can be saved by proper care is a sufficient reason for this somewhat extended communication.

From time to time, there have appeared in the SCIENTIFIC AMERICAN, methods for the reduction of silver wastes, which I thought were not sufficiently explicit; I will now, in as few words as possible, give my plan, which I have practiced for a considerable time.

1. All clippings of silvered paper, old filters, paper charged with drippings from silver solutions, etc., should be kept in a suitable box; and when a sufficient quantity has been collected—from 10 to 15 pounds—they should be reduced to ashes in the corner of a clean hearth, by having a little square place built up with a few loose bricks. Throw into this place a few handsful, set fire to them, and add the remainder gradually, while keeping up a pretty good fire. When all the waste has been burnt in this way, keep the ashes in a pile and let them be converted into gray ash. I am particular in describing this process, as the future success of reduction depends very much on the complete combustion of the waste paper, so that very little charred paper is left, all being reduced to gray ashes, which consist principally of the silica of the paper and partly reduced silver.

2. All the washings of the prints may be collected in a suitable vessel and the silver precipitated as a chloride by means of common table salt; too much salt should not be added at a time, as the chloride is soluble in a large excess of salt. When a sufficient quantity of chloride of silver has been collected, drain it on a muslin filter and dry it thoroughly. Treat in a similar manner the washings of negatives and the waste developing solution. Or both may be precipitated together in a vessel—say a common tight barrel, cut in two—which should be kept in the dark room. The clear liquid must be drawn off from time to time, by means of a siphon or a tap, placed three or four inches from the bottom. The precipitate consists principally of chloride of silver.

3. The hyposulphite of sodium, or fixing solution, should be collected separately in a capacious stone jar, and the silver thrown down by keeping a piece of zinc constantly in the liquid; and when the jar gets full of solution, the supernatant liquid is poured off. When a suitable quantity has been collected, drain, as the chloride, on a filter and dry. When perfectly dry, place this waste, which consists of sulphide of silver and metallic silver, in a sand crucible—an old one that has been used for reducing silver will answer—and expose to the heat of a common stove, merely to expel moisture and sulphur, or, in other words, to roast it.

4. Waste toning or gold solution is more economically collected by pouring it in a shallow dish and evaporating it to dryness on a stove or in the sun. This consists of the various salts used in toning, generally bicarbonate of sodium and chlorides of gold, the latter being more or less reduced to a metallic state. The soda will be useful as a flux in the operation of reduction.

REDUCTION.

The reduction of the wastes to their metallic form is donein a very simple manner and with perfect success, if the following method is carefully carried out: A common stove, one with an egg-shaped cylinder, or one having a similar open fire place will answer exceedingly well, if it has a good draft; this latter is an essential. The fuel should be either common anthracite or bituminous coal or coke. The best flux, for the various wastes, is simply salt of tartar (carbonate of potassium). A sand crucible of the capacity from a pint to a quart, a pair of tongs, a small scoop with a long handle—an iron ladle will answer—and a common poker, are all the necessary implements.

Build up a fresh fire in your stove, introduce the sand crucible, which has been previously filled to the top with an intimate mixture of your waste—either of one kind, or all mixed together—with two or three times its weight of salt of tartar. Put coal around the crucible as high as the top, and give the stove its full draft. In the course of one or two hours, the contents of the crucible will melt into a liquid mass; you may then add with the scoop more waste, mixed as above with salt of tartar. This has to be done very gradually, or the gases, set free, will cause the crucible to boil over. In this way, a quantity as large as that first introduced into the crucible may be added. When the whole mass assumes a liquid form, try, with a hot poker, whether the mass is homogeneous; if it has tough lumps in it, add cautiously some salt of tartar, keeping up a strong heat in the mean time; and when the mass becomes uniform, remove the crucible from the fire, taking a firm grip with your tongs, and either pour out the mass into a dry iron vessel, or set the crucible on the front of the stove or on a brick to cool. When cold, you will find the metal in a button, either in the bottom of the crucible or the inner vessel, as the case may be.

I must not forget to say that the gold waste, collected as stated above, should be mixed with the other waste, and the soda contained therein will answer as a flux in connection with the salt of tartar; and the gold mixed with the silver can be separated as directed further on.

The process of reduction takes from three to four hours, and a strong white heat must be kept up. The materials must be perfectly dry. No small globules of silver should be found interspersed in the flux. If they are found, it is because the heat was insufficient, or the crucible was removed too soon from the fire. The paper ashes should furnish one half or three fourths their weight of metallic silver. One and one fourth to one and one half parts of chloride will yield one part of silver, and the other waste from one half to three fourths its weight.

CONVERSION OF THE METALS INTO NITRATE OF SILVER AND CHLORIDE OF GOLD.

Dissolve the metal in a porcelain dish, in a chimney place, by adding two and one half parts of commercial nitric acid to two parts of the silver; use the heat of a very small gas jet or small kerosene lamp, placed under the dish. To prevent the projection of liquid from the dish, invert a glass funnel over it, resting just inside the edge of the dish. When the silver is dissolved, remove the funnel and evaporate with a stronger heat until dry. It may be used in this state for photographic purposes, or the mass may be dissolved in water, poured off from the black sediment (which consists principally of gold), filtered and evaporated again until a pellicle begins to form on the surface; and then, being removed from the lamp, it is set aside to crystalize into nitrate of silver. The mother liquor may be used in solution or again evaporated to crystalization. The gold, remaining in black powder, is converted into a chloride by adding to it a small quantity of *aqua regia* (nitric acid one part and muriatic acid three parts) in a glass or porcelain vessel, and evaporating to dryness over a water bath.

C. L. LOCHMAN.

Is the Moon Inhabitable?

To the Editor of the Scientific American:

Some years ago astronomers were ventilating the theory of a hot moon, but you published a short communication which extinguished the flaming ardor of the hot theorists. On page 229 of your current volume, you say that your correspondent N. thinks that the moon may be inhabited, and you imply that N. is "too wrong to listen to." Let us think it over.

"How shall we reason but by what we know?" Had the earth been a perfect duplicate of the moon in its topographical structure, what (allowing for difference in magnitudes) would have been the hight of our mountains and how deep would our valleys have been? What would have been the cause that would have rendered impossible the continued existence of plants or living beings in those deep valleys? I imagine that the bulk of our atmosphere would have settled down into them, that the interior heat of the earth would have been of more service to vegetation there than, as now, at the earth's surface: that the valley people could have never reached the plateau above, for want of air in those elevated regions: and that, to an observer on the moon, the earth would have presented the appearance of a "dead planet," devoid of atmosphere, vegetation and organic life. Now if there be any air on the moon, it is all down in the gorges and valleys. If there are inhabitants, plants or animals, they are probably of a size as much smaller than we have here as the moon is smaller than the earth. Large masses cool so slowly that there may be considerable heat at the bottom of a valley fifteen miles deep. The "direct rays of a vertical sun" shine twenty-eight times longer into those valleys than could be the case with us—equivalent to all the sunshine that very deep valleys get in twenty-eight days here (long enough to mature many plants and some forms of animal life)—and without the drawback of nocturnal intermission and radiation. Such small plants and animals as may be there would require less time to grow than the larger sorts of this world. One of their days would accomplish for them as much as a whole year does for us.

From all which I conclude that the moon not only may be, but probably is, inhabited; if not by men or their equals, at at least by animals, insects, plants, etc. The subject is an interesting one, although we might learn more of it if astronomers would only study the moon in comparison with the earth and as being subject to the same natural laws so far as similarity of conditions prevails.

W. L. DAVIS.

Louisville, Ky.

Another Case of Weak Boiler Flues.

To the Editor of the Scientific American:

A boiler in this section collapsed its flues last week. It is of 42 inches diameter, 20 feet length, heavy ¼ inch shell, with ⅜ inch heads, flues of 14 inches diameter of heavy $\frac{3}{16}$ iron. The engine is 10 by 20 inches, running a circular saw mill. They carried about 80 lbs. of steam. The boiler was made this spring, of the best C. H. shell iron; the holes were all reamed and no pins were used. Will you please tell me what caused the collapse?

SUBSCRIBER.

Richmond, Ind.

REMARKS BY THE EDITOR.—The collapse occurred, we presume, simply because the flues were too weak. Had life been lost by the accident there would have been good reason for indicting whoever may have been responsible for the use of such a boiler for manslaughter. If properly made the shell was strong enough to carry, with safety, according to the steamboat law, 110 lbs. of steam. We should run such a boiler at 75 or 80 lbs. The flues, however, were only safe for about one fourth as much as the shell. They would probably have collapsed when new, if perfectly round and true, at $(\frac{3}{16} \times \frac{3}{16} \times 806000) \div (20 \times 14) = 101$ lbs., and should never have been allowed to run at a higher pressure than about 25 lbs., if the judgment of the best authorities in the engineering profession is to be accepted. We are compelled in nearly every number to refer to this shameful recklessness, or ignorance (which is, if possible, still less pardonable in builders) in proportioning flues.

Deep Sea Soundings.

To the Editor of the Scientific American:

In reading Dr. George Robinson's communication on page 244 of your current volume, it occurred to me that using a self recording pressure gage, attached to a line, would give better results than the old way. The currents would make no difference, for the pressure would be the same whether the line was perpendicular or not. And as we know the weight of a column of water one foot high, we could calculate the depth of any body of water by ascertaining the weight at the bottom, if water be incompressible and a column one foot high at the bottom weighs the same as a column of the same hight at the surface. And as water is so nearly incompressible, I think the depth could be approximately ascertained at much less expense than by the mode suggested by Dr. Robinson.

This may be an old idea, but I do not remember having seen it anywhere.

CHAS. F. LEWIS.

Albion, N. Y.

THE NEW HAVEN MANUFACTURING COMPANY, in a note covering a draft for payment of an advertising bill, makes the following statement: "We are the only advertisers in your paper who have advertised in it continually for more than twenty years. Not a number of the SCIENTIFIC AMERICAN has been issued without containing our advertisement, during that time; and we wish both the paper and advertisement continued till ordered stopped." We expect they are not the only twenty year advertisers, but, likely, the only concern whose advertisement has appeated every week for so long a period.

THE MANUFACTURE OF COMBS.—G. T. L., having read our article on page 243 of the current volume, writes to say that in Leominster, Mass., more than 12,000 combs per day are manufactured, besides horn jewelry to a large extent. More than 3,000 hands are employed in this industry. The trade has been carried on for the past 80 years; and when the business exists elsewhere, it was probably originated by a Leominster man.

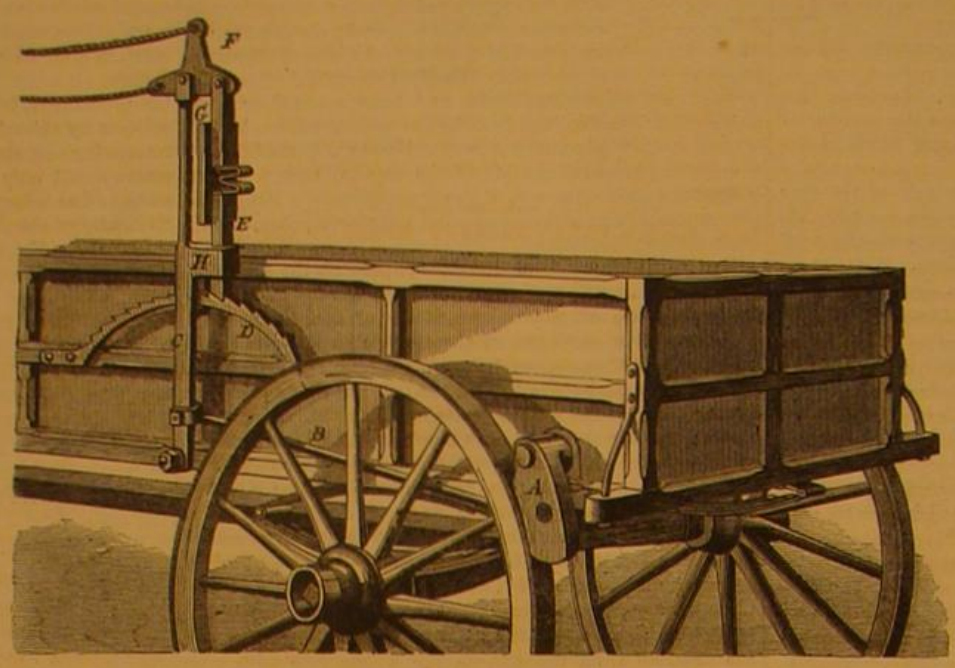
ONE HUNDRED AND THIRTY first class steamers are now employed on the various lines, plying between New York and European ports. During the last thirty-two years—or since ocean steam navigation was fairly begun—forty-four steamers have been wrecked.

CINCHONA.—A careful analysis by P. Carles of the ashes of cinchona bark, from which the well known medicine quinine is obtained, shows that the bark contains the following substances: Insoluble silica, soluble silica, alumina, iron, manganese, lime, magnesia, potash, soda, copper, carbonic acid, sulphuric acid, phosphoric acid, chlorine.

IMPROVED WAGON BRAKE.

We illustrate herewith an improved and convenient form of wagon brake which, by simple devices, may be readily applied or thrown off by the driver from whatever position about the wagon he may be located.

A is the brake shoe, pivoted to the wagon frame, as represented, and connecting with one end of the brake bar, B. The forward extremity of the latter is pivoted to the upright lever, C, which, at its lower end, is similarly attached to the wagon frame. The lever, C, passes up through a slot in the curved rack bar, D, or the latter may pass through a slot in the lever, as shown in the engraving. The rack bar has ratchet teeth formed upon its upper side to receive the engaging end of the sliding spring pawl, E. F is a three armed lever, and is pivoted at or near its middle point to the slotted upper end of the lever, C, and at the end of its rear arm to the slotted extremity of the pawl, E. The latter extends down parallel to the lever, C, and is made in two parts connected by a folded spring. G is a short plate, one end of which is rigidly connected to one part of the pawl, E. The other end is movably affixed to the opposite part. By this means the plate, G, allows the extremities of the two portions of the pawl to approach each other, compressing the spring as the engaging lower end slides over the rack, while it protects the spring by receiving the draft strain when the pawl is being raised to throw off the brake. A guide, H, on the lever, C, serves to keep the pawl in place. To the upper and forward arms of the three armed lever, F, are attached two cords, which can be conveniently operated by the driver. By pulling upon the lower one, the lever, C, will be drawn forward, pressing the shoe against the wheel, when the parts will be held in position by the pawl engaging in the ratchet teeth. To throw off the brake, the upper cord is pulled, lifting the pawl from the rack when the lever, C, will be permitted to return to its original position.



POWELL'S WAGON BRAKE.

Patented March 29, 1870, through the Scientific American Patent Agency. For further information address the inventor, Mr. Michael Powell, Camp Warner, Fort Bidwell, Cal.

The Million Dollar Telescope.

We continue to receive suggestions and offers of assistance in the construction of the proposed giant telescope, from which we extract the following:

S. L. D. suggests that the surplus in the Patent Office treasury should be devoted to this object, as it properly belongs to the inventors in the United States and should be expended only for some purpose which would reflect credit on our national inventive genius. He believes that every inventor who has contributed to this fund, by paying fees larger than are needed to discharge the legitimate expenses of the office, would approve of this appropriation of the money.

J. H. M. proposes a stock company with 100,000 shares of $10 each, and offers to take 2 shares. He is in favor of selecting a board of directors from our most eminent men, with a certain number of practical workmen in addition. He deprecates the idea of begging for subscriptions, and believes that a company, such as he proposes, could execute the work in time for the Centennial of 1876.

J. W. H. says that the idea is sublime, that the country is full of money, and that it is disgraceful that so little is expended for scientific purposes. Though a poor man, he will take a $10 share; and he suggests that each subscriber be allowed to use the telescope in proportion to the amount of his holding, priority being settled by the dates of applications for shares.

S. V. C. was unprepared for so much enthusiasm on this subject, and has sent us a proposition, of which the following are the main points: Organization of the "American Astronomical Society," with a capital of $2,000,000 in shares of $10 each. The presidents of the 315 colleges empowered to confer degrees in arts, should nominate the officers, who are to be elected by the stockholders. The college presidents should organize societies in their several States to promote the work and receive subscriptions for shares. No one who is not of distinguished scientific attainments should be appointed to any office in the Company, lest the public should lose faith in the project. An observatory should be built in the locality determined upon by the scientific officers as most suitable for the purpose. J. W. H. does us the honor to propose the editor of the SCIENTIFIC AMERICAN as the first "temporary secretary" of the American Astronomical Society, whose duty it shall be to communicate, either by circular or through this journal, with the presidents of colleges, etc., as aforesaid. He wants the ball started immediately.

F. H. R. thinks that the scheme could be well promoted by a lottery, a form of speculation much in favor in these days. He points out how theaters, hotels and houses are often disposed of for twice their value by this means; and he says, with much truth, that any one who drew a blank in the distribution would have full value for his money in the increase of knowledge, which will benefit the whole world.

L. P. S. says that, as our various articles referring to the million dollar telescope apparently mean business, if an instrument can be built for one or even two million of dollars, with an effectiveness increased in any reasonable proportion to the cost, the money can be easily raised; and he would like to take some stock in the enterprise for the benefit of science.

T. C. L. C. suggests that it would be a good plan to have a box in every post office in the United States where every one could deposit his share to help forward the great work, each postmaster sending the money to the United States Treasurer. "We are behind the times," he says; "while the inhabitants of other planets point their great telescopes toward us, we have only small ones to look in return with. We want a large one and must have it. We long to know more about the other worlds, which we have hitherto seen only at a distance."

IMPROVED FLY TRAP.

Our illustration represents a new fly trap, which consists in a rotating cylinder, operated by clock work, upon which bait is placed. The flies alighting thereon are carried around until a scraper brushes them off, when they enter a cage from which they cannot escape.

Fig. 1 is a perspective view, and Fig. 2 a section of the device. A is the rotating cylinder actuated by suitable clockwork contained in the case, B, and revolving in a semicircular cavity, C, in the box or frame of the apparatus. To the periphery of the cylinder are attached ribs, D, at such distance apart that one rib may always be in the cavity, C. Upon the surface of the cylinder, between the ribs, bait is placed, seeking which the flies alight upon said cylinder, and

Fig.1

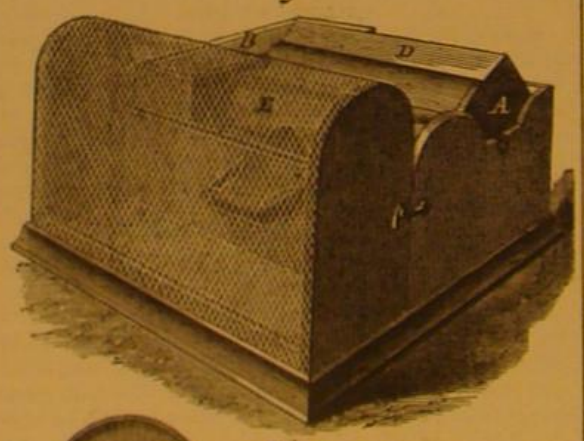
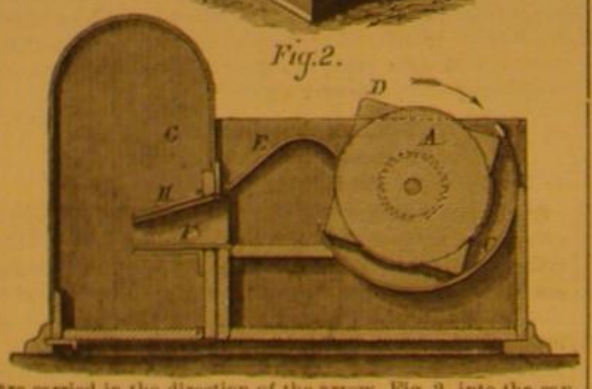


Fig.2.



are carried in the direction of the arrow, Fig. 2, into the cavity, C, the rib in their rear preventing them from returning until they encounter the scraper, E. This last mentioned appliance is pivoted to the rear of the box, and is so arranged that its forward edge comes so close to the body of the cylinder that a fly cannot pass beneath it, and is consequently brushed off. Suitable stops are provided to prevent the scraper from contact with the cylinder, while, by freely moving on its pivots, it allows the ribs to pass. Just beneath the scraper, and near the top of the box, is formed a passage or spout, F, through which the flies, seeing light, quickly pass into the cage, G. The spout, F, fits into another spout, H, attached to the forward side of the cage. The top of the spout, H, is pivoted at its outer edge, and rests upon the top of the spout, F, so that, when the cage is detached, it may drop down and close the aperture to prevent the escape of the flies, which may be then destroyed. Patented to A. M. Chapel and J. G. Hubbard, through the Scientific American Patent Agency, November 26, 1872. For further information address George Fitch, Lenox, Mass.

How to Construct Earth Boring Implements.

Professor G. H. Cook, State Geologist of New Jersey, in his last annual report, recommends the more extensive use of the auger in prospecting for useful products, in which that State so greatly abounds.

The auger, he says, is available in all borings through strata or beds free from stone, and is, therefore, valuable in searching for clays, marls, glass sands, peat, hematites, ochers, etc. Boring scarcely disturbs the surface, is quickly done, comparatively cheap, and affords us correct knowledge concerning the strata penetrated. For this work augers of various patterns are in use. Generally an ordinary threaded auger with a bit, diameter from an inch to two and a half inches, is used. This is welded on to an iron rod, whose cross section may be square or circular. This is made to screw on a second rod, and that on another, so as to get any desired length. These rods are generally square, and about three quarters of an inch on a side, but as a rule the size of the rods is proportional to the diameter of the bit. They may also be spliced together and fastened by a ring shoved down over the two lapping ends. Upon a rod, thus constructed, a handle is fitted so as to move up and down upon it, and to be fastened by a wedge at any desired point. By means of this the auger is turned, requiring, generally, two men. When the thread is filled, the auger is drawn up and the material examined, so that every portion of the strata penetrated can be examined at the surface. Augers are rarely used at greater depth than forty feet, and in nearly all cases this is sufficient to test ground. At such depths, and even at twenty feet, the raising of the auger is a difficult matter, and then a windlass, or better, a derrick, with a block and pulley, may be employed. Such a length of rod also requires guides to keep it erect, and for this purpose shear poles set up at the mouth of the boring are necessary. These may be of the same length or a little less than that of the rods. Sometimes strata of wet, running sands, or quicksands, are met with, and this fills the boring, and the auger makes no headway. To counteract this, tubing must be used. Sheet iron pipes of the size of the bore are driven down to shut off the sand, and the boring is then resumed inside of the tube. Gravel or small cobble stones may be broken by a chisel-pointed rod, and then either raised by the auger or pushed to one side. Sometimes the bit is made convex, or shape-shaped, at the bottom. Equipped with these tools, two men can put down several twenty feet holes in a day, or one (possibly more, with favoring conditions), forty foot boring. Of course the location of the borings must be judicious. Side hills or sloping ground are always to be chosen rather than summits, or ridges, or flats. In Germany, boring is an almost universal mode of searching for brown coal. The strata covering this are earthy, and are such as are readily penetrated by the auger, but the thickness of this covering often exceeds 100 feet. At this, and even greater depths, the auger is employed with success. In Saxony, borings having an average depth of 120 feet cost twenty-seven cents per vertical foot. There the augers are often made with a valve opening upwards to hold the material as it is loosened until raised to the surface. Pod augers, with a vertical slit or a spiral slit, constitute another form. To break a stone or to push it aside, the bit is made double edged, or a chisel borer or drill is let fall upon it. The diameter of the bit is sometimes as much as six inches, and then the rods are correspondingly large, and the working of them requires long levers at the surface and increased power. In New Jersey, depths of 40 feet are in nearly all cases sufficient, as at greater depths the amount of top earth is too much to be moved, and subterranean mining would be too expensive. For this depth, an auger two or two and a half inches diameter, with five eighths inch rods, is sufficiently large. The employment of this comparatively inexpensive mode of searching is earnestly recommended to all interested in the discovery of clays, marls, sands, or other valuable earthy deposits.

Powerful Electro-Magnets.

M. Jamin of Paris has exhibited to the French Academy an artificial magnet, weighing 4·4 pounds, of which the carrying force is 99 pounds. This result has been gained by substituting very thin leaves, thoroughly magnetized—to saturation, as the inventor expresses it,—for the thick plates formerly used in constructing electro-magnets.

An idea of the magnitude of the power thus obtained may be gathered from the fact that, although some natural magnets have carried loads of twenty times, the sustaining capacity of the best artificial magnets has not exceeded four or five times, their weight. The practical application of M. Jamin's discovery will be to diminish, in an immense degree, the volume and weight of the magneto-electric machines for the production of light and electricity.

A New Potato Disease.

E. Hallier describes, in the *Zeitschrift für Parasitenkunde*, a new potato disease which has appeared in the crop at Apolda, near Jena. The disease differs from the one ordinarily known in this country in attacking at once the tubers and not the leaves. The tuber is found to be covered by a purplish felt, which is the mycelium of a fungus; the skin of the potato is in some cases apparently not penetrated by this mycelium, while in others close examination with the microscope shows that it is, the skin being in these cases covered by a number of black spots having the appearance of the perithecia of a pyrenomycetous fungus, the tuber becoming then completely destroyed by a cancerous disease; the fungus, which probably belongs to the genus *sclerotium*, appearing always to accompany the disease. Professor Hallier thinks that the remedy will probably be the same as in the ordinary potato disease: selecting early kinds, using only mineral and no animal or vegetable manures, and a careful selection of the best adapted soil.

Artificial Butter.

We have heard of several plans for the manufacture of artificial butter, and we may add we have tasted an abominable compound which, under the name of "cooking butter," is retailed at a low price by conscienceless grocers, to the poorer classes and boarding house keepers in this city, as the genuine article. The *London Grocer* now publishes a description of a butter artificially prepared, which it editorially states is really excellent. The process of manufacture consists in raising fat to a very high temperature and thereby, and with the aid of steam, carbonizing and volatilizing the objectionable impurities. The thin and unused parts of beef suet are employed while perfectly fresh. The substance contains no butter at all nor any chemical ingredient, and is composed entirely of suet with a very small quantity of salt. The editor of the *Grocer* has tried it and likes it best on toast; but as he says it tastes like pure fat, we question whether any general public, unless it be the Esquimaux, would partake of it with equal relish.

NEW MACHINE FOR SINKING WELL TUBES.

We are indebted to the *Bulletin du Société de l'Encouragement* for the accompanying engravings and description of a novel device for sinking the tubes of instantaneous wells. The pipe is forced down until an underground water level is reached, when it may be used directly as a pump body, a piston being inserted, or as a conduit to a small force pump at the surface.

The apparatus consists in a vehicle, A, the wheels of which are held immovable during the operation of the working parts by the brakes, B. C C are the upright posts, a device similar to a pile driver, which may be turned back upon trunnions, D D, horizontally upon its carriage, for convenient transportation. The posts when erected are sustained by braces, E E, and at their upper ends are provided with pulleys, over which pass cords which are attached to the ram, G, a mass of metal weighing some 220 lbs. In the sides of the latter are placed friction rollers which work in grooves in the side posts. H is the tube to be sunk, in which, just above its sharp lower extremity, is made a number of perforations. It passes through the ram and also through the collars, J J, being held by the latter in a vertical position. The ram is hoisted by the cords, and on being let fall, strikes upon the cylinder, I, which is fastened to the tube for the purpose, thus forcing the latter into the ground. At K are a number of spare tubes piled for transportation at either side of the carriage. L is a tool box arranged under the platform.

It is stated that, by this machine, pipes of from 1·5 to 2·7 inches in diameter have been driven vertically down as far as 48 feet. When one tube is buried, another is fastened to its end by a sleeve, and the ramming continues. The total weight of the apparatus is 1,200 lbs. This method of rapidly obtaining water at points where the supply is most needed is, without doubt, one of considerable importance and value, especially for irrigating and other agricultural purposes.

THE AGRICULTURAL MACHINE WORKS OF CHICAGO.

The increasing tide of emigration setting toward our Western territory, together with the rapid settlement of large tracts of fertile and arable land by classes devoted to agricultural labor as a means of subsistence, has given rise to the development of an industry which, at the present time, has assumed proportions of almost incredible magnitude. We allude to the manufacture of agricultural implements, without the aid of which the profitable working of large farms would be a physical impossibility. Throughout the West the progress in this branch of trade has been not only great but rapid. The tenacious sticky soil of the prairies, and its heavy products, proved at the outset that substantial machinery was requisite for its cultivation. The inventive genius of the country was thus stimulated, first to improve upon the implements in use to render them suitable to existing needs, and afterwards to devise new machines for the same end. The latter, no small number of which have been brought to the notice of the world through the columns of this journal, have, when proved valuable, found a ready market, and vast manufactories have sprung up, producing them in immense quantities to meet the constantly increasing demand.

Of these great works, the largest and most complete are located in Chicago, in which city three establishments exist, which are probably organized on a grander scale than any other of their kind in the world. The most extensive is the manufactory of Messrs. C. H. McCormick & Brother, and is engaged in the production of the celebrated McCormick reaper. The present works are entirely new, having been but recently completed, as the former building, together with all the machinery and a large amount of finished stock, were swept away by the great fire. The present structure is five stories high, 350 feet long, and is built in the form of an E, with wings 660 feet in length. It is constructed of brick, and has an aggregate area of floor of six acres. Besides the immense casting room and blacksmith shop, the latter containing thirty forges, there are forty-five rooms averaging 100 by 60 feet in size, with solid brick fire walls and double iron doors between each. Motive power is obtained from a 300 horse power steam engine. The precautions against fire are as perfect as possible, and are based on a system of great efficiency. On each side of the fire walls mentioned, are large steam and water pipes running parallel and also perpendicular from cellar to roof. Upon each floor are openings in these pipes, to each of which a hose twenty-five feet long is attached. Through the iron doors in the division wall are made a number of small apertures, large enough to admit the nozzle on the end of the hose. Should a fire break out in any of the rooms it can thus be played upon by streams of water in such unlimited quantities as to check its progress at once.

The cost of the new building has been about $500,000, and although the works have not been taxed to their full extent, it is believed that at least 10,000 reapers will be completed before the harvest of 1873. The present force of workmen is 600. The material used is in keeping in quantity with the mammoth character of the establishment. Forty tuns of pig iron are melted daily in the two cupola furnaces, and about five tuns of wrought iron are used in the blacksmith shop.

The manufacture of plows, cultivators, and other implements of farm machinery is carried on on a gigantic scale by the Furst & Bradley Manufacturing Company, a corporation organized in 1854. Some idea of the magnitude of the works may be obtained from the fact that there are in the buildings of the establishment over four acres of floors. The yearly product is 15,500 plows of various descriptions, 7,200 cultivators, 1,500 wheelbarrows, 4,000 sulky rakes, 7,000 road scrapers, 4,000 double shovels, 1,500 harrows, 600 straw cutters, and 50 field rollers, besides a large amount of the machinery used in the manufacture of these articles. No less than forty-nine different varieties of plows, thirteen of cultivators, two of harrows, seven of rollers, six of scrapers, one each of straw cutters and rakes, and three of barrows, making a total of eighty two different implements, are here produced. About 1,000 tuns of iron and 1,000 of steel are annually used. The metal is shaped for plows or cultivators in four powerful drop presses which, together with all the punches, shears, and the 125 horse power engine which drives the works, were made by the company for its own use. The receipts of the establishment last year were, it is said, $600,000, and its products were transported all over the world.

The youngest of the three great factories is that of the Chicago Plow Company, located directly in the city of Chicago. Forty different styles of plows and cultivators are here manufactured, and about 500,000 lbs. each of iron and steel yearly expended. The works employ 150 hands, and are capable of producing 25,000 plows per annum. The buildings recently erected are arranged after the most approved plans, and the machinery throughout is of the finest description.

The three establishments disburse for wages alone in Chicago nearly $50,000 each month, and employ in the aggregate 1,000 men. The manufacture is steadily increasing, and there is little doubt that, when the immense tracts of

Fig. 1.

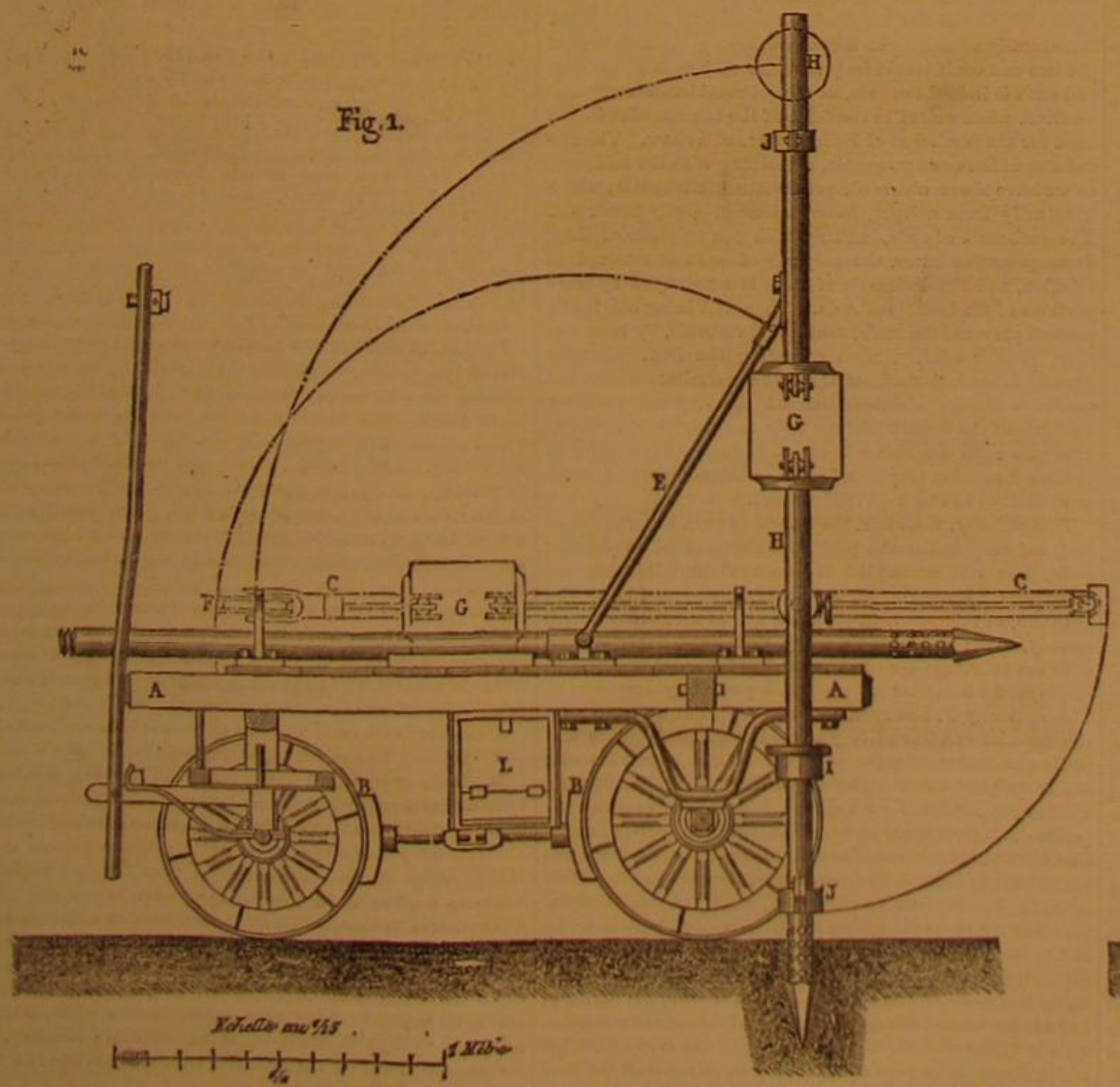
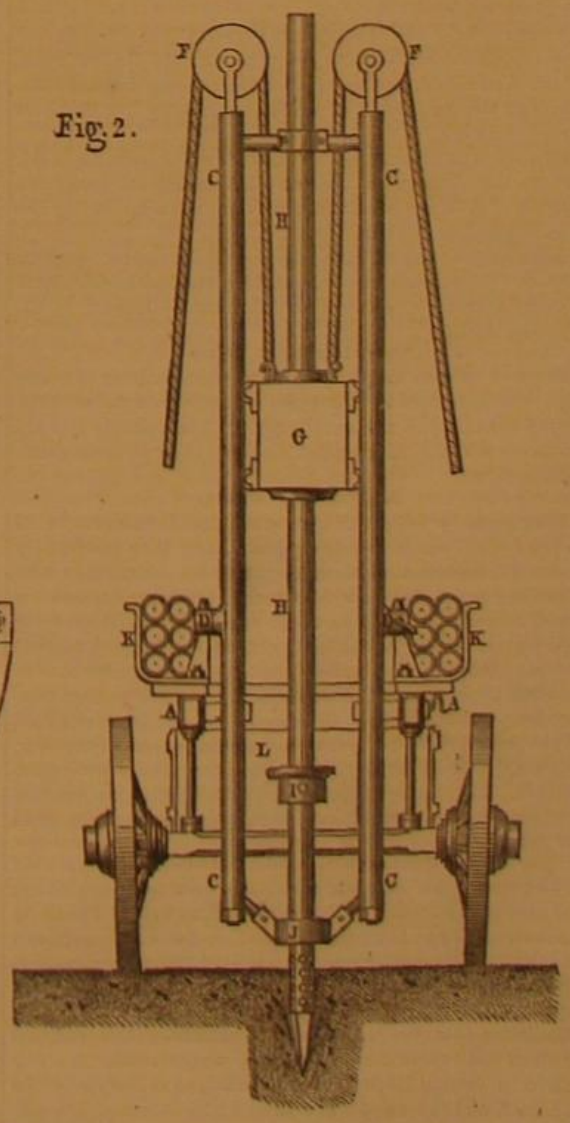


Fig. 2.



NEW MACHINE FOR SINKING WELL TUBES.

territory between Chicago and the Pacific become more densely populated, even the great resources of the workshops above described will prove inadequate to meet the demands upon them.

CHEMICAL NOTES.

Carbon Water Filters.

Water standing in a glass globe, the mouth of which was stopped with cotton wool, showed after some days signs of vegetable growth on its surface. The same water, filtered through a carbon filter into a globe free from air, also soon showed like signs of the existence of life. The same water after boiling remained perfectly clear for days. I therefore conclude that carbon filters are useful only in purifying water from mechanical impurities, as sand, lime, etc., but that they cannot remove any of the so-called germs.—*Julius Müller.*

Rosin Oil and Its Uses.

Rosin oil is a product of the dry distillation of rosin. The apparatus used consists of an iron pot, a head piece, a condensing arrangement, and a receiver. In the distillation, a light oil comes over first, together with water. As soon as a cessation in the flow of the distillate occurs, the receiver is changed, and the heat is further raised, when a red colored and heavy rosin oil comes over. The black residue remaining in the pot is used as a pitch. The light oil, called "pinoline," is rectified, and the acetic acid water passing over with it, is saturated with calcium hydrate, filtered and evaporated to dryness, and the calcium acetate obtained is employed in the manufacture of acetic acid. The rosin oil, obtained after the light oil has passed over, has a dark violet blue color, and is called "blue rosin oil." The red oil is boiled for a day with water, the evaporated water being returned to the vessel; next day the water is drawn off, and the remaining rosin oil is saponified with caustic soda lye of 36° Baume, and the resulting almost solid mass is distilled so long as oil passes over. The product obtained is rectified rosin oil, which is allowed to stand in iron vessels, protected by a thin layer of gypsum, whereby, after a few weeks, a perfectly clear oil is obtained free from water. The oil of first quality is obtained by a repetition of the foregoing operation upon the once rectified oil. The residues of both operations are melted up with the pitch.

Rosin Oil Soap.

One hundred pounds of rosin oil and 80 pounds of lime slaked to a powder are agitated in an iron pot, and the mixture is heated with stirring, till a uniform paste is obtained, free from lumps and running from the stirring implement like sirup. With this rosin oil soap, all the different varieties of patent grease are made as follows:

Wagon Grease.

BLUE PATENT GREASE.—500 lbs. red rosin oil are heated for one hour with 2 lbs. calcium hydrate, and allowed to cool. The oil is skimmed off the sediment, and 10 to 12 lbs. of rosin oil soap are stirred in till all is of buttery consistence and of blue color.

YELLOW PATENT GREASE is prepared by adding 6 per cent of turmeric solution to the blue grease.

BLACK PATENT GREASE.—Lamp black is used to produce the black color.

PATENT PALM OIL WAGON GREASE.—10 lbs. of rosin oil soap are melted with 10 lbs. of palm oil; 500 lbs. of rosin oil are then added, and as much rosin oil soap to make the whole of the consistence of butter, and lastly 7 to 8 lbs. of caustic soda lye.

PARAFFIN RESIDUES.—The thick oil which remains in the paraffin manufacture is used as a lubricating oil, partly on account of its cheapness, and partly on acccount of its not soon solidifying by cold.

In order to thicken, some lead soap is melted with it. Mixtures of rosin oil or rosin oil soap and petroleum, with glycerin also, are often used as lubricants.—*Journal of the Chemical Society.*

Coloring Silk Blue.

20 parts sodium molybdate and 20 parts sodium thio-sulphate are dissolved in 250 parts water. To this solution, heated to boiling, 6 or 8 parts ordinary hydrochloric acid are gradually added. A beautiful blue liquid is thus obtained. *Ibid.*

A Durable Paste.

Four parts by weight of glue are allowed to soften in 15 parts of cold water for some hours, and then moderately heated till the solution becomes quite clear. Sixty-five parts of boiling water are now added with stirring. In another vessel 30 parts of starch paste are stirred up with 20 parts of cold water, so that a thin milky fluid is obtained without lumps. Into this the boiling glue solution is poured, with constant stirring, and the whole is kept at the boiling temperature. After cooling, 10 drops of carbolic acid are added to the paste. This paste is of extraordinary adhesive power, and may be used for leather, paper or cardboard with great success. It must be preserved in closed bottles to prevent evaporation of the water, and will, in this way, keep good for years.

Parisian Wood Varnish.

To prepare this varnish, which has been long celebrated, the author dissolves 1 part of good shellac in 3 or 4 parts of alcohol, of 92 per cent, (by volume) on the water bath, and cautiously adds distilled water, until a curdy mass separates out, which is collected and pressed between linen; the liquid is filtered through paper, all the alcohol removed by distillation from the water bath, and the resin removed and dried at 100° until it ceases to lose weight; it is then dissolved in double its weight of alcohol, of at least 96 or 98 per cent, and the solution perfumed with lavender oil.—*R. Grager.*

Preparation of Floor Wax.

Two ounces of pearl ash, 10 ounces of wax, and about half a pint of water are heated to boiling in a dish, which is frequently agitated, until a thick fluid mass is formed, from which, upon removal from the fire, no watery liquid separates out. Boiling water is now cautiously added to the mass, until no watery drops are, distinguishable. The dish is again set on the fire, but its contents are not allowed to boil, otherwise myricin would separate out, 8 or 9 pints of water being added, little by little, with constant stirring. Coloring matter may be added, if desired.—*Nessler.*

Fireproofing Wood.

1. The wood is twice painted over with a hot saturated solution of 1 part of green vitriol and 3 parts alum. 2. The wood, after drying, is again painted with a weak solution of green vitriol, in which pipe clay has been mixed to the consistency of ordinary paint. This coat is renewed from time to time.—*F. Sieburger.*

The Prevention of Boiler Incrustation.

Experience has fully demonstrated that, for a thorough prevention of boiler incrustation, recourse must be had not to mechanical but to chemical means. Sediment pans in the boiler or ingenious devices placed in the heater to intercept the feed water it is true, render the accumulation, in a great measure, less rapid. But that such means ultimately fail in ensuring to the generator complete immunity from the dangerous deposit is owing to the reason that they merely serve to retard the formation of scale without in any wise eliminating the causes to which it is due.

The substances which practically are found in the precipitated matter of boiler water consist nearly exclusively of carbonates of iron, lime and magnesia, with sulphate of lime. These salts are thrown down and, as all are aware, form a solid and sometimes even vitrified layer, productive of highly dangerous results. To chemically act upon the matter which the water holds in solution, various agents have been tested. Vegetable substances containing acetic acid, though frequently used, are disadvantageous, because the acid attacks the boiler iron and fails to decompose the sulphate of lime, so that the latter is precipitated and slowly forms scale. Starchy materials, though tending to reduce the deposit to a loose and gelatinous mass, easily removed, are open to the objection of causing the water to foam and of thus rendering the gage cocks useless. Muriate of ammonia and petroleum, also sometimes employed, have serious defects, so that in fine our consideration of boiler anti-incrustators is virtually narrowed down to two: tannic acid and the fixed alkalies, potash, soda, etc.

It is a compound of these substances to which it is our present object to direct the attention of the reader. We allude to tannic acid and soda, forming the tannate of soda. Tannic acid, in its free state, added to boiler water, acts directly upon the carbonates and changes them into insoluble tannates, which being amorphous and of light specific gravity, have no tendency to mass, and remain suspended in the currents. The objections to the acid alone are that it tends to corrode the boiler iron, though in a far less degree than acetic acid, and will not decompose sulphate of lime. Fixed alkalies will, however, produce the latter result, but the advantages of their sole use are counterbalanced by other defects. It naturally occurs, from the above, that a combination of the two materials would be productive of beneficial results; and such is indeed the case, as a brief consideration of their reaction, when united in the form of the tannate of soda and used for the treatment of boiler water, will show. The carbonates of lime and magnesia, combining with the acid, are, as we have above observed, precipitated as tannates, which eventually form a light, loose sediment, easily blown off. The carbonate of soda, uniting with the sulphate of lime, decomposes the latter, the sulphate of soda is retained in solution, and the carbonate of lime is acted upon by fresh portions of the tannate of soda. The alkali being constantly present prevents the acids, tannic and carbonic, by reason of their greater affinity, from corroding the iron. On scale already formed, the tannate of soda has a similar reaction and causes a similar disintegration of the exposed surfaces. Portions of the deposit become loose and may be removed at intervals until the boiler is clean, when the prevention of further formation may be effected by the addition of small quantities of the tannate to the water.

Theoretically, therefore, the tannate of soda being a neutral salt, not only fulfils the prime requirement of preventing scale, but will accomplish its work without injuring the boiler iron, It remains for us to consider its practical utility. Hitherto, at this point, an objection was at once encountered, namely, cost; an item, as many who have experimented with the substance are aware, sufficient to render its extended employment a matter of no small pecuniary importance. This difficulty is, however, now removed, and we learn that the material can be and is produced from inexpensive and easily obtained substances, at a price within general reach: ten cents per pound. The manufacturer, Mr. N. Spencer Thomas, of Elmira, New York, having made careful investigations into the nature and composition of the article, states that the fluid tannate can be used in quantities of from one half pound per each horse power of boiler, or, when the latter is badly incrustated, a full pound, with excellent results. The material is mixed with five or six times its bulk of water and pumped into the generator with the feed or put in through the safety valve before the steam is up. After the boiler has been run for a few days it is emptied, the loose scale removed and the same quantity of tannate again used. This is repeated until the entire deposit is removed, after which small amounts of the salt may be mixed with the feed at regular intervals. Necessarily the peculiar nature of any water must govern the engineer in the quantity of the substance to be used, in order to avoid waste.

Apart from the economy due to the preservation of the boiler, its consequent freedom from repairs and immunity from explosion, the use of an effective anti-incrustator is productive of no small saving in coal. On this point, as regards the tannate, we have the evidence of the Oneida community, by which the material was fully tested. The *Oneida Circular* states that the boilers were coated with an exceptionally heavy incrustation due to the use of hard water; but that, in less than a month after beginning the employment of the tannate, a difference in the amount of coal burned was clearly apparent. In summing up the advantages gained, the above journal estimates the economy in one year to be: for two boilers 20 per cent and for one boiler 25 per cent on the quantity of coal consumed, or, in the value of the fuel alone, a saving to be effected of $492.

We would refer our readers to Mr. Thomas for further particulars regarding this valuable material. We understand that it is not sold in quantities of less than a quarter barrel or 125 pounds, which is considered as small an amount as can be used to any advantage, a single application not being sufficient to successfully remove already formed scale.

A Sensible Goose.

The *Syracuse Standard* tells us of a family in that city that kept a small flock of geese. Some few weeks since the geese were missing, and all efforts to find them proved fruitless. But one day recently the gander of the flock returned to the front gate of the premises of his owner, and immediately set up a loud scream, and would not be quieted, nor come into the yard Finally the owner came out and followed it for a number of blocks until it entered a yard, at the rear of which was an old barn. On opening it the ballance of the flock were found, and were taken possession of by the owner. It appeared that the gander had made its escape through a hole in the floor of the barn, and then started for home to give the alarm.

Wire Concrete.

Mr. Philip Brannon, says *Hardware, Metals, and Machinery,* has devised a system of wire concrete which consists of a sustaining metallic framework or skeleton, upon which wires are strained, the whole being enclosed in the concreted materials forming the body of the structure. By this arrangement not only are the walls and floors of a building run up in concrete, but the doors, shelves, and other fittings are formed of the same material. The strains on the building are thus equally distributed, and a fireproof construction, it is stated, insured.

The system is considered advantageous for the building of piers and sea walls, and is applied to breakwaters by lining bags of wire with concrete and filling them with sand. These are placed in position before the concrete has perfectly set, and are well rammed down together.

Permanent Whitewash.

The annual enquiry for a good whitewash has commenced, and the following may be found useful: Take half a bushel of freshly burned lime, slake it with boiling water; cover it during the process, to keep in the steam. Strain the liquid through a fine sieve, and add to it 7 lbs. of salt, previously well dissolved in warm water; 3 lbs. of ground rice, boiled to a thin paste, and stirred in boiling hot; ½ lb. of powdered Spanish whiting, and 1 lb. of clean glue, which has been previously dissolved by soaking it well and then hanging it over a slow fire, in a small kettle within a large one filled with water. Add five gallons of hot water to the mixture, stir it well, and let it stand a few days covered from dirt. It must be put on quite hot. For this purpose it can be kept in a kettle on a portable furnace. About a pint of this mixture will cover a square yard.

POTASH IN DIFFERENT KINDS OF ASHES.—A correspondent of the *Country Gentleman* gives the following table, showing the amount of potash contained in 1,000 pounds of ashes, made from burning different kinds of wood: pine, ½ lb.; poplar, ¾ lb.; beech, 1½ lbs.; maple, 4 lbs.; wheat straw 4 lbs.; corn stalks, 17 lbs.; oak leaves, 24 lbs.; stems of potatoes, 55 lbs.; wormwood, 73 lbs.; sunflower stalks, 19 lbs.; oak, 2¼ lbs.; beech bark, 6 lbs. The remaining portion of the ash, consisting of carbonate and phosphate of lime, iron, manganese, alumina and silica, is an excellent fertilizer.

REAGENT FOR BORACIC ACID.—The flame of illuminating gas, says M. Bidaut, is a very delicate reagent for boracic acid. If a solution of the acid in water in the proportion of $\frac{1}{2100}$ be boiled and the flame placed in the vapor, a green tint in the light will be plainly visible and will become more apparent as the concentration of the liquid advances. This effect is more strikingly obtained by directing the flame upon a minute crystal of the acid, placed on a piece of porcelain. A magnificent green light will be produced.

A FROZEN WASP.—The question "will wasps freeze?" has been decided by a Peoria man, who found one in a frozen nest one day last week, and took the insect into the house, and held it by the tail while he warmed its ears over a gas jet. You wouldn't believe it, says the *Commercial Advertiser*, but the Peoria naturalist says its tail thawed out first; while its head was so stiff and icy it couldn't wink, its "probe" worked with inconceivable rapidity, to the great distress of the scientist who was trying the experiment.

Varnish for Labels.

At a recent meeting of the Newcastle-upon-Tyne Chemical Society, Professor Marreco said that Professor Markoe (of Boston, U. S.) told him, some months ago, that the practice in Boston was never to varnish a label for acid bottles, but to use paraffin instead. They had applied it to a large number of bottles in the college laboratory, and it answered perfectly. The only thing necessary was to brush the paraffin on as hot as possible, so as to get a thin even coating; it looked as well as varnish, and stood a great deal better. It saved a good deal of trouble in sizing and varnishing, and five minutes after the bottle had been brushed it was ready for use. Dr. Lunge said that he had read some months ago, in a German journal, that the use of paraffin could be extended a great deal further; that instead of sealing the tops of bottles—sample bottles of bleaching powder, and for other purposes—it was very convenient to have a small porcelain dish with paraffin always ready, which could be placed upon a lamp, and, as soon as it was warm, to dip the top of the bottle in it, and that gave as good a sealing as sealing-wax, or better, and caused very much less trouble. It had also been proposed to use stoppers made of solid paraffin for soda samples; but he did not like this, because they broke so easily. What he had found to answer perfectly well was to rub some heated paraffin upon the stoppers in place of tallow. He found it a great deal cleaner, and answering in every way for this purpose.

DECISIONS OF THE COURTS.

United States Circuit Court--District of Massachusetts.

TYPE BLOCK FOR HAND STAMPS.—DRAPER *vs.* HUDSON.

SHEPLEY, *Judge:*

The first claim in complainant's patent, as reissued, is for the combination of the devices described in his patent for producing letters and figures upon the edges of type blocks for hand stamps and other purposes, substantially as set forth. The evidence fails to show any infringement of this claim after the date of the reissued patent. The second claim is for, as a new article of manufacture, a type block with letters, figures, or characters produced thereon, in the manner substantially as described. The patent itself shows that a type block such as described was not a new article of manufacture. It describes at least one mode by which a similar type block had been made before, but which mode consumed considerable time and was very expensive. His type block is not represented in the patent as a new article of manufacture in any other sense than as an old article made upon a new machine. This is not a new manufacture in the sense of the patent law. It could not have been the intention of the statute that pins, matches, nails, and other old articles in common use should be patented as new articles of manufacture simply because they were fabricated by the use of new and improved machinery, unless the product itself was a new and improved product, and as such possessing novelty of its own, independent of the new devices or processes or arts by which it was produced. The second claim of the patent cannot, therefore, be sustained.

The record in this case shows the death of the defendant. No injunction can issue against the defendant, and, as there is no proof of infringement by the executor, none can issue against him. No discovery is prayed for against the executor and there is no presumption of any knowledge by him of his testator's acts. Bill dismissed without costs.

J. B. Robb, for complainant.
Walter Curtis and *C. M. Reed*, for defendant.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From March 28 to April 8, 1873, inclusive.

CARRIAGE HEAD.—S. Beery, Urbana, Ohio.
CAST STEEL, ETC.—J. A. Holmes, Philadelphia, Pa.
CUTTING FILES.—A. Weed, Boston, Mass.
GRANULATING MACHINE.—C. H., F. C. Hersey, Boston, Mass., *et al.*
LAMP BURNER.—T. Silver (of New York city), London, England.
MATTRESS, ETC.—H. B. Mountain, New York city.
MEASURING ACIDS, ETC.—F. Nichols, New London, Conn.
ORE CLEANING MACHINE.—J. H. Hillman, Trigg Furnace, Ky.
PYROXYLIN, ETC.—D. Spooner, New York city, *et al.*
SHUTTLE MOTION.—C. I. Kane, Milford, Conn.
STEAM ENGINE.—W. G. Ulery, New York city.
STEAM PRESS, ETC.—J. F. Taylor, Charleston, S. C.
STRAP FASTENER.—J. Fairman, New York city.

Recent American and Foreign Patents.

Improved Wash Boiler Attachment.

Nelson C. Warner, Hopewell Furnace, Mo.—This invention has for its object to furnish an improved attachment for ordinary wash boilers, by means of which the clothes may be washed quickly, thoroughly, and without being injured by the circulation through them of hot water. A plate of tin or other suitable metal is made concave upon its lower side and convex upon its upper side, and may be of any desired form and size, according to the shape and size of the boiler in which it is to be used. In the center or highest part is formed a hole in which is secured the lower end of a pipe, the top of which is upon a level with the rim of the boiler, and tapers slightly. To the upper end of the pipe is secured a cap plate, the upper edges of said pipe having a number of notches formed in it. In the plate first mentioned are formed six holes, which are covered upon the upper side by guards, to prevent the clothes from being forced into said holes and impeding the operation of the washer. The guards are open at their sides to allow the water to pass freely beneath them and through the holes. The latter are covered upon the lower side of the plate by valves, opening downward, so that they may be closed by the upward pressure of the water and steam in the space beneath the plate, and may be opened by the downward pressure of the water in the space above, to allow the said water to flow back into the space beneath.

Improved Clothes Line Pole.

Charles B. Brown, New Rochelle, N. Y.—This invention has for its object to furnish an improved pole for supporting a clothes line between the posts or other points of support to prevent it from sagging with the weight of the clothes, and which shall be so constructed that the line cannot be blown from the pole however much it may be swung about by the wind. It consists in an improved clothes pole, formed by the combination of a hinged arm and coiled spring with the upper part of the pole, said parts being provided with half round notches in their adjacent faces, and with bevels upon the adjacent edges of their ends.

Improved Potato Digger.

David M. & George E. King, Mantua Station, Ohio.—The invention relates to that class of potato diggers which are provided with shovels to run under the potatoes, lift them up, and cause them to slide with the dirt and vines upon a rear sifter. The invention consists mainly in two reversely moving sifters, pivoted side by side and directly in the rear of shovels or diggers, and of a number of improvements in the details of construction by which a most practicable, efficient, and economical potato digger is obtained.

Improved Pattern for Cutting Dress Waists.

Mrs. Elizabeth P. Smith, Chicago, Ill.—The invention has for its object to provide a pattern having a series of scales printed thereon and so arranged as thereby to measure, lay out, and cut dresses to fit any person; and to that end it consists in two separate sheets or patterns, one representing the front and the other the back of the waist, and each provided with a system of scales or figures corresponding with the measurement of the person to be fitted, and so arranged as to describe the outlines of the front and back of the waist, when used in accordance with the directions given. It further consists in shaping the edges of the separate sheets, approximating the curves described by figures arranged upon the separate scales by which the requisite curve is formed upon the fabric.

Improved Soldering Machine for Making Pipes or Cans.

Wm. S. Brooks, Baltimore city, Md.—The invention consists in bringing together a can-holding cylinder, clamp and blowpipes, so as to enable the seam of a can to be quickly and thoroughly soldered. It also consists in carrying a pipe—to throw a current of cold air—along the recently soldered seam so as to solidify it in as brisk a time as possible. It also consists in a peculiar construction and arrangement of air pipes, so that the same blower, bellows, or air pump may be utilized for furnishing both the oxygen to the burners and the cooling current to the solder seam. It also consists in means for actuating the cocks of both air and gas pipes by the same single hand movement of the operator.

Bedbug Trap for Bedsteads.

Constantine Legab, Pittsburgh, Pa.—The invention consists in extending the cover beyond all parts of the bedstead to render it certain and sure that the bedstead will never be jammed against the side wall so as to receive bugs therefrom. It also consists in detachable, slotted, tenoned and bifurcated uprights, which connect the cover with the foot and head board, that the distance of the former from the latter may be graduated to suit the views of different persons.

Improved Fireplace Grate.

James M. Woodcock, Bridgeport, Ohio.—The invention consists in making the back of a grate movable on pivots so that the accumulation of ashes can be readily removed therefrom, and from the mass of fuel which can thus be more readily shaken and loosened. It also consists in providing this pivoted back with the oblong slotted bearings so that it may be raised and lowered, vertically slid backward, and horizontally and vibrated. It also consists in providing this pivoted back with a downward projection having a tenoned end that works in a hole of the lever, so that it may be conveniently operated.

Improved Safety Valve.

Gabriel J. Rains, Aiken, S. C.—This invention relates to a hollow cone safety valve for steam escapes from steam boilers of every description, which cone is made to cover and in part inclose the end of the escape pipe, on which it is made to fit steam tight, pressed down upon it by weights, spring, or other device; and the elements of this cone are to make a right angle or less with each other at the vertex. The chief advantage of this valve is that, owing to the inclination of its outer sides, the steam has no power while escaping to cause it to be forced back upon the seat.

Improved Medical Compound.

Joseph L. Putegnat, Brownsville, Texas.—This invention consists in a compound composed of fluid extract amargosa root, essence of Jamaica ginger, pure glycerin, and simple sirup. These ingredients, when thoroughly combined, form an improved specific for diarrhœa, cholera, dysentery, and diseases of the bowels generally.

Improved Door Spring.

William M. Kellie, Chicago, Ill.—This invention has for its object to furnish an improved rubber door spring, which shall be so constructed as to cause the door to close gradually and without slamming. The invention consists in an improved door spring formed by the combination of the inclosed elliptical coiled wire spring, having its ends embedded in the solid end parts of the rubber bulb, with said bulb having a hole in its side, and its solid ends perforated to receive the fastenings.

Improved Boot and Shoe Sole Stamp.

Alfred M. Burnham, Lynn, Mass.—This invention relates to a new means for stamping the number upon the sole of a boot or shoe. At present these numbers are applied by hand, after the soles are cut out, and considerable time and labor are consumed in this process. This invention consists in applying the stamp to the presser foot of the sole cutting die, so that the sole will be cut and stamped at one process. The stamping will thus consume no time whatever, except perhaps what is consumed in changing one stamp for another, when different sizes of soles are cut out.

Improved Grindstone Trough and Support.

Charles P. Richardson, Groveton, N. H.—This invention relates to the construction of troughs for grindstones, and the brackets or hangers for supporting the stone; and it consists in the manner of putting in the bottom of the trough, and in so constructing the hangers that the trough may be fastened down with screws. The hangers support the shaft of the grindstone, and serve to hold the trough firmly in place. The trough is light and substantial, and much cheaper than the cast iron troughs in common use.

Improved Machine for Making Ox Shoes.

William Hamilton, Neversink, N. Y., assignor to himself and James L. La Moree, of same place.—This invention consists of a trip hammer and anvil with faces adapted in size and form to hammer the upper and lower sides of the half shoe for oxen, with which a horizontal reciprocating die is combined in such manner as to be actuated by the hammer stock, and caused to hammer up the inner edge of the shoe, and form the cavity in it between the heel and toe; also, to shape the outer edge, the said horizontal hammer die operating alternately with the trip hammer.

Improvement in Putting Up and Preserving Cider.

Moses Halsted and John L. Wheeler, Brooklyn, N. Y., assignors to Halsted, Couse & Co., of New York city.—The invention relates to methods of arresting fermentation and in preserving the fruity flavor of cider, so that it may be offered to the public pure and without sediment. This process is applicable to and tried only on the pure apple juice which has been previously run into large tanks or casks in a cool underground cellar. Here it is charged with carbonic acid gas. Ordinary siphon bottles, used for certain other liquids, are then connected with the tank or cask, and carefully filled. The air being excluded and the carbonic acid gas having been applied before the bottle fermentation, no deposit is made, and the native fruity taste of the cider is entirely preserved. Separate drinks may be taken from the same bottle at the interval of several months without a perceptible change in the beverage.

Improved Railroad Switch.

Don Juan Arnold, Brownsville, Na.—The invention consists in the improvement of railroad switches. The switch rails are connected by a rod with a crank to the switch lever, so that by moving said lever the switch rail may either be brought in line with the main or with the branch track. At the point where the rails of the two tracks cross each other, and where usually a triangular frog is placed, is arranged a movable short rail, which is, by straps, connected with the crossing rails, and which is further connected with another crank of the lever. The straps are so made as to allow the frog rail to be swung into line with either rail. Being connected with the lever, the frog rail will be moved simultaneously with the switch rails, but in opposite direction thereto, in such manner that, when the switch is brought in line with the main track, the frog rail also will be brought into line with that rail of the track in which it is placed; and when the switch is brought in line with the branch track, the frog rail will be brought in line with that rail of the track in which it is placed. In either case the wheels of the train, passing over the connected track, will find continuous rails, and no obstructions similar to those usually offered by railroad frogs.

Improved Construction of Bridges.

Samuel B. B. Nowlan, New York city.—This invention has for its object to furnish an improvement in the construction of bridges, of any span and of any hight, over navigable waters, and which may also be applied to the construction of coffer dams, roofs, domes, etc. The invention consists in the voussoirs formed by casting frames around vertical parallel plates, and provided with lock flanges or hooks and sockets upon their opposite inclined ends. Holes are arranged opening into grooves or passages leading through the frames along each line of sockets, so that when the voussoirs are locked together melted composition metal may be poured into the said holes to flow along the passages and around the hook flanges, filling all the interstices and making the connection closer. This construction makes the connection much stronger, and requires much less time than when bolts or rivets are used. By this construction, as each succeeding voussoir is secured in place it will be self-sustaining, and will also be strong enough to sustain a derrick for hoisting the next voussoir into place. The vertical connecting plate is cast in sections in connection with the crown plates, which are anchored in the masonry of the piers. The crown plates and vertical connecting plates have sockets formed in them to receive hook flanges formed upon the abutting voussoirs, thus forming a vertical and an angular lock, the passages for the melted composition metal extending from the holes along both the vertical and angular line of sockets. The voussoirs are so arranged as to break joints, and are connected laterally by dovetailed steel keys.

Improved Acid Pump.

Francis Nichols, New London, Conn.—This invention consists of a glass acid pump, which is also converted into a siphon by the application of an extension tube to the nozzle, in which pump action is produced by the compression and rarefaction of air in a chamber between the valves, the air being compressed in the chamber by a hollow collapsible bulb, and rarefied by expanding into the bulb again. The apparatus is also useful for measuring the liquids at the same time, by having the bulb constructed to deliver a given quantity by each operation. The bulb is so contrived with relation to the compression chamber of the pump that it is not exposed to destructive acids. It is designed for corrosive liquids, such as all the stronger acids (except fluoric): also sensitive liquids, as solutions of nitrate of silver; volatile liquids, as aqua ammonia, chloroform, etc., can be handled without injury to them, and without passing through the bulb. It is also adapted for drawing wines, liquors, etc., and for general use in the laboratory. Patents for this invention have been secured in foreign countries.

Improved Box Slides for Ornamental Chains.

Oscar J. Valentine, Newark, N. J.—This invention consists of skeleton boxes or frames for the slides of bracelets, chains, etc., with the binding springs for holding them arranged on the edges of the chains instead of the sides, as heretofore. The springs are thus concealed.

Improved Cotton Harvester.

James W. Leigh, Norfolk, Va.—This invention consists of a series of saws on an upright or approximately upright shaft at the front end of each of the side boards of a large box or hopper arranged on a low truck. This box is of such width that, running between two rows of cotton, the brush of each row will be pressed over to one side so that the saws (which are kept running and work between two guides, from which the teeth project enough to catch the cotton, but not enough to catch the brush) will come in contact with about half the cotton and carry it inside of the box, where revolving brush strippers discharge it from the saws. The portion of cotton remaining on the brush will be taken off in same manner when the machine returns along the other side of the row.

Improved Stone Puller.

George Sprinkel, North Leverett, Mass.—This invention has for its object to improve the construction of the stone puller for which letters patent No. 121,820 were granted, to the same inventor, December 12, 1871. The wheels revolve upon the axle journals, to the upper side of which is secured a strong casting to which are pivoted two drums, each of which has a ratchet wheel formed upon each end. Four spring pawls take hold of the ratchet wheels to prevent the chain drums from turning back. To the rear side of the casting is pivoted a rod having four cranks or arms formed upon it, which are opposite to and connected with the pawls. This crank rod is operated to withdraw the pawls and allow the chain drums to turn back to lower the load or run out the hoisting chains, one end of which is attached to said drums, and their other ends are attached to the stone or other load to be raised. To the shaft of the chain drums and between the adjacent ends of said drums, is pivoted the end of a lever. By suitable devices the arm, as it moves forward, may turn the chain drums, wind up the hoisting chains, and raise the stone from the ground. To the forward side of the upper end of the arm is attached the rear end of the draft chain, which passes beneath the friction and guide roller pivoted to the forward end of a tubular arm, and its forward end is attached to the forward end of the tongue. The tongue slides back and forth in the tubular arm when raising and lowering the stone, and may be locked when moving the stone by a pin or other fastening. In using the machine, the pawls are raised from the ratchet wheels and the hoisting chain is attached to the stone. The arm is then drawn back, which draws the tongue back into the tubular arm. The draft animals are then attached to the forward end of the tongue, and as they move forward the arm is drawn forward, winding the chains upon the drums and raising the stone from the ground. When the tongue has been drawn out to its full extent, the animals are backed, and the arm is drawn back by the chain to be again drawn forward by the advance of the team.

Improved Bee Hive.

Joseph Newman and Noah Brown, Rossville, Ill.—The invention relates to improvements in bee hives. The case of the hive is made in prismatic form, of size suitable to accommodate eight frames. The top, back, and side of the hive are hinged, and can be swung open. The hive is supported partly by a moth trap, and in part by legs. The moth trap can be removed and the legs can be turned vertically on the side of the hive when desired to house or transport, so it will occupy less room than ordinary hives of equal capacity. In front the hive has two entrance openings, one directly above the bottom, and the other in line with the lower part of the honey frames. The bees are thus enabled to enter the upper honey department without having to climb to it within the hive. The lower opening can be more or less closed by slides moving horizontally and vertically. The vertical slide is used to so reduce the opening at the swarming season as to prevent the escape of the queen bee; also at other times to exclude the drones, always, however, permitting free entrance and exit to the working bees. The horizontal slide serves to reduce the length of the opening, that the same can be more easily defended against robber bees. The moth trap can be entered through two inclined openings which extend from a beveled piece on the top board of the trap. The moth millers enter the hive, find the openings, and descend into the trap, where they can be destroyed by suitable means. The moth trap may be converted into a drone trap by enlarging the openings. By contracting the entrance the drones, being excluded from the hive, pass through the opening into the trap, where they can be destroyed; if working bees should enter the trap they may escape through an opening which can be contracted by a gate, in order to retain the drones. The frames are set up within the hive side by side, and may be quickly adjusted in place. The upper honey frames can also be removed from above. The upper slat of each lower frame is made so much wider than the remaining parts of said frames that at that hight the spaces between the series of frames are contracted, forming narrow throats, through which the working bees can pass, but not the queen. The latter will thus be effectually excluded from the honey frames, which will be preserved for the purpose for which they were originally intended.

Improved Die for Forming Tubes.

Joseph Kintz, Meriden, assignor to himself and P. J. Clark, West Meriden, Conn.—This invention relates to the operation of forming tubes or cylinders from sheet metal; and consists in dies and a mandrel constructed and arranged for that purpose. The sheet metal, being cut to the proper width, is placed on the bed die with its edges against lugs, which are guides for placing it, and a semicircular former is applied. This is the first operation. For the second operation the back of the bed die is used, where there is a removable cleat, the inner corner of which is the arc of a circle corresponding with the diameter of the tube. A projecting wire is arranged at each end of the die for guiding and keeping in place the half formed tube.

Improved Floor Timber Support.

Theodore Voelckers, Boston, Mass.—This invention has for its object to furnish an improved device for connecting floor timbers with the supporting walls in such a way as to firmly support said timbers without weakening the wall, and in such a way that, should a joist break, be burnt off, or otherwise give way, it may fall without pulling the wall down with it. The invention consists in the two plates, the one having a transverse groove formed upon the upper side of one or both ends, and the other plate having a corresponding transverse projection formed upon the under side of its outer end for the purpose of supporting floor timbers and connecting them with the walls.

Improved Apparatus for Tapping Water Mains.

William Young, Easton, Pa.—The two parts of the drill case are clamped tightly together and have a hole formed, half in each part, for the drill, with arrangements on the side of the pipe to make a water tight joint. A cock traverses the drill hole to close it when the drill is drawn out. It has a handle on the outside for turning it, and also a deep notch cut in it coinciding with the drill hole, to let the drill pass into the pipe for drilling the hole. After the hole is drilled and the point of the drill drawn back beyond the cock, the latter is turned so that the hole is stopped. The drill is then drawn out through the stuffing box and the pipe to be screwed in the hole is put in through the stuffing box; the cock is turned back again, and the pipe is pushed forward and screwed into the water main; and then the apparatus is removed.

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Manufacturers of Stave Machinery, please send Price List to J. Stoney Porcher, Bonneau's, S. C.

Standard Spring Steel Machinist's Rules, manufactured by The Star Tool Co., Middletown, Conn., the only company that can graduate on spring steel. Every Rule warranted. C. W. Sweetland, Selling Agent, 84 Washington Street, Boston, Mass.

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Agents' names wanted. Wendell & Francis, 436 Walnut Street, Philadelphia, Pa.

Wanted—The address of parties who will contract to cut gas retort carbon into blocks 5 ins. long, 2 ins. wide, and ¼ of an in. thick. Address, stating price per thousand, Leclanché Battery Co., No. 40 West 4th Street, New York.

Shaw's Planer Bar—For Shop, County, and tate Rights, apply to T. Shaw, 913 Ridge Av., Phila., Pa.

Special Notice—One of two valuable Sewing Machine Patents—both on new principles—for Sale or work on a royalty. Working machines can be seen on application to the undersigned. G. L. DuLaney, 180 Pearl Street, Brooklyn, N. Y.

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Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

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Monitor Leather Belting you can always rely on. Send for Circular. C.W.Arny, 301 Cherry st., Phila.

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above, see Scientific American, Nov. 27th, 1869. Also, Glazier's Diamonds. John Dickinson, 64 Nassau St., New York.

3 Winn's Pat. Improved Portable Steam Brick Machines. Averages 40 m per day. Fully guaranteed. For sale cheap. John Cooper Engine Manufacturing Company, Mount Vernon, Ohio.

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Notes & Queries

P. F. B. asks for a recipe to restore old files, if there is such a thing.

E. M. asks for a recipe to tint human hair a blonde or golden color.

A. S. J. asks for a plan for making charcoal in a sheet iron box or oven.

M. C. M. asks for practical directions for burnishing gold picture frames.

L. V. Y. asks: Can you inform me how a lathe such as is used by picture frame makers for turning ovals is constructed?

W. M. V. asks for a process for hardening cast iron other than case hardening. "I once had a recipe in which acids were used, but I lost it and have forgotten its contents."

H. H. D. asks: What is the *modus operandi* of waxing meerschaum pipes? What shall I do to prevent a white film, which spreads over the surface of the pipe when cooling?

E. W. W. says: Given the chord and versed sine of a segment of a circle, how can I find the length of the arc? I want a short formula for practical building purposes.

W. A. B. would like information how to properly construct a Ruhmkorff coil. "I wish to try an experiment which requires at least the knowledge of one. I have all the apparatus for insulating the wire, etc. Will fine cotton do for insulation?"

A. B. asks why the rudders of vessels are uniformly placed at a greater than a right angle with the keel of the vessel? Why not at a right angle, as the rudder would then seem to take more hold upon the water?

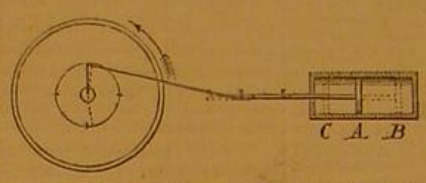
J. P. H. says: Take a piece of card board, bend up the sides, and fill the inside with tin foil. Hold the card board and tin foil over an alcohol flame and the foil will melt and the card board not burn. What is it that prevents the card board from burning?

G. W. R. asks: How can I arrange a system of dampers to regulate heat? I wish to keep the temperature of a box, 2 feet x 1 foot x 1½ inches, at about 100°, the heat to be supplied from steam heated by oil lamps. It is very necessary that the temperature should be kept within a slight variation for a week or so.

H. P. M. asks: What is the best manner of constructing an annealing furnace to anneal malleable iron? How should the top be built or braced to have it flat? Should I use fire brick inside, or will common brick do, except for the fire boxes? How should the flues be placed? What degree of temperature is the best to anneal with?

J. B. says: I have a number of large grindstones running at high speed; are they not equivalent to a fly wheel? If so, why use up half my power in carrying a separate one? I know the importance of steady speed. Cotton mills have large pulleys and card cylinders running at high speed; are they not equally efficient? On adding machines, the speed must be checked before the governors of the engine will act. The only effect of a fly wheel, as far as I can see, is to require so much power that in adding a little extra weight it will refuse to respond immediately. I do not propose to abandon fly wheels altogether, because there are many cases where they are indispensable, in rolling mills, for instance.

R. H. B. says: I find that the irregularity of the motion of a piston attached to a fly wheel is not understood by many who should be familiar with it. The annexed diagram will explain my meaning. Supposing,

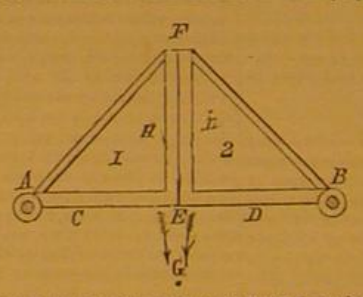


of course, that the motion of the fly wheel is regular, the piston, A, must travel to B and return in the same length of time that it travels from A to C and returns; or, in other words, when the stroke is half made, the fly wheel has not made one quarter of its revolution. Is not this so?

W. P. W. says: On my boilers I use glass water gages of the common construction; the glasses are 16 inches x ¾ diameter. They are packed in the usual way with a soft rubber ring or gasket about ½ inch thick when put in. Now in, say, from 5 to 8 or 9 weeks, they will burst, and the steam end appears to be eaten all up, sometimes as thin as paper, while the lower end is always all right, showing no decay at all. They don't always break at the top, but sometimes in the middle. They show no signs of being eaten below the packing of the steam end. The water I use comes from a well which is situated perhaps 150 feet from a small river. It appears to be good, although there is a white deposit from it where it drops on to any hot surface. I blow down say 4 or 5 inches once or twice a week. What is it that eats the glass? Is it the steam, or is it the action of the steam and rubber? I carry steam, on an average, at 80 lbs., but sometimes at 105 lbs.

J. H. N. says: 1. We have a wire fence which we wish to preserve from the action of the weather. Can we use anything better than linseed oil paint? 2. At what time of the year should building timber, pine, oak, hemlock, spruce, etc., be cut in order that it may be strongest and least liable to decay? 3. Please give us the chemical analysis of honey. What is the chemical difference, if any, between honey gathered from clover, basswood, or buckwheat blossoms? 4. In what particulars does honey differ from sirup made from white sugar? 5. Is honey used to any extent in the manufacture of candies or other articles; or, in fact, to what extent can honey be used in place of sugar made from sorghum? 6. Honey will slightly granulate, resembling lard, when exposed to cold, but will resume its liquid state again when warmed; is there any process by which it can be made to form dry grains which will retain their form, like sugar?

L. E. R. says: Suppose the triangles 1 and 2, pivoted at A and B at such distances that the perpendiculars of the triangles will meet at E and F, are drawn downwards and together by forces moving in the direction of the arrows toward the point, G, will there be any gain of pressure at E and F over the power applied at G? If there is, will the comparative lengths of C and H, and of D and I, affect it in any way?



ANSWERS TO CORRESPONDENTS

W. R. H. will find directions to make cupro-ammonium on pp. 129 and 177 of vol. 28.—C. R. B. can find the needed information as to the transmission of power by belts on pp. 240 and 257 of vol. 28.—A. B. N. can obtain the necessary instructions on lightning rods by reading pp. 49 and 103 of vol. 27.

P. P. H. asks if alcohol can be kept in an iron or steel vessel without damaging the vessel. Answer: Yes.

J. M. asks: What effect does coarse sugar have on black ink, and for what purpose is it used in the manufacture? Answer: Copying ink is frequently made by adding sugar to ordinary ink.

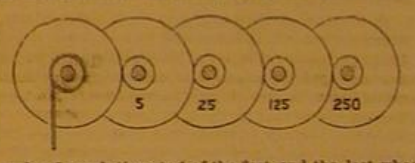
J. D. says: 1. Suppose a ball of cast or wrought iron suspended by a cord, say, 5 feet long, approach a ball magnet held in the hand, will the latter draw the ball to itself before touching it? 2. If it will, how near must it approach to cause the ball to swing? 3. Please tell me what is meant by "it will hold about a pound"? 4. Is magnetic iron ore the same thing as lode stone? 5. How heavy a ball, and at what distance, would the Stevens Institute magnet draw? 6. If the magnet will not draw the ball, would it if the latter were also charged? 7. Would attraction draw a heavy or light ball best? Answers: 1. Yes. 2. That will depend on the weight of the ball and the power of the magnet the lighter the wrought iron ball the greater the distance at which it will be affected by a magnet of a given power. We can have an electro-magnet made for you, which, with one of Grove's battery cups, will attract a ball (weighing one pound, and suspended by a five foot cord) at eight inches; that is, a magnet that will, when placed eight inches from the ball cause it to swing to and stick against the magnet. With two or three of Grove's cups, you could swing the ball at eighteen inches; and with the electro-magnet, you can make any number of permanent steel magnets. One twelve inch electro-magnet, one turned wrought iron ball, and one cell of Grove's battery, will cost, as near as we can judge, about twenty dollars. 3. It means that it will hold a pound weight of iron if it is in contact with the magnet. 4. Yes. 5. That would depend on battery power; with twenty cells of Grove's battery, it would move twenty pounds of wrought iron suspended at two feet from the magnet. 6. It will; the charging of the ball is impracticable. 7. It would move the light ball at the greater distance.

J. H. G. writes to ask if information as to the mineral resources of Virginia is acceptable. Answer: We are always glad to receive such communications, and will give them due attention; and will publish them if they are of any public interest.

J. A. H. says: Please inform me how I can make an iron zinc battery. 1. Does the iron occupy the place of the carbon in the Bunsen battery? 2. If so, what acid or solution is it immersed in? I want about one hundred plates or bars of carbon for a battery, and desire to make them myself. I have a number of works upon electricity, but cannot find any hints upon the subject. 3. I imagine the coke should be pulverized and cemented with some conducting substance. Should it not be molded into a block, and then cut up into plates with a saw? 4. Will an ordinary wood saw cut it? Answers: There are at least a dozen different ways of making such batteries. 1. Yes, in one method of construction. 2. One part of sulphuric acid to ten parts of water, to act on the amalgamated zinc outside of the porous cup, and a saturated solution of bichromate of potash inside the porous cup to act on the iron; either cast or wrought iron will do. 3. That is one way, but it requires great pressure; it is better to cut from the block as it comes from the retort. 4. Yes.

E. S. C. says: Two blocks, one measuring 11x13, the other 12x12 inches, show 1 inch difference in superficial measurement. Will the 11x13 piece placed in one position cover the 12x12 and leave 1 inch to spare? If so, why is it? Answer: The 13x11 block will overlap in one direction to the extent of 1x11—11 square inches; the 12x12 will overlap in the other direction to the extent of 1x12—12 square inches; difference, 1 square inch. Try the actual experiment.

F. O. W. says: Given a set of cog wheels, as in illustration herewith, where the second wheel



makes 5 revolutions to 1 of the first, and the last wheel makes 250 revolutions to 1 of the first. What power must I apply to wheel No. 1, in order to develop a power of ten pounds on each revolution of the last wheel; or how heavy a weight would I require to haul and wind up on the axle of wheel No. 1? Answer: This ratio of power to weight will be inversely that of the velocities of the driving and the driven point. To determine it by calculation, multiply the radii or diameters, as may be most convenient, of the small wheels together, and divide the product by that obtained by multiplying the radii or diameters of the large wheels together. Thus $\frac{1}{5}\times\frac{1}{5}\times\frac{1}{5}\times\frac{1}{5}=\frac{1}{625}$; hence 1 pound will raise 1,250 pounds, provided there is no friction. Add 20 per cent to allow for friction. To determine the ratio by experiment where weights cannot be conveniently used, move the wheel to which power is to be applied until the resistance has been overcome through the space of one inch, and measure the distance moved by the first. In this case it will be found to be 1,250 inches and the ratio thus found is, as before, the ratio of force applied to resistance overcome, friction not being taken into the account.

B. W. F. asks: 1. What is the best way of cleaning printers' rollers? 2. What is meant by a local telegraph battery? 3. How can I construct a cheap electric alarm bell? I have a medium size horse shoe magnet. Answers: 1. Wash the rollers with lye made by dissolving potash in water. 2. A local telegraph battery is a galvanic battery used to assist the working of telegraph instruments at the stations along the telegraph line. 3. To make an electric alarm bell, the armature of the magnet should have a small hammer attached to it, so arranged that, when the armature is attracted towards the poles of the magnet, the hammer will strike on the bell. For examples, see engravings in back pages of the SCIENTIFIC AMERICAN.

F. B. asks if there is anything certain in the method practiced by some to find the locality of underground water streams, known here as "water witching?" I believe it is done by holding each end of a stick, or each leg of a forked stick, firmly in the hands, and when the "water witch" goes over or near water, the stick turns in his hands. Some not only pretend that they can point out the exact locality where water can be found, but can also tell approximately how far it is below the surface. If so, what is the philosophy of it? Answer: The water witch or forked stick for finding water is delusive.

E. B. says: 1. I wish to procure or make a magneto-electric machine. Which will be best for procuring heating and chemical effects, a magnet weighing 10 lbs. moving at the rate of 6 feet per second, or one weighing 1 lb. moving 60 feet in a second? I use the word feet instead of revolutions, because the machine I wish to procure operates by producing a constant advance of magnetism, instead of rapid reversions. 2. How is silicon used? Is it of practical value? Answers: 1. The first is the best for heating and chemical effect, and the second for giving shocks and producing intense electricity, that is, the kind that will dart through the air. 2. It is expensive to make, and at present is of no value.

T. P. B. says: I have a small oscillating engine, 1¾ inches in diameter x 3 inches stroke. What power will it give at 60 lbs. of steam, and what sized boiler will it take to run it? Answer: About one quarter of a horse power, probably. Put in a boiler of about 15 inches diameter with 10 or 12 square feet of heating surface. Such small engines require larger boilers, proportionally, than large engines.

C. O. says: A party wishes to hire steam from me, and wants to know how much I will charge for an inch pipe per hour, he keeping the valve wide open, at a pressure of sixty pounds. Can you give me a rule for finding the velocity of steam at any given pressure? Answer: No rule that will give the discharge from a steam pipe can be given, except where the difference of pressure at the two extremities is known. The steam may rush out with a velocity of nearly 2,000 feet per second, or it may have any less velocity, down to zero, as the difference of pressure becomes less. An inch steam pipe, if quite short, would drive about a four inch cylinder, as usually proportioned. Ascertain, as nearly as may be, what is the amount of power that the tenant can use, as an average, and charge for it, trusting to his business capacity for his ability to get an equivalent for what he pays.

M. H. B. says: 1. I have a common slide valve engine, working steam for ⅛ of the stroke; I wish to have it cut off at ⅛ of the stroke. Is there any way to effect this without having a new valve? And would new ports also be needed? 2. An engine is running 150 revolutions per minute, with 40 lbs. pressure; would there be any advantage either in pull or power, in speeding the engine down to 100 revolutions with 60 pounds pressure, and putting a larger wheel on the engine shaft, so that the counter shaft would have the same speed as now, and do the same work? 3. Does the top of a drive wheel on a locomotive turn or run any faster than the bottom when it is running on the rail? Answers: Add a strip of metal to outer edge of valve face, securing by tap bolts, to give additional lap; chip off exhaust lap and then set eccentric ahead. Do not alter ports. 2. The difference would not probably pay for expense incurred in making the change. 3. Yes.

O. K. asks how a condenser, to be used with an induction coil, is constructed. Answer: It would be difficult to explain the construction of a condenser without a drawing. We handed your letter to a manufacturing firm; a condenser one foot long and seven inches wide, containing eighty sheets of tin foil, will cost five dollars; if you take this apart and put it together, you will get a better idea of construction than we could give you in any other way.

E. F. G. says: 1. Can you tell me what work on steam engineering is best for a young man to study, who wishes to fit himself for taking charge of an engine? 2. How small a yawl boat could be driven by a screw wheel? Could a boat 18 feet in length, of 4 feet beam, be driven as fast and easily as it could by one pair of oars? Answers: 1. The books of Bourne, Main and Brown, Long and Buel, and King, all contain a great deal that would be useful and essential. Look them over and take the one that best suits the special case, financially or otherwise. Bourne's quarto treatise is an expensive work; but his "Catechism" and "Handbook" and the other works mentioned are all of comparatively small cost. Probably Main and Brown, all things considered, will best suit in such cases as this. 2. Oars will give best effect.

J. S. A. says: I have a 12 horse double flue boiler and a 30 horse engine, and wish to run a portable grist mill that requires about 10 horse power. Can I get this power from these, or will the engine exhaust the steam faster than the boiler can generate it? Answer: The engine will work perfectly well, but somewhat uneconomically. Its speed can be controlled by a good governor, and there is no danger of its exhausting steam without giving some equivalent for it.

P. F. L. says: We have a boat with a recess wheel 16 feet in diameter, with 10 feet buckets, and 12 inches in width. The engine is 16 inches, with 5 feet stroke, and makes about 18 revolutions per minute. We want to get the best speed on the boat that we can, as she runs too slowly; and the engine labors hard. There is quite a diversity of opinion in regard to the best plan to improve her speed. Some say the engine should run 40 revolutions, others, 28, and another as low as 18 revolutions per minute. One advises the reduction of her wheel to 14 feet, another says "reduce it in width to 8 feet and leave the diameter as it is." Will you give us your opinion? Answer: If the engine and boiler can be loaded safely to a higher pressure, simply carry more steam, retaining wheel unchanged. If the steam pressure cannot be raised, reducing the wheel would allow the engine to run faster, developing more power and giving higher speed of boat. Such an engine should have been originally proportioned for higher speed. We suspect that reducing the wheel will best answer in this case.

C. says: I wish to know how much fall you must give to the mile in a stream of water, to give said stream a certain velocity, say 4 miles per hour. Answer: We can only approximate for accuracy of determination in any case. Variation of dimensions, shape, and character of bottom, all affect the actual results, and experiment also has not yet been successful in determining the laws of flow of water in open channels, with precision. It is even disputed whether the surface velocity is greater than the mean velocity of the current. Probably Trautwine's rule is as good as any: "Multiply the area of water way in square feet by twice the fall in feet per mile, and divide by the length of wetted perimeter in feet. The square root of the quotient is the mean velocity in feet per second." About five sixths of this result will be the velocity in miles per hour.

S. L. C. says. A piston has an area of 144 square inches and, with the rod, weighs 100 pounds. The pressure of steam is 100 pounds to the square inch, the stroke is 24 inches, and the steam is cut off at ⅔ of stroke, or 16 inches. Suppose no resistance is encountered except weigth of piston and rod, what power is required to stop the piston at end of stroke and force it in opposite direction; in other words, what power is lost, under such circumstances, at each stroke? Answer: This case belongs to a class of problems which are solved by the principles enunciated in our article on "Laws of Impact," for which see SCIENTIFIC AMERICAN, current volume, page 208. In actual practice, no power is lost in the manner described.

W. M. J. says: In your issue of March 22, 1873, under head of "Scientific and Practical Information," you give a rule for fly wheels for steam engines, thus: Multiply the average pressure on piston in lbs. by length of stroke in feet, and divide by 45 times diameter of wheel; the result will be weight of rim in hundredweights. To obtain the weight in lbs. multiply by 28 instead of dividing by 45. Now I cannot see how the same result is obtained. Suppose an engine with a 12 x 20 inches cylinder with 80 lbs. average pressure, making 125 revolutions per minute, running two pairs millstones of 9 feet diameter at 200 revolutions (which is commonly done in this country), what will be the diameter and weight of the fly wheel, to overcome all the back lash? There is a rule for running the fly wheel 800 or 900 feet faster or ahead of the millstones that gives the best of results; and I built and put the same size engine, doing the same work as above, in a mill here; and there is no spring to overcome; the back lash and everything runs perfectly smooth and steady. I would like to get a rule to calculate any number of stones or sizes of fly wheels for all sizes of engines, and in fact I do not know the rule that obtained the above result. Now suppose, for example, the cylinder has 12 inches diameter and area 113 inches: multiply by 80 lbs. and the length of stroke, 1⅓ feet = 9416, divided by 45 times diameter fly wheel, say 9 feet = 405 = 23¼ cwt. the same as above multiplied by 28 gives 235,400 lbs.; now if the 28 was ⅓ the result would be very much the same as the first: how is this? Answer: Our correspondent has called attention to a typographical error. Instead of multiplying by 28, multiply by 2·5 and he will find the result sufficiently accurate. The rule given by W. M. J. for excess of speed to prevent back lash is a good one. We should determine the weight by the dimensions of the engine as is done in the last rule given on page 177.

G. A. says: I have undertaken to run a flouring mill engine where there has always been trouble about power since the owners took out two old fashioned engines, which were 8x36 inches, running at 60 revolutions per minute. There is now one engine, 12x24, running at 90 revolutions per minute, with a fly wheel 10 feet in diameter. The rim is 4¾x 3¾ inches, and the weight, 3,200 pounds. This engine will only run one run of burrs with 60 pounds of steam; it cuts off steam at two fifths of stroke; it takes all the steam the boiler will make. This engine ought to give all the power that is needful. 1. What is the trouble and how is it to be remedied? 2. We have another engine (not in use) of the same size; would there be any power gained by putting it in and running the two at the same speed and cut the steam off at one fifth of stroke and thereby save power by expansion? 3. According to Templeton, when one engine cuts off at one fifth with 60 pounds pressure, the other would have 30 pounds on expansion. Is that correct? 4. What power would be gained by putting in the other engine? 5. How is steam superheated? Answers: 1. We should suppose that the trouble is most likely to be a consequence of a leaky piston or leaky valves, but could only tell with certainty after applying an indicator. Take a set of indicator diagrams, or, if unfamiliar with the instrument, get an engineer to do it, and meantime learn to use one. An engineer who cannot use an indicator has a great deal to learn. 2. Probably not. It is not likely that much economy would result from greater expansion than two fifths in the common engine. 3. Yes, if we understand the question correctly. 4. If similar to the first, we presume the added power would be equal to that of No. 1. 5. By leading the steam through a superheater, which is usually a box set in the chimney, sometimes forming part of the boiler and sometimes wholly disconnected, which box contains a set of tubes. The steam is conducted around these tubes and the furnace gases pass through them, or *vice versa*. Other forms of superheater are in use, but that described is most generally adopted.

J. E. E. replies to F. R. M., who asked for a process of tempering steel, that can be utilized in dressing mill picks, mining drills, etc.: First select a good quality of cast steel, and heat it slowly in a fire free from sulphur (charcoal or coke is best); be careful that no part of it is overheated; a cherry red is high enough for the heat. Finish hammering at a black heat (that is, just red in the dark) or as near that as possible. In forging, do not upset or drive back the edge (as this destroys the granular formation produced by forging) but either cut, file, or grind off. To temper, heat in a slow fire free from sulphur, heating the tool above the edge at first, and letting it gradually work down so as not to overheat the corners or edge. When at a dark cherry red, plunge the steel slowly, edge downwards, into a bath of strong salt water. At first harden higher up on the tool than is required for the use to which the tool is to be put, then gradually draw the tool up out of the water; this leaves a portion with the temper graduated from soft to very hard, and prevents breakage at the positive hardened point; then draw the temper gradually to the color required. For a mill pick, just change from the hardened silver white to a very light straw. Rock drills should vary with the hardness of the rock and shape of the drill point. If a very blunt point, for quartz or flint, use it at the same color as for mill picks; if for granite, usually a darker straw color will do; for stone softer than granite and harder than slate, a light blue with straw mixed is right. If for ordinary marble or slate, draw to a dead blue; for a railroad pick, the point should also be of a dead blue. If for a mining pick for cement, with a blunt point, blue and straw mixed is right. If you want a very tough point, never let the temper run down fast, but draw it very slowly; when the temper is down to the proper color, stick the tool instantly into dry earth or sand, and let it cool off gradually. Do not plunge it into cold water to cool it off, as this sets the particles too suddenly and makes it brittle, and often causes crystalization to commence.

J. E. E. says, in answer to F. H. R., who asked how to harden steel for turning off emery wheels: I would say that steel cannot be so hardened as to cut solid emery wheels successfully. Tolerable results may be obtained by running the emery wheel very slowly. Still better results may be obtained with thin spring tempered cast steel; a piece of an old buck saw or a hand saw blade will answer. Hold the steel across a rest about 2 inches from the front of the emery wheel and below the center; then hold the steel on an angle with the point inclining upward, so that the end of the steel will strike the wheel when in motion a little above the center; hold it firmly so that the steel will chatter. This will back the wheel and break off the emery by concussion. Construct the rest so that its position can be changed, and then cross hack it. A very little practice will enable the operator to produce wonderful results in turning off his emery wheels, with very little wear to his steel. This process will also hack and sharpen glazed wheels. But the black diamond turning tool is of course preferable.

G. H. H. replies to J. H. L. who asked for opinions as to his mode of building: We have dwellings and shops in our village, constructed substantially as you suggest, which have been inhabited for between 60 and 80 years. They are to all appearance good for twice that term of service. They are remarkably free from vermin, and warmer than either, brick, stone, or timber buildings, when either are used alone; and we have all three varieties in the village. We have no frame buildings with brick filling for more than two stories up; but these are solid and firm, without any appreciable tremor during the high winds which frequently prevail.

E. V. replies to R. W., who asked how to make joints in an article made of slips of wood, to fold up: Use bolts such as are found in tinners' shears.

H. H. replies to G. W. H.'s query on coloring butter: Annatto is the best thing; you can get it at any drug store. Five cents' worth will color one hundred pounds of butter. If too much is put in, it will give the butter a brown tinge. A piece rather larger than a swan shot, put in the cream a day or so before churning, will give a good color to about ten pounds of butter. I have used it for years in the winter time, and never heard any complaints of its being unwholesome or ill flavored.

J. B. H. replies to E. T. C., who asked how to prevent the rats gnawing the leather of his bellows: Oil your bellows with petroleum; the rats and mice will not touch it, and it is an excellent leather preservative. I use it on belting, boots, etc., and have done so for three years, first carefully experimenting.

R. D. B. says, in reply to W. H. H., who asked for a solution to take sand off castings: Try sulphuric acid and water.

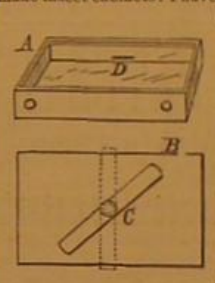
E. H. replies to G. W. H., who asked how to color butter: The juice of carrots expressed and mixed with the cream before churning, is best, as it does not injure the butter in any way.

W. T. H. says, in reply to C. M., who asked how can the glue joint of a violin be undone without injuring the instrument or spoiling the varnish: I used my violin near a red hot stove, one night, for about an hour, and put it away; in a day or so, I took it out and found it unglued. After regluing, I did not perceive any injury. A jet of steam applied to the part will do the work, but will whiten the varnish.

F. M. W. replies to M. J. D., who asked how to find the pressure per square inch on a slide valve: Multiply the area of all the ports in inches by steam pressure in pounds; if the valve cuts off at ¾ stroke, that will give the pressure during ¼ the stroke; for the remainder of the stroke, deduct the pressure on the area of one induction port found as above.

C. E. G. says, in answer to D. H. E., who asked how to adjust his scales: Let D. H. E. get some article that weighs exactly 100 lbs., and place it on the platform of his scales; next, let him place the 100 pound weight at the end of the lever, and put enough shot in the cup to make it just balance; this will balance the scales, and it will then be an easy matter to get the new pea of the right weight.

H. W. U. replies to A. L. who asked how to make insect cabinets: I have a case consisting of a dozen drawers like the diagram. A is the drawer, with a glass top put in with a molding. B is the bottom, with under part shown. C is a movable stick which fits into the niche D, keeping the drawer in place. By this device the insects can be pinned to the bottom without any trouble. It is made of seasoned pine, and I prevent trouble from mites, etc., by keeping a little piece of sponge saturated with camphor in each drawer.



C. H. H. says: I claim that a large circular saw, say 72 inches, will cut lumber with less power than a smaller one, say 48 inches. Is this so? Answer: Under no circumstances can a 72 inch circular saw be made to cut lumber with less than, or even as little power as, a 48 inch, both saws being of same thickness.—J. E. E.

M. L. says: I have a circular saw which I bent in sawing limbs of trees. How can I remove the bend or kink? Answer: A kink or bend in a saw can be removed only by a practical saw maker. An amateur, if a first class mechanic, might make a passable job of a simple bend by hammering the highest parts on the oval end of a hard wood block. But I would only recommend this in case of absolute necessity. Better send it at once to the nearest saw maker. It is an art known only to the trade.—J. E. E.

E. S. asks: How much crown is best for iron pulleys? For instance, in a pulley of 4 feet diameter x 20 inches face, how much larger should the center be than the edges? Answer: About one eighth of an inch for ordinary use, although this may be varied more or less, to suit different purposes. For example, a quarter twist belt will run better on a higher center. Pulleys should be turned a true oval and not straight from center to edge; if straight, the belt will not adhere to the pulley closely on either side of the center.—J. E. E.

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 Prayer Gage Absurdity. By F. H.

On the Effect of Sunlight on Combustion. By E. B.

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

On the Heating of the Earth by the Sun. By W. F. Q.

On the Force of Variations of Temperature. By W. A. M.

On the Wreck of the Atlantic (two letters). By J. B.

On Deep Sea Soundings. By C. F. L.

On the Manufacture of Combs. By G. T. L.

On Weak Boiler Flues. By S.

On Superheated Steam. By S. E. W.

On Artificial Fuel. By J. R. H.

On Ignition by Steam Heat. By J. N.

On Professor Young's Lecture. By J. D.

On the Boiler Explosion at Conshohocken. By W. B. LeV.

On Low Water in Boilers. By F. E. C.

Also enquiries from the following:

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

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.]

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FOR WHICH

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WERE GRANTED FOR THE WEEK ENDING

April 1, 1873,

AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSIONS.

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

24,655.—SHEET METAL COFFIN.—I. C. Shuler. June 18.
24,668.—LOOM PICKER MOTION.—W. Stearns. June 18.
24,669.—CORRUGATING SHEET METAL.—W. E. Worthen, H. B. Renwick. June 18.
24,725.—OPERATING WINDLASS.—P. Philip. June 25.

EXTENSIONS GRANTED.

23,557.—SEWING MACHINE.—W. C. Hicks.

DISCLAIMERS.

24,525.—BEDSTEAD FASTENING.—L. W. Buxton.
23,445.—PAPER FOLDING MACHINE.—C. Chambers.
133,276.—GLOVE.—J. F. Mason.

DESIGNS PATENTED.

6,538.—MUSIC STAND.—W. P. Bigelow, Natick, Mass.
6,539.—PEN SIGN.—Le R. W. Fairchild, New York city.
6,540.—JEWELRY CASE.—M. Hendberg, Boston, Mass.
6,541 to 6,543.—SODA WATER APPARATUS.—C. Lippincott, *et al.*, Philadelphia, Pa.
6,544.—TUMBLER HOLDER.—C. Lippincott, *et al.*, Philadelphia, Pa.
6,545.—LUBRICATING CUP.—F. Lunkenheimer, Cincinnati, O., *et al.*
6,546 & 6,547.—OIL CLOTHS, ETC.—C. T. Meyer *et al.*, Lyon's Farms, N. J.
6,548.—STATUARY.—J. Rogers, New York city.
6,549.—COOK STOVE.—W. J. Semple, Cincinnati, O.
6,550.—BILLIARD TABLE.—N. Stoll, Chicago, Ill.
6,551 to 6,554.—CARPETS.—J. T. Webster, Philadelphia, Pa.
6,555 & 6,556.—LAMP CHIMNEYS.—M. J. Wellman, N.Y.city.
6,557.—BELL PULL.—J. B. Whitney, New York city.

TRADE MARKS REGISTERED.

1,187.—WATCHES, ETC.—Bourquin Brothers, New York city.
1,188 & 1,189.—BOOTS, ETC.—T. Emerson's Sons, Wakefield, Mass.
1,190.—PRINTING INK, ETC.—L. H. Gein, New York city.
1,191.—PLAYING CARDS.—V. E. Mauger, New York city.
1,192.—CANDLES.—Proctor & Gamble, Cincinnati, O.
1,193.—MEDICINES.—R. Rattinger, St. Louis, Mo.
1,194.—RUFFLES, ETC.—J. V. Rockwell, New York city.
1,195.—MEDICINE.—D. D. Tomlinson, San José, Cal.
1,196.—HAMS, ETC.—F. P. Woodbury, New York city.

SCHEDULE OF PATENT FEES:

On each Caveat	$10
On each Trade-Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
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On an application for Design (3½ years)	$10
On an application for Design (7 years)	$15
On an application for Design (14 years)	$30

VALUE OF PATENTS

And How to Obtain Them.

Practical Hints to Inventors

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

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

HOW TO OBTAIN *Patents*

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

How Can I Best Secure My Invention?

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

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

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.

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 1851 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of fomer, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row, New York.

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.

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.

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.

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Trademarks.

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

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

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

Foreign Patents.

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

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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.

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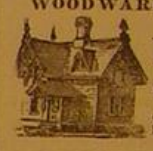
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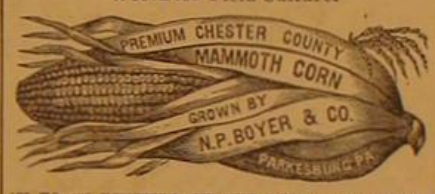
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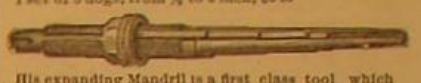
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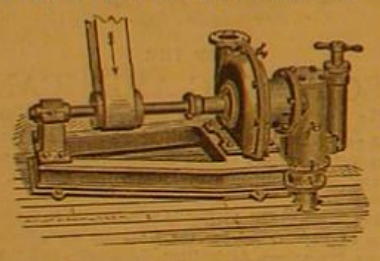
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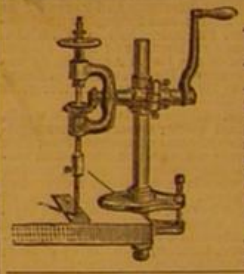
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Vol. XXVIII.—No. 19. [NEW SERIES.] NEW YORK, MAY 10, 1873. [$3 per Annum, IN ADVANCE.

DOUBLE TENONING MACHINE.

The chief points of advantage to be noted in the improved form of double tenoning machine, illustrated in the accompanying engravings, consist in the mechanical devices by means of which the cutter heads, aside from their individual motion, can be so connected together that when the cylinders are adjusted to the required thickness of tenon, both heads can be moved at once. They can thus be arranged at a suitable hight from the carriage to give the desired depth of shoulder.

A, Fig. 1, is the carriage upon which the material rests while being operated upon. B is the pulley which drives the cutters, C and D, one of which is shown more clearly in Fig. 4, through the medium of the smaller pulleys on the arbors, E F. These arbors work in composition boxes in frames which have a free vertical motion on the main stand, and which are coupled together by the right and left hand screw, G, working in suitable nuts. This screw, G, is rotated through bevel gear, H, by the hand wheel, I, and serves both to adjust the cutters, C D, parallel to each other and also to raise and lower the cutter frame as desired. By referring to Fig. 5, the reader will understand how this is accomplished. J is a section of the hub of the bevel gear, H, through which the lower portion of the screw is seen passing. K is a plug, tapped on its end so that it will form a part of the gear nut thread, which is slipped into the hole made for the set screw, L. When this set screw is not tightened, the plug will press against the screw, G, with sufficient friction to turn it: and consequently, when the bevel gear, H, is rotated, it will elevate or depress the screw, and with it the cutter frames in which it operates. If, however, the plug, K, be tightly clamped, so as to bite against the screw, G, the latter will be compelled to revolve with the gear; which, as it is threaded in opposite directions, will cause the frames to recede from or approach each other in accordance with the direction in which it is turned. By this ingenious arrangement it is clear that the two cutters, C and D, can be arranged in any suitable position either relative or together, according to the desired thickness of the tenon shoulder. Their vertical adjustment being thus provided for, a horizontal motion may be imparted to the heads in order to cause them to cut to a required depth, as, for instance, in cases where it is necessary to make one shoulder of a tenon deeper than the other. This is effected by connecting the rear ends of the journals of the arbors, E F, with sliding boxes. In the extremities of the latter, screws are tapped which are actuated by the small hand wheels, M. The wheel, N, on the screw, G, enables the latter to be revolved in order to cause slight changes in the position of the cutters. O is a tightening pulley, and is shown more clearly in Fig. 2. It runs in a frame which is moved up or down in accordance with the adjustment of the cutters by means of the rack, P, connecting with a pinion, Q, which communicates with a ratchet, lever, and weight (not shown) on the back of the machine.

The portions thus far described serve to cut a single tenon. To make a double tenon after the patterns shown in the foreground of Fig. 1, other devices come into play. R (Fig. 2) is a vertical shaft which revolves in a sliding frame, S, just back of the tenoning cylinders. On its upper end is a horizontal cutter head, T, shown partly in section in Fig. 2, and in perspective in Fig. 1. U is a bevel gearing actuated by the lower of the two hand wheels shown, which communicates with the screw, V, which works in a nut in the sliding frame, S. By this means the cutter, T, can be placed in any desired position vertically, or it may be thrown entirely out of the way while making single tenons.

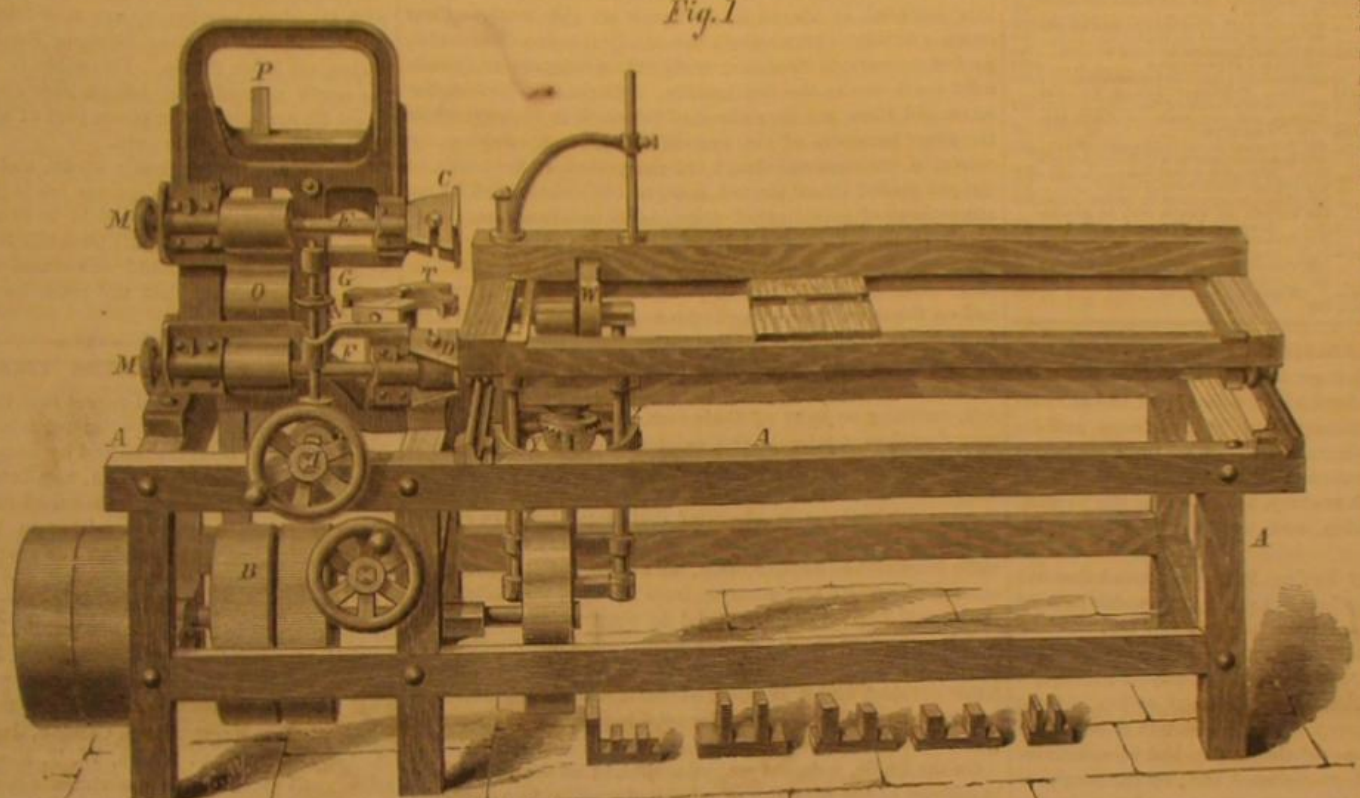
W, Figs. 2 and 3, is the gaining cylinder, which is actuated at the back of the machine, where the operator stands while using the same. It runs in metal boxes placed at the upper ends of the wrought iron rods. These rods are connected, as shown at their lower ends, by a cast iron bar, in the center of which is tapped a nut which receives a screw which, by the bevel gear, Y, communicates with the hand wheel, Z, at the rear of the machine. By this mechanism the operator is enabled to move the gaining cylinder up or down to any desired point, or he can place it altogether out of the way, so that the carriage will pass directly over it, when making single or double tenons. As the belt which drives this cylinder will necessarily vary in length as the latter changes position, a tightener, Z', is provided, arranged in an iron frame as shown, which presses upon the belt, and is of sufficient weight to fulfill all requirements.

The machine is self-contained, having one countershaft underneath, on which is a sufficient number of pulleys to drive its different parts, and a second countershaft, suspended on bracket hangers (shown broken in Fig. 2), bolted on the back of the apparatus to actuate the double cutter shaft.

From the above explanation of the essential parts, the method of operation is readily followed. The timber to be tenoned is placed upon the carriage, which is suitably mounted on trucks, and in this position is passed between the tenoning cylinders. As it emerges, cut in one thick tenon or in the outlines of two, it comes in contact with the cutter on the vertical shaft. This makes its way through the center of the thick tenon, cutting out a space and completing the double tenon. The gaining cylinder cuts gains from the under side of the timber as it passes over it while on the carriage, making them from one sixteenth to two inches in depth, and by forming several cuts, of any length. The machine is particularly suitable for use in railroad workshops, as it is claimed to be capable of operating upon the largest and longest timber used in the construction of railroad cars.

Patented February 25, 1873. For further information address the manufacturers, Messrs. Collins & Baxter, Lebanon, N.H.

Fig. 1



BUCK'S DOUBLE TENONING MACHINE.

Fig. 4

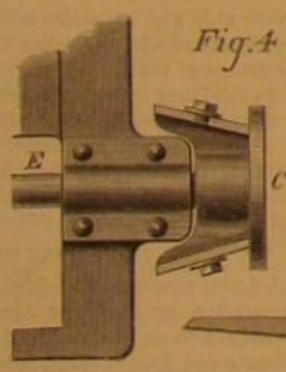


Fig. 2.

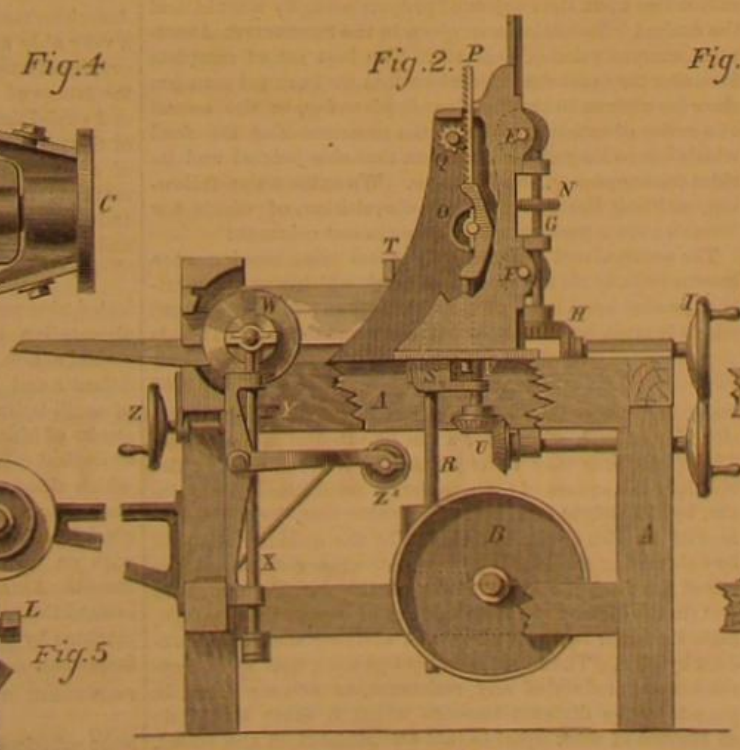


Fig. 3

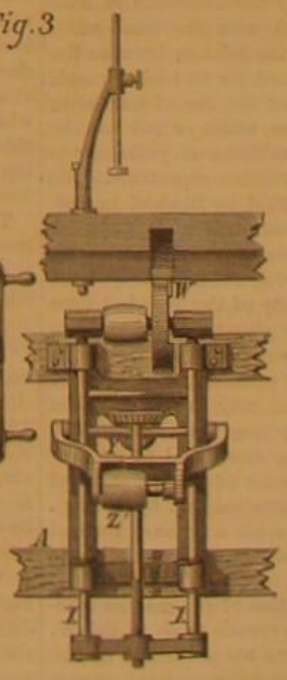
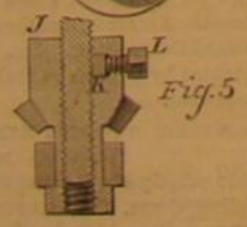


Fig. 5



[Mammoth Remains.

In 1872 a party of Americans, led by P. Pavy, left San Francisco to endeavor to reach Wrangel Land in the Arctic Sea. They landed near the mouth of a large river running from the N. W., and, about eighty miles inland, observed many indications of mammoth remains. On clearing away the snow from one of the spots, the whole of a well-preserved animal of this genus was exposed to view. The head was beset with long thick white hair, and the tusks, eleven feet eight inches in length, were curved backwards towards the eyes. The animal was in a kneeling position, the hinder part of the body being deeply buried in the snow, and in such an attitude as it would take if it had died while endeavoring to extricate itself from the bog. In its stomach was found bark and grass. These remains were distributed for miles over the plain, and were so abundant that it appeared as if a numerous herd had perished there. The place swarms with polar bears, which live upon the bodies.—*Geolog. Reichsanstalt, Vienna.*

Insurance on ships and merchandise was first made in A. D. 43.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year - - - - - - - - $3 00
One copy, six months - - - - - - - - 1 50
CLUB RATES { Ten copies, one year, each $2 50 — 25 00
Over ten copies, same rate, each — 2 50

VOL. XXVIII., No. 19. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, MAY 10, 1873.

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THE PHYSICAL CONDITION OF THE PLANETS.

While the savants of former centuries have, with the utmost minuteness, determined all the details of the motions of the bodies which constitute our planetary system, and definitely settled the astronomical aspect of the question, it was reserved for the astronomers of the present day, the latter half of the nineteenth century, to determine the particulars of their actual condition, and to settle the physical aspect of the question.

First of all, astronomy having long ago proved that our earth contains scarcely the four hundred thousandth part of the matter constituting our planetary system, and that she has a common origin with the rest of the same, the new science of geology proved that our earth had passed through a gradual cooling process, that many portions of her surface were to all intents and purposes equivalent to a burnt up cinder, while other portions of the surface had been disintegrated, washed, dissolved, precipitated, etc., by the long prolonged action of water. We are, as it were, driven to the conclusion that the history of the other members of our planetary system must be similar to that of our earth, that sooner or later they have gone or will go through the same phases of existence, and that the fate in store for our earth may be learned from the condition of those planetary bodies which are the furthest advanced in this slow cooling process.

The celebrated French naturalist Buffon was the first to make experiments in order to determine the period of time required for highly heated bodies of different size to cool off by radiation; he had very large iron balls cast of different sizes, exposed them freely to the air in order to cause them to cool down, and noticed carefully the difference in time required by the large as compared with the small ones. He thus found the law regulating the relation between the size of the ball and the time required for its cooling; and, applying this law directly to a ball of the size of our earth, in the supposition that it was once white or red hot, he found the lapse of millions upon millions of years necessary for her cooling down to the present temperature. His experiments were more recently verified by Bischoff in Germany, who had balls cast of certain furnace slags similar to basalt; some of these balls were of colossal size. He came to similar conclusions, supporting the evidences of the geologists in regard to the immensity of the period of time required for the past history of our planet. This consideration alone makes the now almost antiquated idea, that the planets are all inhabitable at the present period of their existence, if not untenable at least very doubtful. The planets are of very different sizes; they therefore require different periods of time for cooling down, and as they originated from the same nebulous mass of matter, and had after its first condensation, by gravitation (not by cooling), nearly the same temperature, they must now have reached very different conditions of heat, which vary according to their sizes.

Let us now see what the combination of the modern spectroscope, photometer, and telescope reveals to us in this respect, and whether these conclusions are confirmed by the most scrutinous observations of the present day. Fortunately one of the smallest bodies of the planetary system, and therefore one of those which must have cooled the soonest, is the nearest to us, our moon. Observations point to the undeniable fact that, in the moon, all effects of its own heat have utterly ceased, that the whole satellite is cooled down to a low temperature, scarcely reached on earth by the tops of the Himalayas and Andes; that all former volcanic action, of which she bears strong evidences, has utterly ended, and that all water ever possessed by her has long ago been absorbed by her lavas and rocks as water of hydration; while no trace of an atmosphere can be discovered, so that we even do not know whether she ever had one.

The next body of which we have some definite knowledge is the planet Mars. Although he is at several hundred times greater distance from us than the moon, we can observe his atmosphere, clouds, and changes of seasons in his two hemispheres, by the periodical increase and decrease of the ice belt around his poles. In fact, there is no heavenly body in which the conditions are so similar to those of our earth at the present time; but the planet is much smaller than our earth, and is further from the warming influence of the sun; therefore the probability is that he is farther advanced in the cooling process, and this is confirmed by the closest modern observations. Clouds and water are much more scarce there than on our earth, and the fate awaiting us, of drying up of vegetation by want of sufficient water, has commenced to be realized there on a large scale, as on our earth it is realized over limited surfaces, such as the Asiatic and African deserts.

In order to understand the reason of this continual diminution of the amount of water on a planet, we have only to consider that after every volcanic eruption, by the hydration of the cooled lavas, a certain amount of liquid water is withdrawn from the general provision and solidified in the rock, and that the liquid interior of our earth contains enough of this material to absorb many times all the water of our oceans; as these extend down to scarcely the one thousandth part of the earth's diameter, while only a comparatively thin solid crust covers the hot interior. These two bodies, the moon and Mars, are thus ahead of the earth in history, while the other members of the system are behind. Jupiter, by reason of his immense size, 1,000 times that of the earth, is not yet cooled below the red heat, and is surrounded by an atmosphere of superheated steam, as we mentioned on a former occasion; Venus by its neighborhood to the sun, being nearly of the same size as our earth, is in very much the same condition as Jupiter, only cooled down a little further, and on the eve of becoming fit for vegetable and animal life. Of Mercury, still nearer to the sun, we know nothing, but the probability is that he is hotter than Venus. The satellites of Jupiter have been proved to be darker than the planet itself, emitting no light of their own, as the planet does, and may therefore rejoice in the existence of life, if the other complex conditions of proper atmosphere, water, etc., are favorable; but this is improbable, as the main planets appear to appropriate the atmosphere of their satellites. In regard to Saturn, it appears that this planet is very much in the same condition as Jupiter, only, on account of its somewhat small disk and greater distance from the sun, its cooling has progressed further, as evidenced by observations. Uranus and Neptune are too far off for us to found any conclusions or observations; while of the moons of all these planets we know nothing, and it is reserved for future astronomers to come to any positive conclusions in regard to their conditions.

On the whole, we must recognize that, in all the discussions in defense of the plurality of inhabited worlds, two elements have been overlooked, time and space. The first is eternal, the latter infinite; and if even only one inhabitable world exists at a time, and if each of their great number has its turn to become the scene of life, eternity is long enough to give such an opportunity to every world in the infinite universe.

THE FLY WHEEL.---EXACT FORMULAS BY WHICH TO PROPORTION IT.

A correspondent wrote recently, asking us to quote known authorities upon the subject of proportioning fly wheels, and the desired information was given in the SCIENTIFIC AMERICAN, current volume, page 177. The best set of complete formulas for exact determinations that we have yet seen has since been given in the London *Engineering*, in the course of a series of articles written in the prosecution of the feud which has so long existed between that able journal and its elder contemporary, the *Engineer*. We extract the following, omitting the mathematical disquisition, of which the formulas are a part, as out of place in our columns:

The accumulated work in a fly wheel rim, moving at a known velocity, is the amount of work which was necessarily expended upon it to give it its motion, and the amount which it must itself do before it can come to rest. This is equal to $W=\frac{N^2wb(R^4-R'^4)}{3738}$, or $=\frac{N^2WbR^4}{3738}$, for the two cases, first where the revolving body is a disk, like a grindstone, or, second, where it is a rim like that of a fly wheel. These equations may be expressed by the following rule: Multiply the square of the number of revolutions per minute, by the weight of material per cubic foot, by the thickness of the disk or rim in feet, and by the quantity obtained by subtracting the fourth power of the inner radius of the wheel rim from the same power of the outside radius in feet (in the disk by the fourth power of the outside radius, since the inner radius is zero), and dividing the whole product by 3738. The result is in foot pounds, that is, it represents the product of any resistance, or driving force, in pounds by the distance through which it must act to do an amount of work equal to that accumulated in the wheel. Thus, for a grindstone 6 feet in diameter, $1\frac{1}{2}$ feet thick, and weighing 144 lbs. per cubic foot, we get $120^2 \times 144 \times 1{\cdot}2 \times 3 \div 3738 = 53912$ foot pounds.

An iron fly wheel rim, similarly, would require, to stop it, if making 20 revolutions, having a diameter of 20 feet outside, 18 feet inside, and rim 6 inches thick, the weight of metal being, say, 444 lbs. per cubic foot:

$W = 20^2 \times 444 \times \frac{1}{2} \times (10^4 - 9^4) \div 3738$, more than 80,000 foot pounds, and this, if expended by stopping the wheel in one minute, would yield a mean of two and a half horse power.

The stress on the rim of a cast iron fly wheel is given by $S=\frac{RN^2r^2}{952}$, or the rule: Multiply the section of the rim, in square inches, by the square of the number of revolutions and by the square of the mean radius of the rim, and divide the product of 952. Thus, a wheel having a section of rim = 72 square inches, a mean radius of $9\frac{1}{2}$ feet, and making 20 revolutions per minute, would have a strain upon its cross section of $72 \times 20^2 \times 9\frac{1}{2}^2 \div 952 = 2730$ lbs., which would tend to tear the rim apart.

The weight of a wheel of cast iron weighing 444 pounds per cubic foot = 38·75rR, = the product of the mean radius by the cross section and by 38·75. The weight assumed is equivalent to a specific gravity of 7·1, which is a fair figure for ordinary cast iron.

These formulas and rules, together with those already given in the earlier numbers of this paper, will afford our readers the information necessary to correctly proportion the fly wheel in any case that is likely to present itself, and to determine the power and weight of one already constructed.

THE NEW OCEAN TELEGRAPH CABLE.

The British steamer Kangaroo has arrived at New York with the shore portion of the new telegraph cable which is to be laid this summer between England and the United States, *vid* Nova Scotia. The cable is to be landed here on the south side of Long Island near Rockaway beach. The Great Eastern, with the ocean part of the cable on board, is expected to arrive here soon.

The French cable recently broke, and communication was suspended. It will be a serious job to fish up and repair the wire. The break is supposed to be at a joint 230 miles out from the French coast. All business is now done over the Atlantic or Newfoundland cable, and such is the pressure of work on the line, that the rates have been advanced to $1.50 per word.

ANOTHER PHASE OF THE VIENNA EXPOSITION.

It is a source of national regret that the information which has reached the State Department, relative to irregularities alleged to have been committed by some of the commissioners to the Vienna Exposition, appointed under the act of 1872, has been considered as based on sufficient proof to warrant the investigating committee in Vienna, Minister Jay and Mr. McElrath, in advising the suspension of these officials, pending further examination, and also the appointment of a temporary commission in their stead. The exact nature of the charges is not yet made public, but it is hinted that permits for restaurants, saloons, etc., have been sold. The recommendation has, however, been approved by the President, and the necessary orders were recently forwarded by cable, placing Messrs. L. B. Cannon, Jackson S. Schultz, W. H. Aspinwall, S. C. Ward, W. T. Blodgett, and others in office until permanent appointments can be made.

The suspensions, it is understood, are not to be taken as an opinion pronounced against any particular person suspended, and therefore any of the original commissioners may be recommended for re-appointment; nor does the measure affect the skilled artisans, scientific or honorary commissioners, holding office under the act of 1873, whose appointments were made subsequent to the irregularities under investigation.

THE GEOGRAPHICAL WORK OF THE WORLD IN 1872.

Chief Justice C. P. Daly recently delivered before the American Geographical Society, of which he is the president, a very able and elaborate address on the progress of geographical knowledge during 1872, giving a full account of the labors of the various surveys and exploring expeditions, and explaining the work accomplished up to the beginning of the present year. After alluding to the physical events, of a geographical character, which have been especially marked: including earthquakes, atmospheric disturbances and similar phenomena: the subject of American explorations and surveys was first considered.

THE VOYAGE OF THE HASSLER

lasted nine months. The chief scientific results have been the observation by Professor Agassiz of the evidence of post glacial action on the coast of South America: both on the Atlantic and Pacific sides, below the thirty-seventh parallel of south latitude, with the detection of existing glaciers in the straits of Magellan and on the coast of Chili: and an immense zoological collection embracing 100,000 specimens, the fish in which alone amount to 30,000. The conclusion drawn by Professor Agassiz, from what he saw, was that during the glacial period both hemispheres must have each been capped with an enormous sheet of ice, one moving northwardly from the Antarctic and the other southwardly from the Arctic, toward the equator. Ice, he considers, has been the great machine by which the rocky surfaces of the globe have been fashioned.

PROFESSOR HAYDEN'S EXPLORATIONS, IN UTAH, IDAHO AND MONTANA

were principally devoted to examination of the valleys of the Yellow Stone, Madison and Gallatin rivers, a tract of 3,575 square miles which has been set apart as a grand national park. The event of the season was the ascent of the Grand Teton, 13,762 feet above the sea, the summit of which no white man had ever before reached. A rude enclosure was found there, evidently designed as a protection against wind and probably hundreds of years old. On Lake Shoshonie a new geyser basin was discovered, containing over one hun

dred springs. All this wonderful region was carefully surveyed and mapped.

EXPLORATIONS IN THE ALEUTIAN ISLANDS

have been carried on by Mr. W. H. Dall. He has discovered in these islands the remains of a people antecedent to the race which now inhabits them. Around the sites of ancient villages, he found burial caves in which the dead bodies had been placed soas to indicate their ordinary occupations: men in canoes, as in the act of rowing, women dressing skins, holding children, etc.

THE DARIEN EXPEDITION

was dispatched for the second time in the winter of 1871, under Commander T. O. Selfridge, U. S. N., to explore the route by the Atrato and Tuyra rivers, which was done, and found impracticable. Another route was, however, surveyed from the Pacific to the Atrato, which appeared so favorable that at the close of last year Commander Selfridge was sent back to complete the work. If a canal by this route is practicable, its construction will shorten the voyage from New York to Hong Kong for sailing vessels from 110 to 83 days. There is also an expedition for a survey across Nicaragua at work at the present time.

THE AMERICAN PALESTINE EXPLORING EXPEDITION

is in charge of Lieutenant E. Z. Sleever, U. S. Engineer Corps, who, with three associates and a number of natives, will explore the country east of the river Jordan and in the northern part of Syria. Besides the labors above described, the geographical work accomplished in 1872, and in progress, in this country, comprises the continuation of the survey of the 40th parallel, explorations west of the 100th meridian, a reconnoissance of the basin of the Yellow Stone river, explorations of the Colorado river, surveys for the building of the Northern Pacific Railroad, and some others principally devoted to cartographical objects. The various

ARCTIC EXPLORATIONS

and their present condition, we have recently referred to at length. The Swedish expedition wintered in Mossell Bay, Greenland, and during the coming summer will endeavor to reach the pole by sledges. Another party sailed from Sweden, during the year, to establish a colony on the southwest coast of Spitzbergen, for the obtaining of phosphates for artificial manure. Count Wilczek, of the Austrian expedition, returned home in November. The Tegethoff, the remaining vessel of the fleet, intended to penetrate the sea east of Nova Zembla. Nothing has been heard from the Polaris since August 5, 1871. Captain Hall was then in latitude 73° 21′ north, longitude 56° 5′ W., and all were well. He sailed for Smith Sound, following the route of Kane and Hayes. An interesting relic has been found by the master of a small Swedish sloop, who succeeded in passing the north east point of Nova Zembla. It was the hut left by Barentz, the Dutch navigator, 276 years ago, and which has since never been entered by man. The sleeping berths, halberds, muskets, and clock upon the wall, were untouched, and among the books was found a description of China, the country the explorers hoped to reach by the north east passage. The remains were purchased by the Dutch government.

GENERAL GEOGRAPHICAL LABORS.

Government surveys are in progress connected with the publication of maps of various European countries. The Challenger has been fitted out by the British government to examine the great ocean basins of the world. A group of islands in the South Pacific known as the New Hebrides have been explored and other investigations have been made of general scientific value. Among the

ARCHÆOLOGICAL DISCOVERIES

of the year is that of lake dwellings or lacustrine villages of the prehistoric inhabitants of Europe at Bienne in Switzerland and elsewhere, the finding of a skeleton of a man at Mentone in France, which is supposed to be of great antiquity, and the exploration of pit dwellings in England. In the United States, the ruins of what was once a populous city, covering an area of 3 square miles, have been found in Arizona. The entire space within the enclosing wall of sandstone had been covered with houses, built of solid sandstone without mortar. The ruins consisted entirely of stone, not a stick of wood being visible. On the N. W. coast of Asia Dr. Schlieman claims to have found the remains of ancient Troy. His excavations have led him through ruins of successive settlements, at the lowest of which were structures built of massive stones. A wall of huge stones joined together with clay, and the ruins of a solid tower of masonry forty feet thick, built upon the primitive rock, were found. General Di Cesnola's Phœnician antiquities we have already fully described; they are at present being arranged in a suitable museum in this city. The principal

ASIATIC EXPLORATIONS

have been made by English engineers in Persia, for the location of telegraph lines. The Russian government has had under consideration a canal connecting the Black and Caspian seas, which, although only about six miles in length, will require the labor of 32,000 men for six years. Surveys are being made for a railroad from Scutari, on the Bosphorus, to Shikapore, in India, and another line is proposed from Moscow to Pekin. In

AFRICA,

the results of the year have been the rescue of Dr. Livingstone by the *Herald* reporter, Stanley, and the knowledge of the explorations of Dr. Schweinfurth, in the regions west of Khartoum and to within 3½ degrees of the equator. The latter traveller has found a race of pigmies, or dwarfs, supposed to be the same described by Herodotus. M. Alfred Grandidier has devoted his labors to Madagascar, and has fixed the latitude of 188 points, and examined the coast line for 1,250 miles. Karl Mauch, the discoverer of the gold fields in 1871, has found a ruined city on the east coast of Africa, containing massive stone structures of great antiquity. He thinks the spot to be the famous Ophir so long sought for, to which Solomon sent for gold and precious stones. Sir Samuel Baker left Gondokoro in 1871, since which time no authentic news has been received from him. Sir Bartle Frere has arrived at Zanzibar, and communicated with the Sultan, relative to the suppression of the slave trade, and two English expeditions have been despatched to coöperate with Dr. Livingstone.

THE PROBLEM OF THE COMING TRANSITS.

In resuming the consideration of this subject, commenced in our last week's issue, we must remember that, as photography was an undiscovered art at the time of the last transits, it could not of course be made use of. The same results were aimed at by the method proposed by the great astronomer Halley. According to this method, the observer, instead of attempting the hopeless task of determining the planet's exact position on the sun's disk at any moment, merely notes the duration of her transit, which is necessarily different for different stations. Having the exact time occupied by the planet in traversing her chord of transit, the length of the chord can be calculated, and consequently its distance from the sun's center. A comparison of two chords obtained from the observations made at two stations suffices to show, as in the photographs, the planet's displacement for the two stations; the distance between the stations being known, the planet's distances from the earth and from the sun follow as before. This method requires simply that each observer shall note the exact beginning and end of the transit as seen at his station, and that his clock shall measure the interval correctly; but as the planet appears as a comparatively broad disk on the sun's face, it is no easy matter to determine the precise instant when her center crosses the sun's edge at the beginning and end of the transit. To do this, the observer has to note with infinite precision the moment when the edge of the planet first touches the sun's rim, that is, her first external contact; next, the instant when the planet is just wholly immersed and the broken edge of the sun appears to close, that is, her first internal contact; and lastly, he must repeat both observations in reverse order when the planet leaves the sun's disk. The obstacles to the easy and exact observation of these phenomena are numerous and apparently insurmountable. To secure the requisite distance between the points of observation, it is necessary that one station be as far north, the other as far south, as possible; hence the sun cannot fail to be near the horizon, at which times the outline of his disk is greatly distorted. Atmospheric causes very frequently aggravate this difficulty by giving the sun's edge an uneven or rippled appearance. Then the planet, when just in contact with the sun's edge, always assumes a peculiar pear-shaped aspect which makes it all but impossible to fix the exact moment of contact, and this is a time when a fraction of a second is all-important.

There remains one more method, which can be described in few words. It is known as Delisle's, and is especially valuable in that it aims to determine the sun's distance in a manner entirely different from those thus far noticed, and is applicable at times and places altogether unfavorable to Halley's method. Again our ball and circle may help to make the matter more easily comprehensible. Suppose the camera to be placed as before and the ball be made to pass from left to right between the instruments and the screen at a uniform rate of motion. It is obvious that the ball will come in line between the edge of the circle and the left hand camera first. After an interval, depending on the ball's rate of motion and the distance between the points of view, the ball will come in line between the right hand camera and the edge of the circle. When it reaches the other side of the circle, the appearance will be reversed; that is, it will seem to the observer at the left hand camera to leave the circle sooner than to the one at the right. Let us confine our attention to the first case. If each observer notes the exact time when the ball appears to him to touch the rim of the circle, the difference —say four seconds—will measure the interval occupied by the ball in passing a certain distance. Now if that distance can be exactly calculated, the ball's rate of motion can be easily ascertained.

We know the distance between the cameras (12 inches). The position of the ball, relative to the cameras and the screen, is also known, since it divides the whole space into parts having to each other the ratio of two to five. Hence, by a simple geometrical principle, the space passed over by the ball, in the given interval, is to the distance between the cameras as five to seven; which gives 8½ inches. If the ball moves over 8½ inches in four seconds, its rate of motion must be 2½ inches a second.

In like manner the rate at which Venus moves in her orbit is calculated from the interval between two observations of the same phase of transit as seen from two stations. The time which the planet takes to make a complete circuit of her orbit is known; this time, multiplied by the planet's rate of motion, gives the circumference of her orbit in miles, whence its radius, or the distance of Venus from the sun, is easily found. The ratios of the planetary distances being known by Kepler's third law, the sun's distance from the earth or any other planet in miles follows by a simple proportion as soon as his exact distance from one is determined.

The advantages of this (Delisle's) method are many. Its disadvantages arise from the fact that the exact moment at which the planet's ingress or egress occurs must be known. Besides the obstacle to the nice determination of these phases, this method involves the further difficulty that the clocks made use of at each station must show absolutely true time at the moment of observation. And since, to determine the exact interval between different observations the local time at each station must be changed to some common standard, say Greenwich time, it is essential that the longitude of the stations be determined with especial accuracy. Halley's method, on the contrary, requires only a relatively rough determination of the observer's position, and a timekeeper which shall not vary appreciably in the course of four or five hours. Both methods, supplemented by photography, will be employed in the observation of the coming transits. The reasons which govern the choice of stations for each method are not within the scope of this article. The main point is that the stations shall be sufficiently numerous and carefully selected to give the minimum risk of the thwarting of all observation by foul weather.

SCIENTIFIC AND PRACTICAL INFORMATION.

HIPPOPHAGY IN PARIS.

There are forty stores in Paris devoted to the sale of horse meat as an article of food. During 1872, 9,725 horses, 866 asses, and 51 mules were consumed by the inhabitants. *Les Mondes* says that the animals are prepared for the market in the ordinary way, and that the meat sells for about half the price of beef. The horses are inspected at the slaughter house with the greatest care. It may be noted as an interesting fact that hippophagy is decidedly on the increase, as 2,408,076 pounds of equine meat were eaten in 1872 as against 1,113,024 in 1869.

ADULTERATION OF ULTRAMARINE.

Ultramarine may be adulterated with some finely ground white substance, like alabaster, gypsum or isinglass, by contriving to color the outside of the particles with ultramarine. This is accomplished, according to Dingler's *Polytechnisches Journal*, by sifting them together, then moistening the compound with a very fine sprinkler until it packs in the hand and no dry powder remains. It is left for 3 or 4 hours, then sifted, dried, etc., in such a manner that the blue still adheres to each white grain.

The adulteration can easily be detected by rubbing a little of it on a piece of paper with a knife, thus exposing the white surface of some of the grains, so that on comparing it with the original sample it has a lighter color.

PREPARATION OF PURE SULPHATE OF POTASSIUM.

Commercial sulphate of potassium usually contains a large amount of sulphate of sodium. To free it from this, on a large scale, E. Sonstadt proposes the following method: 664 parts of the salt is dissolved in boiling water and 149 parts of chloride of potassium added in small quantities. Thereupon pure sulphate of potassium immediately separates as a fine crystaline powder, and as the liquor cools a fresh quantity crystalizes out. The mother liquor may then be concentrated by evaporation, until saturated at the boiling temperature. It is then allowed to cool, and a crust of pure sulphate of potassium forms on top. The process may be repeated three or four times before the liquor is sufficiently concentrated for the chloride of sodium, formed by the mutual decomposition, to crystalize out. Common salt is also as soluble in cold water as in hot, which the sulphate of potassium is not, and a solution not saturated with the former when hot will not deposit it on cooling.

TOILET SOAPS BY THE COLD PROCESS.

There are two methods by which toilet soaps may be prepared; these are known as the hot and the cold processes. The fine English soaps are chiefly made by boiling, while most of the fancy soaps in this country are made by the cold method. When made by boiling, a weak caustic lye is used and the soap is boiled until it is almost perfectly free from alkali. The soap which is then in solution is separated from the water by "salting out;" the glycerin, of course, remains in the water and is lost. The cold process is briefly as follows: The fat is melted in a well cleaned iron or copper kettle at a low temperature, then filtered through fine linen or muslin into another kettle, and cooled to 101° Fah. or lower; a very strong lye, usually about 36° B. is added, 80 lbs. of fat requiring about 40 lbs. of lye. It is then stirred with a wooden paddle until a ring made by stirring may be recognized. At this time the coloring matter and perfumery are added. It is next run into frames lined with muslin, closed, and left for 12 hours, by which time saponification will have taken place, the temperature rising to over 175° Fah. It is now ready to be taken from the frame, cut, dried, and sold. Soaps made by this process are softer and pleasanter, because they contain the glycerin; but they are unfortunately always more or less alkaline, no matter how much care is bestowed upon their preparation. A Frenchman named Mialhe claims to have invented a method of neutralizing the free alkali and thus combining the advantages of both methods and making a perfectly neutral glycerin soap. This is accomplished by taking the ordinary soap prepared by the cold process, shaving it up fine, and spreading it out on grates in suitable chambers, where it is exposed to the action of carbonic acid gas until all the free soda is converted into the bicarbonate of soda. Thus a perfectly neutral soap is obtained, which contains all the glycerin present in the grease and a certain quantity of bicarbonate of soda.

THE railroad tunnel at Baltimore, which is to unite the roads on the north and south sides of the city, is to be completed before the end of June, and, until the completion of the Broadway Underground Railway in New York, will form the largest underground railroad possessed by any city in America.

GENERAL GEORGE S. GREEN, formerly Chief Engineer of the Croton Aqueduct, New York, has been appointed Chairman of the Engineer Commissioners who are to supervise the construction of the Broadway Underground Railway.

THE ORNAMENTAL USE OF METAL.

The custom of embellishing parks with statuary and other ornamental objects, arising with the Greeks, was never carried to so great an extent as in the famous pleasure grounds of Italy. In the neighborhood of Rome there still exist the celebrated villas of the Dorias and Di Medicis, while near Genoa the great Pallavicini gardens yet form the principal attraction of the city. It was in these grounds that the famous sculptors of the Middle Ages designed their choicest works, and even now, too weather worn and injured to meet places in the museums, a few antique vases and figures still stand in the same spots where centuries ago they were first placed.

It has been asserted that the art of sculpture, as now practiced, is but reproductive, and that the genius of the present age tends more toward the rejuvenation of ideas of the past than toward the development of original conceptions. The reason, perhaps, may be traced in the fact that the world is no longer content with a single embodiment of a grand or beautiful thought, but demands its infinite multiplication—calling upon modern invention for processes reiterative of ancient prototypes rather than for fresh creations of the imagination. The same figures of Flora, of Venus, of satyrs, dryads, and wood nymphs, which, buried in ancient foliage, decay in the villas or are admired by millions in the museums of Italy, are now trite and every day ornaments. We turn the cover of a work before us, and their familiar forms appear upon the initial sheet. Metal has replaced the stone, the molder's flask and the melting furnace have superseded the sculptor's mallet and chisel; and while the originals remain immured in the cities of Europe, their counterparts, by thousands, beautify the pleasure grounds of the New World.

Ornamental work in metal, as now carried on, is not however entirely reproductive. Our larger illustration represents an article of garden furniture of exquisite and entirely original design, which, for grace and beauty, will favorably compare with many similar works of ancient art. The vase in the smaller engraving is, it is true, copied, but from an object the fame of which is worldwide, the celebrated Warwick Vase, still existing in Warwick Castle, England. Filled with flowers and trailing plants, no more elegant ornament could be desired.

There is another thought suggested by these tasteful objects, and that is the great progress which is being made in adapting the metals, especially zinc and iron, to all kinds of ornamentation. The latter is becoming more and more employed for architectural decoration to the exclusion of stone; the former, in the hands of a skillful artist, is capable of the most finished and expressive treatment. For counterfeiting the fine lines of statuary, and more especially floral subjects, it is excellently suited, as the thin petals and leaves of plants can be worked out in it, in all their infinite variety. As a material for out-door exhibition, in connection with iron, it is superior to either stone or terra cotta, being neither as expensive as the one nor as easily injured as the other. A coat of paint protects it from the effects of the weather, and insures its durability while giving it the appearance of the marble or other material it is intended to represent.

We select the accompanying engravings from a number of beautiful designs of various objects of art and ornamentation in the catalogue of the J. L. Mott Iron Works, No. 90 Beekman street, in this city, one of the largest establishments devoted to the specialty of ornamental work in the United States.

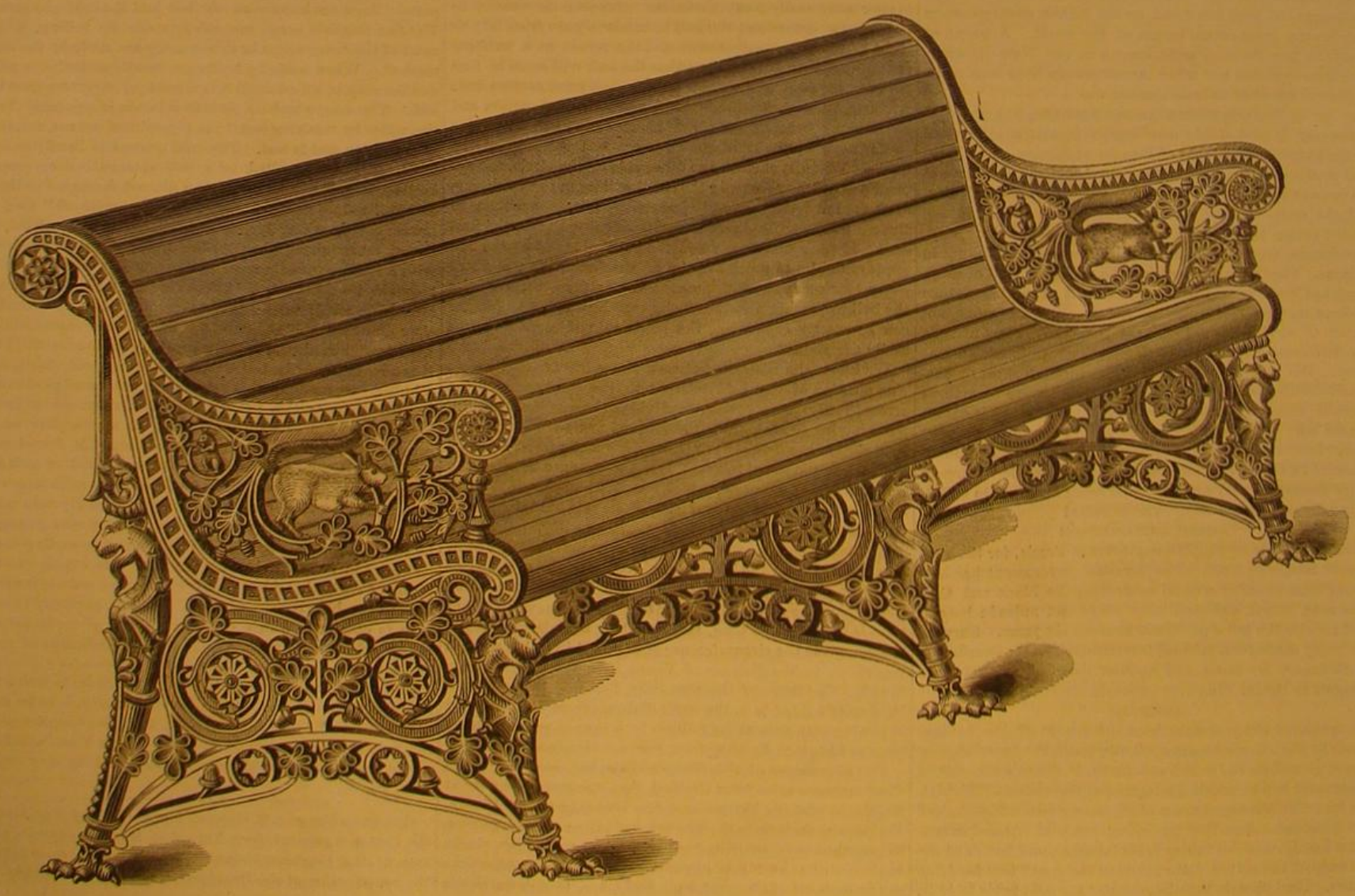


THE WARWICK VASE, REPRODUCED IN IRON.

Glue Making.

According to Yardley's process, the bones are put into an apparatus in the shape of a hollow globe, and made of wrought iron (copper cannot be used because the gelatin has a very powerful action upon it). The first process is to cleanse the bones by immersing them in a pit or cistern of water, where they remain about twelve hours; the water is then drawn off and fresh water added to them; this operation is sometimes repeated to remove any dirt, etc. The water being withdrawn from the bones, a solution of lime, in the proportion of one bushel of lime to 500 gallons of water, is to be poured into the cistern for the more perfect cleansing of the bones and the removal of any superfluous matter. After three or four days' saturation, the lime solution should be drawn off and fresh water added, to get rid of the lime. Thus prepared, the bones are placed in the globular vessel called the extractor, which is filled with them by removing the interior plate which covers the manhole; this aperture is of an elliptical form, and allows the plate to be slipped round and refixed in its place by turning a nut which draws it up tight against the interior surface of the extractor, and the junctures are made air-tight by luting. The extractor turns upon a horizontal cylindrical shaft; one half of this shaft is made hollow, or consists of a strong tube, which tube also proceeds downward towards the center of the vessel to conduct the steam beneath the grating upon which the bones are laid. The steam, of about 15 pounds pressure, is admitted by the cylindrical shaft, proceeds first to the bottom of the extractor, then rises up through the grating and among the bones, until the vessel is completely charged; previously to this, however, the air in the extractor is got rid of by opening a cock at the top of the extractor, and closing it after the admission of steam. While the steam is acting upon the bones, the extractor is occasionally turned round by means of a hand winch. When at rest, a quantity of fluid gelatin is collected at the bottom of the extractor, whence it is discharged by means of a cock into a tub beneath, after opening the air cock to allow it to run off. This done, steam is again admitted from the boiler into the extractor to act upon the bones for another hour, when the second portion of condensed liquor is drawn off. When the products thus obtained have become cold, the fat which has formed upon the surface is to be carefully removed by skimming, and the gelatinous portion only is to be returned to the extractor by means of a funnel through the cock on the top. The steam is then admitted to the extractor for another hour, after which it is finally drawn off into another vessel to undergo a simple evaporating process until it arrives at a proper consistency to solidify when cold, previous to which some alum is added to clarify it. When cold, this gelatinous mass is cut into square cakes and dried as usual in the open air.

THE Commissioner of Patents, Canada, has presented to Parliament a bill for the further amendment of the Canadian patent laws. The amendment simplifies the preparation of the application, and does away with a great deal of the red tape proceedings now required. The design is to assimilate both the proceedings in preparation of papers, and the procedure before the Patent Office to those of the United States.



NEW IRON GARDEN SETTEE.

STEVENS INSTITUTE LECTURES.---MOONLIGHT AND ITS SOURCE.

BY PRESIDENT HENRY MORTON.

The moon shines, as is well known, by reflected light; and a consideration of the nature of reflected light will therefore be a profitable introduction to the study of the moon itself. When a pebble is dropped in the smooth water surface of a pond, circular ripples or waves will be formed, constantly expanding as they recede from the center of disturbance. In like manner, a source of light produces a disturbance in the ether pervading all space, thereby throwing it into ripples or waves, which differ from the former only in being spherical instead of being confined to a flat surface. When one of these advancing waves of light strikes against an obstacle, it will be thrown back as an india rubber ball would be when thrown against a wall, returning with the same force with which it struck, because the impinging ether is perfectly elastic.

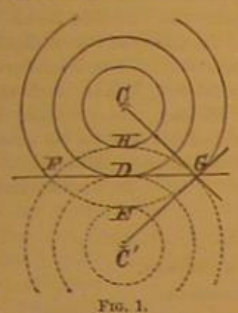
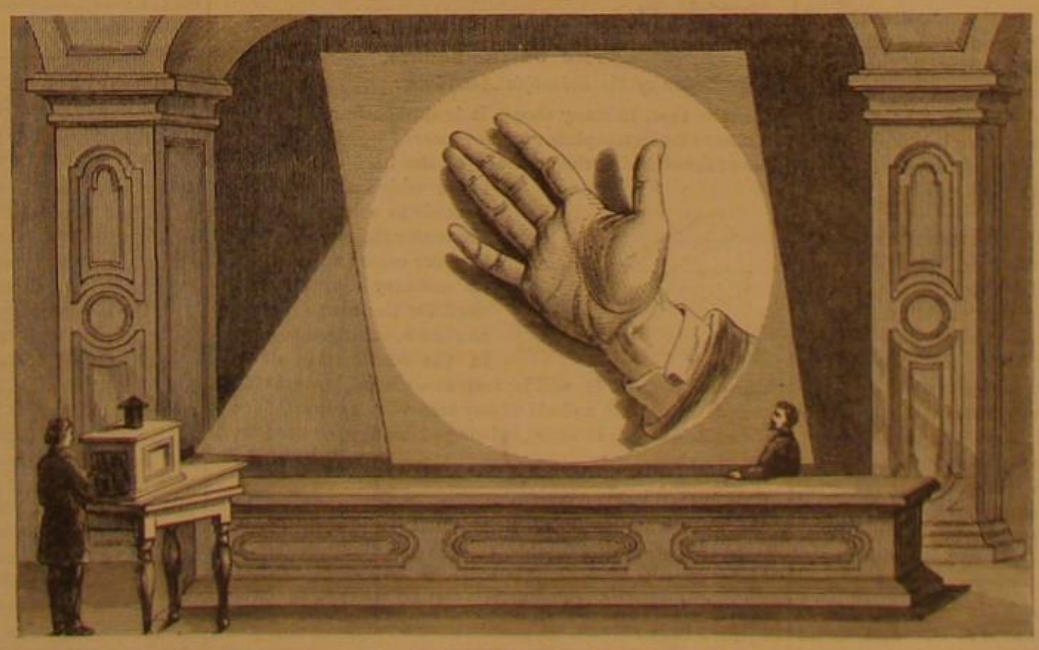


FIG. 1.

In the accompanying figure are seen a series of waves proceeding from the center, C. One of them has arrived at an obstacle, D, but for which it would have reached E, as shown by the dotted lines, F,'E, G; as it is, however, the wave is thrown back with the force with which it struck, evidently describing the curve, F, H, G, just as far above the obstacle as the unobstructed wave would have gone below it. The other waves would be reflected in the same manner and give rise to a series of curves having a center at C', as far below D as C is above it. When speaking of reflection, it has been cnstomary to explain the phenomena by using the term "rays;" but it must be remembered that these only represent the direction in which waves proceed, and not the manner of their propagation. If a line joining C and G represent the direction of the wave striking at the latter point, the direction of the reflected ray will be indicated by a line joining C' and G, thus furnishing an easy proof of the law that the "angle of reflection is equal to the angle of incidence."

After the above new explanation of the familiar law, the lecturer exhibited the reflection of waves upon the screen, by means of a beautiful piece of apparatus. The light of an oxycalcium burner was reflected by means of an inclined mirror through a flat horizontal glass tank filled with water. By means of puffs of air, waves were produced upon the center of the water surface, and these were reflected upon the screen by a large inclined mirror above the tank. The sides of the latter were made to slope considerably outward, so as to avoid reflection from them; and the audience was thus enabled to verify what had been stated about the propagation of waves. A glass plate held in the water on the side of the tank reflected back the waves of water, in circles having very much the appearance of those in Fig. 1.

After dwelling briefly upon the well known laws of reflection, and exhibiting in illustration some of those beautiful Yo Semite views where the eye strives in vain to discover which is the landscape and which the reflection in the river, the lecturer described how objects thus reflecting light become of themselves secondary sources of illumination. A number of objects, lighted up by the lime light and thrown upon the screen by means of a lens, appeared in bold relief and startling proportions. The engraving herewith, representing the professor's hand, will give some idea of the effect.


FIG. 2.—ILLUMINATION BY RADIATION.

It is in this manner that the moon receives its light from the sun and becomes in turn a source of illumination to us

Passing thence to the consideration of the moon itself, photographs representing its different phases were exhibited. These, the lecturer stated, made by Mr. Rutherfurd and Dr. Draper, were productions of which America might be justly proud, as nothing had ever been produced in other countries that would bear comparison with them. The topography of the moon has been accurately studied and the different portions of her surface have received names, some of them poetical. Thus we have the Sea of Nectar, the Sea of Storms, the Frozen Sea, the Lake of Sleep, the Lake of Death, the Misty Marsh, the Meadow of Dreams; the mountains have been named after distinguished men. Some of the most important are Tycho Brahe, Ptolemy, Herschel, Archimedes, Copernicus, etc. The different regions containing these various parts were separately discussed. It seems that the moon is composed of burnt out craters of immense volcanoes, some of them a hundred miles across the top, and that there is no vestige of water or atmosphere about it. Consequently the stars will be visible thence, even when the full blaze of the sun is upon it, during its day of fourteen terrestrial days, because there is no diffusion of light. It is the presence of our atmosphere that prevents us from seeing the stars in daytime. The manner of measuring the hight of lunar mountains is by observing their shadows at different times of day. They are carefully measured by means of the micrometer; and from their length and the accurately determined relative position of sun and moon at the time, the astronomer is enabled to calculate the hight of the mountains. Different views taken from paintings by Mr. James Hamilton, an artist of note, of what must be the appearance of portions of the moon by earth-light and by daylight were then exhibited. They gave an excellent idea of what is believed to be the condition of the moon's surface. All we know of the moon is of one side only; for she never turns the other towards us. Professor Janssen accounts for this fact by supposing that the greater part of the mass of the moon lies on the side away from us, and that our side is comparatively light and frothy, thus giving it an eccentricity which would prevent the other side from ever turning towards us. If there existed any water or air on the moon, it would, according to this hypothesis, be drawn away from our side towards the opposite one.

It has been advanced as a theory that the moon has passed through the different stages which geology teaches us took place on the earth; that finally, by cooling off, all the air and water have been absorbed and that she is now a dead planet, devoid alike of animal and vegetable life, burnt out and frozen. This is represented to be the ultimate destiny of our earth and of all the planets, though millions and millions of years may be required to accomplish it. The earth, we suppose, has partially cooled from a liquid, molten mass, and the greater part of her interior is still in that state. Afterwards she was covered by immense glaciers, which have left their imprints upon the rocks all over her surface. These stages of development can be seen now going on simultaneously in the other planets. Jupiter being greatest in bulk and consequently requiring a longer time to cool, according to the hypothesis, has not yet arrived at our stage. Observations by Professor Mayer and others demonstrate that it has for some time been undergoing changes and sending out more light than it received from the sun; while Mars has passed our stage and exhibits the phenomena of huge snowstorms and evidences of an Arctic period. Maps of the two planets, showing their characteristics, were produced upon the screen in this connection. According to this bold hypothesis, the moon represents the very remote future of the planet on which we live, a time when it will be no longer a fit habitation for man.

THE WONDERS OF THE EGG.---SECOND LECTURE.

The following lecture was recently delivered by Professor Agassiz, before the Museum of Comparative Zōology, at Cambridge, Mass.:

I closed my last lecture with the remark that before approaching the question of origin it was indispensable to be familiar with the conditions under which organized beings were multiplied. It is a feature which is too frequently neglected in any discussion of this kind. I propose to bring before you, as plainly and methodically as I can, the conditions accompanying the maintenance of animal life upon the earth. Do you realize that all the living beings which surround us, however great their diversity, have a short time since been eggs; that there is not a human being, nor a quadruped, nor a bird, nor a reptile, nor a fish, which has not been an ovarian egg; that generation after generation these ovarian eggs bring forth new beings like those from which they were produced, and that this is an indispensable condition for the very existence of all the life with which we are familiar? But this is not all. Besides the individuals capable of producing eggs, there must be a corresponding set of individuals from whom the egg receives an impulse, leading to the formation of the new being within it; in other words, the egg must be started by an influence from without, that is, by contact with sperm cells, into those successive changes or transformations by which the new being is produced. This is true of all beings not provided with the power of reproduction by budding or self-division; although, as I said in my last lecture, there are occasional exceptions to the rule, as among bees and certain moths and butterflies, known to produce living beings by means of non-fecundated eggs. We have many animals among the lower organisms, and especially in the class of radiates, that combine the three modes of reproduction: multiply by eggs, buds, and self division at various times. Others propagate by the two first processes alone, without the last. Among the higher animals propagation by eggs is the only method known. Neither mammal, bird, reptile, nor fish multiplies its kind in any other way. All eggs arise in what are called ovaries. These are clusters of cells, forming bunches of a somewhat glandular character in appearance. Between these cells the eggs are formed and in such a way as at first to be hardly distinguished from the cells themselves. The same is true of sperm cells, which arise in organs of the same character as the ovary, and are formed in a manner perfectly similar to that of the formation of the egg. So we have these two spheres of growth which characterize sex in the animal kingdom, arising in conditions so very similar that the essence of the two is hardly to be determined by observation. It is only by the process of growth, by the influences produced by the one upon the other, and by the consequences of these influences, that we recognize the essential difference which distinguishes them.

In order fully to appreciate what eggs are, we must remember—what has been known for about a half a century only—that all organized bodies are composed of little bags which are called cells, and which are formed and multiplied in various ways. Most of these cells are so small that they can only be perceived by the aid of high magnifying powers. There are, it is true, a few cell structures large enough to be seen with the naked eye, as for instance, the cells of common elder pith, or the coarse cells of the orange. It is one of the great problems of modern research to ascertain how these cells are formed and what is their mode of reproduction. For it does not seem that cells are formed in the same way under all circumstances. Some naturalists assume that in the animal substance secreted by a living body, such as milk, which is secreted by the mammary glands or similar substances secreted by other organs, certain particles become centers of action, around which other particles crowd; and when a little collection of this kind, microscopically small, has been formed, an envelope arises around it, and we have the utricle or cell. Others believe that minute, imperceptible particles of animal substance swell and enlarge, and become hollow, so that a little bag is formed, a cell envelope in short, which fills as it enlarges into a fluid substance.

As yet we know but imperfectly what cells are; still more imperfectly do we know how they are formed, and still less do we understand their function. Yet the amount of facts already ascertained respecting them is truly overwhelming. This much, however, may be positively stated: between ovarian eggs in their earliest condition and cells in their elementary state, such as constitute the substance of all animal bodies, there is no essential difference.

THE EGG OF THE MAMMALIA.

Let us now consider the ovarian egg as we know it in mammalia, and then proceed to compare it with the ovarian egg as far as is known in other classes of vertebrates. When it has acquired its ultimate growth, prior to the formation of the germ, the egg of the mammalia presents a bag the walls of which are exceedingly transparent. This bag is filled with a substance which is itself transparent, and yet which appears, under a very high magnifying power, to be granular, as if dotted with particles floating in the fluid. In that outer bag is another diminutive bag containing also a transparent fluid. This inner bag occupies an eccentric position with reference to the periphery of the outer bag, and in it are contained one or several dots. These parts of the mature egg have received names. The outer envelope is called the vitelline membrane, because it has been ascertained by comparison that it corresponds exactly to the exceedingly thin skin inclosing the yolk in the hen's egg. A yolk is called the vitellus, and hence the name. The bag contains the yolk; and however transparent this fluid may be, it retains the name of yolk. To the naturalist the word yolk no longer designates that peculiar substance contained in the bird's egg of a yellowish color. The yolk may be any substance which is contained in the outer envelope of the egg. The inner bag is called the germinative vesicle. That name was given to it under the impression that from it the germ arises. The name has been retained, though I wish at the outset that you should free yourself from the idea that it has any special connection with the formation of the new being. The dot or dots within the germinative vesicle are ordinarily called the germinative dots. From their discoverers these parts have also had some other name applied to them. It was Professor Purkinje, of Breslau, who discovered the germinative vesicle, and in his honor some physiologists call it the Purkinjen membrane or vesicle. Professor Wagner of Göttingen discovered the presence of the dot in the germinative vesicle, and in his honor it is occasionally called the Wagnerian dot or dots.

The dimensions of such a mammalian egg are very small. It comes just within the range of the power of the human eye. Practiced embryologists may detect, without the use of the lens, an ovarian egg in its organ when it has reached

maturity. Owing to the difference in the power of human vision, some observers will easily detect the egg in its natural position in the ovary with the naked eye, while others are unable to see it except by the aid of the magnifier. Place the ovary under the microscope and you will find that it contains eggs of various dimensions in various stages of growth. In some the amount of yolk is less than in others; in some the germinative dot exists; in others it is not formed; indeed vesicles are found in the ovary in which neither germinative dot nor germinative vesicle exists, and which are supposed to be eggs in process of formation.

Correspondence.

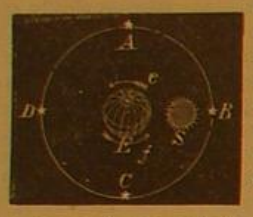
The Retrograde or Direct Motion of the Sun.

To the Editor of the Scientific American:

In your issue of March 12, a scientific friend, C. H. B., has very kindly tried to set me right in relation to precession; he thinks that I am "wrong in some of his [my] views." Well, may be I am; I will not assert that I am absolutely right; but I have the strongest kind of evidence to show that I am right, namely, proof, and I am satisfied that C. H. B. and many others of your readers will be astonished to see it, if you will allow me to present the same to them.

C. H. B. says that "the retrograde motion of the equinoxes is real, and does not necessarily involve the idea of a direct or other motion of the sun," etc. By this language I understand him to mean that the earth makes a gyratory wabble, retrogressively, as Newton said, and as all Newtonians assert, and that it is independent to solar movement altogether.

Now let us test the truth of this by diagram, and we will soon find out who is in error. E is the earth; S, the sun; A B C and D, stars in the ecliptic, or in a circle surrounding the pole of the ecliptic, and at all points 23½° from it. E is understood to be rotating always at a regular rate, in the direction of the arrows. Consequently, in rotating, it will take the same time exactly to turn round from S and come to S again that it will require to turn from A B C or D and return to it again. The pole of E is now inclined to A, but must be understood as gradually leaving it and traveling towards B, passing it and moving to C, and so on, until it comes to A again in 25,868 years.



Now the first lesson we learn from this diagram is that the Newton notion of the earth making a retrograde gyratory wabble is not true; for, when we suppose that the pole of E, now laying towards A, gradually moves retrogressively and comes to B, we find that solar and sidereal time would both be the same. Why? Because it would take the same time, as we have already said, for E to turn from S and return, as it would to turn from any of the stars marked A B, etc., and return to them. If the earth was really making any such independent revolution, there would be a recession of the equinoxes, it is true; but where would be the difference between solar and sidereal time? Could there be (if S remained where it now is) one single moment's difference in ten thousand years, aye, or in ten thousand recessionary revolutions? This simple little trifle, to wit, no difference between solar and sidereal time, kills the Newtonian notion entirely; for Nature yields a difference annually of 20 minutes and about 23 seconds.

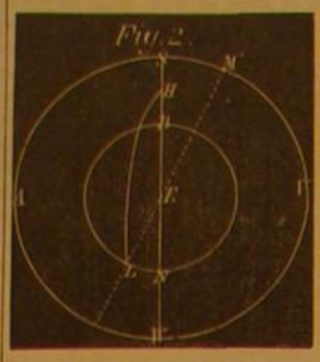
Further, suppose S to continually move in the direction of B, and E to swing her poles round in the direction of A B C D in 25,868 years. In every revolution E made from A to A, a recession of the equinoxes, and, of course, of the four seasons of the year, would result. But, in all that time, and with such direct solar motion, not a single minute's difference in solar as compared with sidereal time would result. Is not that plain? Is not that a fact? Where is Newton's notion now?

Again, suppose S were to pursue a path towards *e*, and E to keep swinging her poles and rotating on her axis, as we have supposed. Would not solar time, then, be longer than sidereal time? Would not B be in the meridian before *e* could? And would not the increase of solar time depend upon the rate of advance of S to *e*? These facts are so manifestly true that none who study the subject enough to understand it would attempt to deny any one of them. Such a result is not the result of Nature; therefore we know that the direct motion of the sun, which popular astronomy so universally claims to be true, is not true, and never was. What say you to that, popular astronomy?

Again, and lastly: Suppose S to be moving in the direction of *f*, and E to be rotating and swinging her poles round, as before supposed; would not solar time be shorter than sidereal time? Would not E (the earth), in her rotary movement, arrive sooner at *f* than she would at B? And would not the degree of shortening be in proportion to the rate of retrograde motion of S to *f*? Now such a result is the yield of Nature; hence we know, certainly, that the sun (S) is pursuing a retrograde orbit in the direction of B C D A. These, my much respected friend, C. H. B., are facts, which I think you will be willing to admit, when you next write. Although, as you say, the retrograde motion of the equinoxes does not necessarily involve the idea of a direct or other motion of the sun; yet the difference between solar and sidereal time does; and it is by this that we know that the sun is moving retrogressively in his orbit. Nothing is clearer in all astronomy.

As to the one day, so called, of precession, I would remark that it cannot be a day of 24 hours. It may be called (if we must call it a day) an equinoctial pole day of 25,868 years' length.

It is true that from the moment the pole of the earth prolonged leaves H (I allude to C. H. B.'s diagram, Fig. 2, annexed), or A in my own diagram, it cannot return thither again until about 25,868 years. But in respect to the rotary movement of the earth or sidereal time, as compared to solar time, is not the difference 1 in 25,868? And if so, then a solar day is shorter than a sidereal day to the amount of one day in 25,868 days, and to one year in the same number of years.



I hope, at some future time, to give a diagram of my theory of solar motion, showing how precession of the stars, and recession of the four seasons of the year, is produced, which I believe will be both interesting and instructive to your many scientific readers, as well as to my friend C. H. B., who, I hope, will send me his full name, so that I can privately thank him with much gratitude for the kind and gentlemanly manner in which he has made an endeavor to convince and correct me.

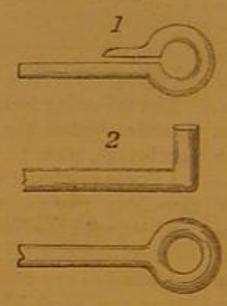
JOHN HEPBURN.

Gloucester, N. J.

Wrinkle No. 2.

To the Editor of the Scientific American:

I noticed a short time ago, in your journal, an article entitled "A Wrinkle;" the idea is undoubtedly of benefit to the practical workman, and you will allow me to suggest another, which may be of equal value. It is customary with blacksmiths, in making hooks for chains, clevises, and other like articles having an eye, to draw out the bar, bend it over to form the eye, and then weld down the lap, back of the eye. This always makes an imperfect eye, to say nothing of overheating the end of the part turned, which is invariably the beginning of a fracture. (1.) Now let the smith cut off the iron, or leave it on the bar, as he may think proper, bring the end to a welding heat, and bend (over the edge of the anvil), at right angles, as much as he desires, to form the head; then draw it on the face of the anvil, with end up (2); strike on the end thus turned until flattened down (this must be done while there is a welding heat on iron); then punch a hole back of the center of the head, and work out the eye on the horn of the anvil as large as desired. There you have it.



To such as are accustomed to draw out and form the eye in the old way, I would suggest the above plan; and should they find reason to be thankful, let them bestow a favor on the SCIENTIFIC AMERICAN and its many readers. If they know of any process by which their class will be benefitted, and by which we may become more intelligent and skillful workmen, give us the benefit of such knowledge.

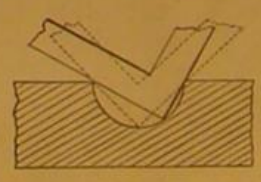
N. P. Q. R. S. T.

Mansfield, Pa.

Tried on the Square.

To the Editor of the Scientific American:

I notice that, in many shops, it is the custom of pattern makers to make templets of thin pieces of wood, for the purpose of determining the accuracy of the half circle in core boxes which are chambered or made to a larger circle in the center than at their ends. It never occurs to them that an ordinary square may be used for the above purpose, as shown, saving much time in the construction of machine core boxes. It will be seen at a glance, however, that the square will test a circle of any size with as much accuracy as it does a right angle, it being 90 degrees, or the fourth part of a circle.



GEORGE B. DURKEE.

Farmington, Ill.

The New Patent Law Bill in England.

To the Editor of the Scientific American:

As one of the Committee of London Patent Agents, who prepared the new patent law bill which was severely criticized in your issue of March 29, permit me to explain its object and its bearing on the cause of patent law reform. In the years 1871–2 a select committee of the House of Commons sat "to enquire into the law and practice and the effect of grants of letters patent for inventions." The result of this enquiry was a report embodying several recommendations which were supposed to be needed for improving the working of the patent laws. These recommendations commanded by no means the general approval of patent agents, and some of them were even denounced as impracticable. It was however thought, and, I venture to say, not unreasonably, that if the recommendations were to be followed, the putting them into working order, so that the least possible amount of mischief should accrue therefrom, might be the best effected by those whose experience enabled them to judge of their ultimate action. The patent agents therefore undertook to embody in one bill the existing statutes, and clauses which would include the machinery for working out the recommendations of the Committee of the House of Commons.

All that is new, therefore, in principle in the bill, the Commons committee is answerable for, and all that is old is the work of the legislature. Our self-imposed task was simply to supply the details for putting the resolutions into a working shape. For my own part, I agree with you that "nearly all the changes proposed in this bill are steps in a backward direction," but you will understand that it is of no small importance for the legislature to have before it, whenever the amendment of the patent laws may be taken in hand, not only the whole law as it exists, but also the recommendations of the Committee in a working shape, combined in one document. Moreover, suggestions may at the first blush seem to possess some value, but when put into working shape their impracticability may be demonstrated. If this result has been attained by the labors of the Committee of Patent Agents, and your remarks seem to indicate that it has, I venture to say that good service has been rendered, by the drafting of our bill, to patent law reform. At any rate you may rest assured that the bill will never become law in its present form if it is within the power of the London patent agents to prevent it.

A. V. NEWTON.

66 Chancery Lane, London.

Superheated Steam.

To the Editor of the Scientific American:

Knowing how much every one using steam power is interested in producing it economically, I send you the following facts, which have added very much to my opinion of the advantage of using superheated steam:

We have been using in our business for some years an upright tubular boiler, the tubes passing entirely through the steam space, giving us very dry steam. This boiler furnishes a little more power than did a horizontal tubular boiler, having more fire surface and using more fuel, which was used to run the same machinery. I was still more impressed with the economy of our boiler by the following comparison: Last summer a foundery and machine shop was established in a building adjacent to ours. They put in an ordinary two flue horizontal boiler. By a careful estimate, I judged they used about three quarters the power we do, while they consumed nearly one half more coal. I noticed that they worked very damp steam, which was evident from the water escaping from the cylinder cocks, which were always open. Their boiler has a dome and mud drum; ours has neither; and although our middle gage is only 15 inches from the top of the boiler, it never foams unless we are using very dirty water. We are not using any "lime or dirt extractor," although we take water from the Missouri river, which is often very muddy. After three years' use, the boiler appears to be very slight incrusted with scale. I account for this from the fact that our engineer pumps water into the boiler after he has drawn the fire, which seems to settle the impurities, which he blows out through the mud cock. The only trouble we have with our boiler is that it sometimes gets to leaking around the upper end of the tubes, which we stop in a few minutes with an expander. I lay this fault to the engineer, who, when late, makes up a very hot fire to raise steam in a few minutes, which causes the upper end of the tubes, not surrounded with water, to become red hot. I do not think this would ever occur with slow firing at the start, for I am of the opinion that steam under a slight pressure would take off the heat nearly as fast as water.

S. E. WORRELL.

Hannibal, Mo.

Professor Young on our Knowledge of the Sun.

To the Editor of the Scientific American:

In your journal of March 1, 1873, pages 131, 132, is a part of one of Professor Young's lectures on the sun; and, if he said what is there reported, it is hard to see how his statements can be reconciled. In speaking of the heat of the sun, quoting Sir John Herschel, he says: "Suppose ice could be formed into a rod forty-five miles in diameter, and that rod of ice should be darted at the sun with the velocity of light: if all the heat of the sun could be concentrated upon the javelin of ice, it would never approach the sun, for the point would melt off as fast as it came." At that rate the sun would melt 305,363,520 cubic miles of ice in a second, if light moves 192,000 miles in a second. He says again: "Suppose we should take two and a quarter miles square of solid ice, and should concentrate upon that the heat of the sun, it would take just one second to melt it." If he means, by "square," to imply a cube of that size, he would make the sun melt $11\frac{2}{64}$ cubic miles of ice in a second. Now if by one estimate the sun will melt over three hundred million cubic miles of ice in a second, and by the other, less than twelve cubic miles, there is certainly an appreciable difference in the estimates: the ratio being over twenty-five millions to one, not very close for an "exact science."

But perhaps these estimates are about as satisfactory as any that can be made on the subject of the solar heat, for I notice that by different scientists the sun's heat is estimated at from less than 212° Fah. to eight or ten million degrees of the same scale.

The Professor thinks that "if the sun were of solid coal, it would have been completely burned out in 5,000 years." I have seen it estimated that it would burn out in less than five minutes. And the latter estimate seems more correct, as it was based on the ratio of the sun's mass and radiation, compared with a globe equal in diameter to the earth's orbit. He thinks also that "meteors" help to keep up the solar heat. But, according to the SCIENCE RECORD, the meteors

are only the dust from the comets' tails, blown off by the atmosphere. Of the thousands which have been seen in the August and November showers, I have never heard that a single person has been able to light his pipe from the heat they have produced. If, then, the known effect of the greater part of meteors is so small, upon what principle is so great an effect attributed to them as that of contributing largely to heat up such a body as the sun, and through it the vast space of the solar system? Can any one tell? Does not the Professor's lecture need to have its statements better harmonized? JACOB DAVIS.

Florida, Mass.

Ignition by Superheated Steam.

To the Editor of the Scientific American:

I have noticed the letters that have appeared in your journal lately, on steam ignition, and I will give you a singular fact which occurred in my own experience a few days ago.

I had prepared some gun cotton, and after washing it a little from the acids, I laid it on the T joint of a steam pipe to dry, 80 yards distant from the boilers; the pipe runs 40 yards of the distance under ground. In about three minutes, there was a flash like lightning; the cotton I laid on the T joint had exploded by spontaneous combustion.

I have often seen cotton yarns and raw cotton, that have been dyed with sulpho-nitrates and nitro-muriates, ignite in a few hours, being in contact with superheated steam pipes. May not wood, under certain circumstances, absorb inflammable gases, and thus be rendered more liable to spontaneous combustion? JACQUES NICHOLSON.

Frankfort, Ky.

Retardation by Ocean Tides.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of April 12, there is a paper on this subject alleging that the "tidal wave spends its force, moving from east to west, on the coasts of Africa and America, retarding the rotation of the earth"; but the wave does not remain there, and the reflux would be equal to the afflux. Without surface oceans, no thought of retardation by the moon's attraction would be entertained; and, if surrounded freely with ocean water, the earth being supposed to be stationary, a swell of the water directly under the moon would result; and as the earth might begin its rotation east, that side of the swell would fall back or recede, and the western progress of the moon's attraction would continue to renew the swell from the approaching western supply. Thus the swell would undulate around the earth, without change of place as a whole T. W. B.

Pittsburgh, Pa.

CHEMICAL NOTES.

Zinc and Aluminum in the Sun.

The observation that the number and length of the lines in the spectra of metallic vapors depend upon the density of the absorbing or radiating vapor, and that only the longest lines remain visible when the vapors are rarefied, obtains additional importance by the author's discovery that the inverted lines in the solar spectrum are without exception the longest lines observed in the spectrum of the vapor of each element. The presence of zinc and aluminum in the sun had hitherto been extremely doubtful, as only very few lines of their spectra had been found inverted in the solar spectrum; this doubt we may now consider as removed, since the author has found that the lines corresponding to these elements in the solar spectrum are the longest lines of the spectra of their vapors.—*N. Lockyer.*

The Spectrum of Nitrogen.

According to A. Schuster, the true line spectrum of nitrogen invariably shows a bright green line followed (towards the blue end of the spectrum) by a green band. The fluted spectrum shows shaded violet bands.

Phosphoretted Hydrogen and Ammonia.

K. B. Hofmann says that the spectrum of phosphoretted hydrogen shows four green lines, lying between D and F (Fraunhofer). The green color, according to the author, is not due to burning phosphorus, because phosphorus burned alone shows no spectral lines; nor is it due to the burning of the gas phosphoretted hydrogen, because this gas when heated is split up. The chemical process going forward in the mantle of the flame is supposed by the author to produce beams of constant refrangibility, and the green color to be due to these.

The spectrum of ammonia is yellow. This spectrum is not to be accounted for by the decomposition of ammonia and the burning of the nitrogen.

Production of Light by Atomic Movements.

Many bodies emit light at ordinary temperatures. This fact forms the basis of a speculation by the author, in which he supposes that the atom of a substance may rotate without any appreciable movement of the molecules, and that the production of light may, in many instances, be due to such atomic movements.

These movements will depend upon the mass of the atoms and the chemical force binding them together. When these movements are so extensive as to cause a disruption of the molecule, a new substance is formed, accompanied by a greater emission of light. The tension of vapors and the change of volume upon increase of temperature are to be regarded as caused by molecular movements. The atomic movements causing emission of light waves may be taken up by the molecules, and so we have absorption of light.

As the sphere of action between any two atoms must be limited, chemical decomposition will ensue as soon as the atoms pass out of this sphere; if their excursions exceed the distance between the middle points of the neighboring molecules, a complete breaking up of the molecule must ensue.—*Journal of the Chemical Society.*

Interference Colors of Gold.

W. Stein observes that gold in thin plates, or when precipitated from very dilute solutions (by action of sulphur dioxide in water), manifests dichroism, appearing indigo blue by transmitted light, but reddish yellow by reflected light. But if the particles of gold be very small (as when gold is precipitated from its solution by means of stannous chloride) the laws of interference come into play and the gold appears purple. Such gold the author calls molecular gold, and he thus distinguishes three modifications of gold, (1) ordinary, (2) dichroitic, (3) molecular. Ruby glass he regards as a solution of molecular gold in glass.

Recent Experiments with Oxyhydric Illuminations.

With a recent issue of the *American Gas Light Journal* there is published, as a supplement, a careful translation, by the editor, of a report made by Simon Schiele, a distinguished gas expert of Frankfort, Germany, on the subject of oxygen illumination in that country. He does not coincide with the conclusions of Le Blanc on the Tessié du Motay process as tested in Paris.

Mr. Schiele's report says that the illumination by the Tessié du Motay method comes no dearer than any other mode of lighting, and that it is perfectly well adapted for public illumination. The carbon in the rich gas is consumed, in all cases, more completely and with greater light-production than in any other mode of combustion hitherto practiced. When the two gases are adjusted to the proper relative proportions, in suitable burners like the Andreae, there occurs no waste of either the one or the other gas.

As carburreting at the place of burning may, by recent improved methods, be averted, this objection becomes futile. The gas may be conducted into the interior of houses and through all parts thereof. By the recent improvements in Vienna, rich gas of uniform quality can be delivered through pipes to very remote localities; and there is no doubt but that oxygen also, of nearly uniformly good quality, can always be sent forward through mains over wide spaces. The results of the Vienna experiments prove the practicability of the oxygen illumination for all towns and even for large cities, while the profits of the plan are as little to be doubted as those of any other gas-lighting enterprise. There is no necessity of delivering the oxygen in a state of compression to consumers when it can be readily, as proved, transmitted through pipes. With regard to the hygienic value of oxygen lighting, as compared with ordinary gas lighting, Mr. Schiele observes that when the oxygen necessary to combustion is furnished specially and directly to the flame, that of the room lighted by the latter is of course not drawn upon; and when the hydrocarbon employed for the production of an equal amount of light is diminished in amount, the quantity of carbonic acid resulting from the combustion must be proportionally less than in the case of ordinary gas lights.

Volcanic Eruption in Iceland.

A great eruption of the Skaptar Yokul, a volcano in Iceland, took place on the 9th of January. It lasted over four days, and the magnificent sight it presented was visible from most parts of the country. The Yokuls, or enormous ice mountains, are among the greatest elevations in Iceland. The Oreefa Yokul, 6,280 feet in elevation, is the most lofty of which any accurate measurement has been obtained. The celebrated volcano Hecla is more remarkable for the frequency and violence of its eruptions than for its elevation, which is only about 5,200 feet. Besides more than thirty volcanic mountains, there exists an immense number of small cones and craters, from which streams of melted substances have been poured forth over the surrounding regions. Nine volcanoes were active during the last century. Twenty-three eruptions of Hecla are recorded. The most extensive and devastating eruption ever experienced in the island happened in 1783; it proceeded from the Skaptar Yokul, a volcano (or rather volcanic tract, having several cones) near the center of the country. This eruption did not entirely cease for about two years. It destroyed twenty villages and 9,000 human beings.

New Musical Instrument.

If into a glass tube two flames of convenient size be introduced, at a distance of one third the length of the pipe, counting from its base, these flames will vibrate in unison. The phenomenon continues as long as the flames remain separate, but the sound ceases the moment they are brought in contact. If the position of the flames in the tube be varied, it is found that the sound decreases until one half the entire length is approached.

Based on these facts, M. Kastner has constructed a new musical instrument of a very peculiar timbre, closely resembling that of the human voice. The "pyrophone," as it is termed, has three key boards; each key of which is, by simple mechanism, placed in communication with the conduit pipes of the flames in the glass tubes. By pressing upon the keys, the flames separate and sound is produced. When the pressure is removed, it is instantly stilled by the junction of the flames.

CONICAL JOINT FOR IRON PIPES.—In the manufacture of cast iron tubes, the practice has been introduced, with satisfactory results, of turning off one end conically, and boring out the end of the tube to which it is to be united at the same angle, the end of one tube being thus inserted into the other without the necessity of applying any cement, the junction being effected in this way very readily, and the joint being perfectly tight.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the month of February, 1873:

During this month, there were 855 visits of inspection made, and 1,520 boilers examined, of which 443 were carefully inspected internally and externally, the boilers being blown down and cool; 151 were tested by hydraulic pressure. The number of defects in all discovered were 782, of which 192 were regarded as dangerous. These defects were as follows:

Furnaces out of shape, 39—8 dangerous; fractures, 76—25 dangerous; burned plates, 52—15 dangerous; blistered plates, 106—13 dangerous; case of deposit of sediment, 133—14 dangerous; incrustation and scale, 134—13 dangerous; external corrosion, 60—15 dangerous; internal corrosion, 27—10 dangerous; internal grooving, 16—12 dangerous; water gages defective, 29—9 dangerous; blow-out defective, 13—3 dangerous; safety valves out of order and overloaded, 26—4 dangerous; pressure gages defective, 101—19 dangerous, varying from —20 to +20; boilers without gages, 1; cases of deficiency of water, 14—10 dangerous; cases of broken braces and stays, 24—11 dangerous; boilers condemned as unsound and unfit for use, 18.

There were 10 boiler explosions during this month. None of them, however, were under the care of this company: 3 were of rolling mills, 3 locomotives, 1 cotton mill, 1 flour mill, 1 agricultural works, and 1 mill the occupation of which we were unable to ascertain. By these explosions, 23 persons were killed and 55 injured. We were unable to gain any satisfactory particulars of some of these disasters. Coroner's juries on such occasions are not usually composed of practical men, and the verdict is generally "low water" or "a Providential visitation," both of which may be true; but it would be very satisfactory sometimes to those investigating the subject of boiler explosions, and studying their cause and cure, to be permitted to examine fragments of the exploded boiler, and see if some corroded spot, broken brace or defective safety valve, might not be made the cause of the accident, and the responsibility thereby shifted from Providence to a mercenary steam user, who, to save (?) expense, had employed an incompetent engineer or run a weak and over worked boiler for months, and perhaps years, without examination or repair. Every month of our work reveals the grossest carelessness in the care and management of boilers, and why they do not oftener explode is more than we can say.

How the Transit of Venus will be Photographed.

The following method, devised by M. Janssen, is to be employed in photographing the apparent contacts of Venus with the sun's edge. The sensitive plate of the apparatus is in the form of a disk, fixed upon a plane which rotates on an axis parallel to that of the telescope. The disk is eccentric, so that the images are formed near its circumference. Before it, a second disk forming a screen is arranged, in which is made a small aperture in order to limit the photographic impression of the portion of the solar image to around the locality where the contacts take place. The circular plate which carries the sensitized material is toothed and placed in communication with a small escapement apparatus actuated by an electric current. At each second the pendulum of a clock interrupts the current, the plate turns ahead one tooth and thus disposes, under the hole in the screen, a blank part of the negative for another impression. If, therefore, the disk has 180 teeth, the plate will receive 180 images of the solar edge. The photography can thus be begun a minute and a half before the presumed instant of contact; then when the series relating to the first contact is obtained, the sensitive plate is withdrawn and replaced by another which gives the second contact and so on for the four. The plates are afterwards examined at leisure with the microscope.

Cornell University.

The annual report of the President and Register of Cornell University furnishes a gratifying exhibit of the rapid and substantial growth of that institution. There are at present five hundred students, and the faculty consists of forty professors and instructors. We note the erection of a college of mechanical engineering, provided with machine shop and all accessories through the munificence of Mr. Hiram Sibley of Rochester. The college library ranks third in size, and second in value, of those of its kind in the country. The university now comprises five large buildings of stone, three of brick and two of wood, constructed almost entirely by the aid of money, aggregating $1,400,000, donated by friends. The regulations of the institution state that its benefits are open to all, but only students resident in the State of New York receive free instruction. It is not a manual labor school though opportunities are offered for work, but employment is not guaranteed to any student. It is stated that a limited number of good practical machinists, who have already a sound English education, who wish to become thoroughly scientific master mechanics, may be able to do something toward their own support by making models of instruments, apparatus, etc., for the museum in the new machine shop. This requires skilled labor and a good knowledge of the use of tools.

NEW YORK CITY is supplied with early vegetables from the Bermuda Islands. New potatoes are found in our market from the above locality in February. Strawberries from Charleston, S. C., are now selling here for $2.50 per quart; green peas from Florida, $8 per barrel; hot house cucumbers, $5 a dozen; Bermuda new potatoes, $10 a barrel.

THE TAY BRIDGE.

We are indebted to the *Engineer* for the accompanying illustrations, representing operations in the construction of one of the greatest civil engineering works ever undertaken in Great Britain. The bridge, which will be the largest iron structure of its class in the world, will cross the Tay river, in Scotland, about one and a quarter miles west of Dundee, bringing the great coal fields of Fifeshire into direct communication with that city, and adding much to its importance as a shipping port.

The total length of the bridge, from shore to shore, is 10,320 feet. Commencing from the south, or Fife side, there will be three spans of 60 feet, two of 70 feet, twenty-two of 120 feet, fourteen of 200 feet, sixteen of 120 feet, twenty-five of 66 feet, one of 160 feet, and six of 27 feet. The first three spans (60 feet), south side, are on a descending gradient of 1 in 100, the two 80 feet spans are level; the bridge then rises with a gradient of 1 in 353 to the center of the 200 feet spans. It again descends with a gradient of 1 in 73·56 to the north shore, passing at a hight of about 48 feet over Magdalen Point and the esplanade now being constructed.

The bridge thus comprises eighty-nine spans, and at the commencement on the south side the rails are 78 feet above high water, running over the tops of the girders as far as the 200 feet spans which cross the navigable channel of the river.

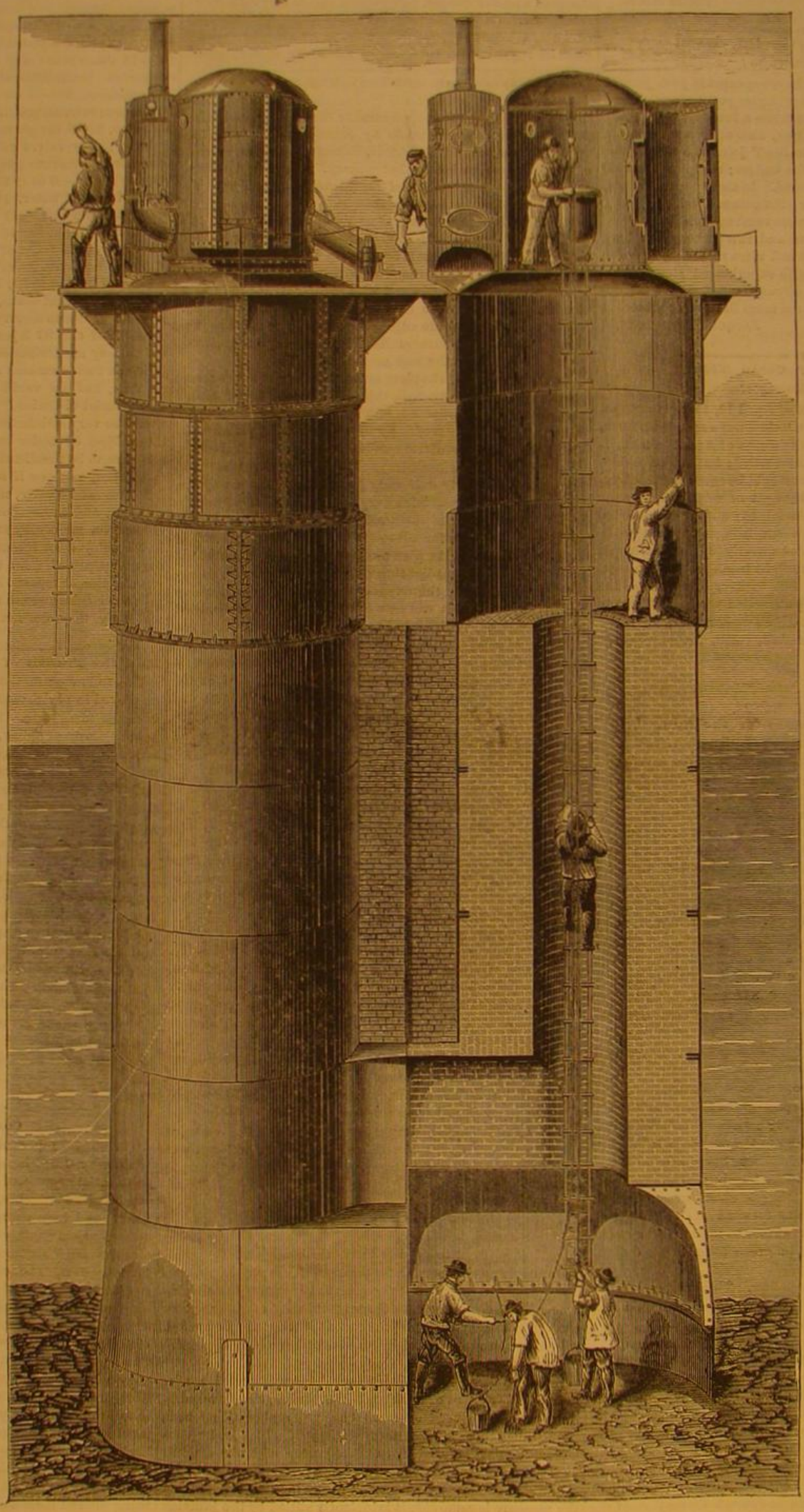
The greater part of the piers are built of brick, varying in diameter from 6 feet to 15 feet.

The method of building the piers and sinking them to the foundation is carried out in a novel manner, and specially adapted to rivers having strong currents, and with little soil overlying the rocky bed—which here in one case did not exceed 4 feet—prohibiting the use of timber staging, as heretofore used for such structures.

The piers are first built up to the hight of 15 feet on the foreshore on a temporary basis of concrete; the girders, carried by the pontoons shown, are floated over the pier, and with the falling tide are left hanging to the pier by brackets, the pontoons being floated away and moored in the harbor. The pier is then built up to such a hight that, when resting on the bottom in its permanent position, the top will be above low water. The girders, on which are resting the hydraulic rams for lowering the pier, are then connected to the wrought iron lowering links with the base of the pier. The pontoons are floated underneath the girders, and the whole pier floated from its temporary resting place at high water and towed out to its permanent position.

The caisson piers are formed by combining the two cylinders into one base, having long straight sides with circular ends. This base is provided with vertical suspending bars to which are connected a pair of balancing crosshead plates by a central bolt; the hydraulic rams are similarly provided with crosshead plates, and the upper and lower sets are connected with the wrought iron links already mentioned. The hydraulic rams have a stroke of 12 inches, and the links pass through slotted holes in their bases. These links are composed of wrought iron bars. In the first place the weight of the pier is carried out on steel pins passed through the holes in the links, and resting in bearings provided on the the bases of the rams. The whole mass is then towed out at high water to its place, the pier being then submerged to the extent of 8 feet only. The pontoons are securely anchored, and the lowering commenced. To begin lowering, the crossheads on the rams are connected by pins with the links at the top of the stroke. The hydraulic force pump—of which there is one on each pontoon—with a few strokes raises the pier about ¼ inch, so that the weight is no longer on the steel pins; they are then drawn out and placed in the link holes 1 foot higher up; by means of a suitable arrangement of cocks the water is let out of the rams, first on one side then on the other, and the pier lowered until the steel pins again rest on their bearings. The crossheads are then disconnected, and the rams pumped up again to the top of the stroke Links, which are 4 feet long, are added as the lowering proceeds, and the whole apparatus is under such control that the time taken in lowering 1 foot is only 4¼ minutes. In the diagram the ram is at half its stroke downwards.

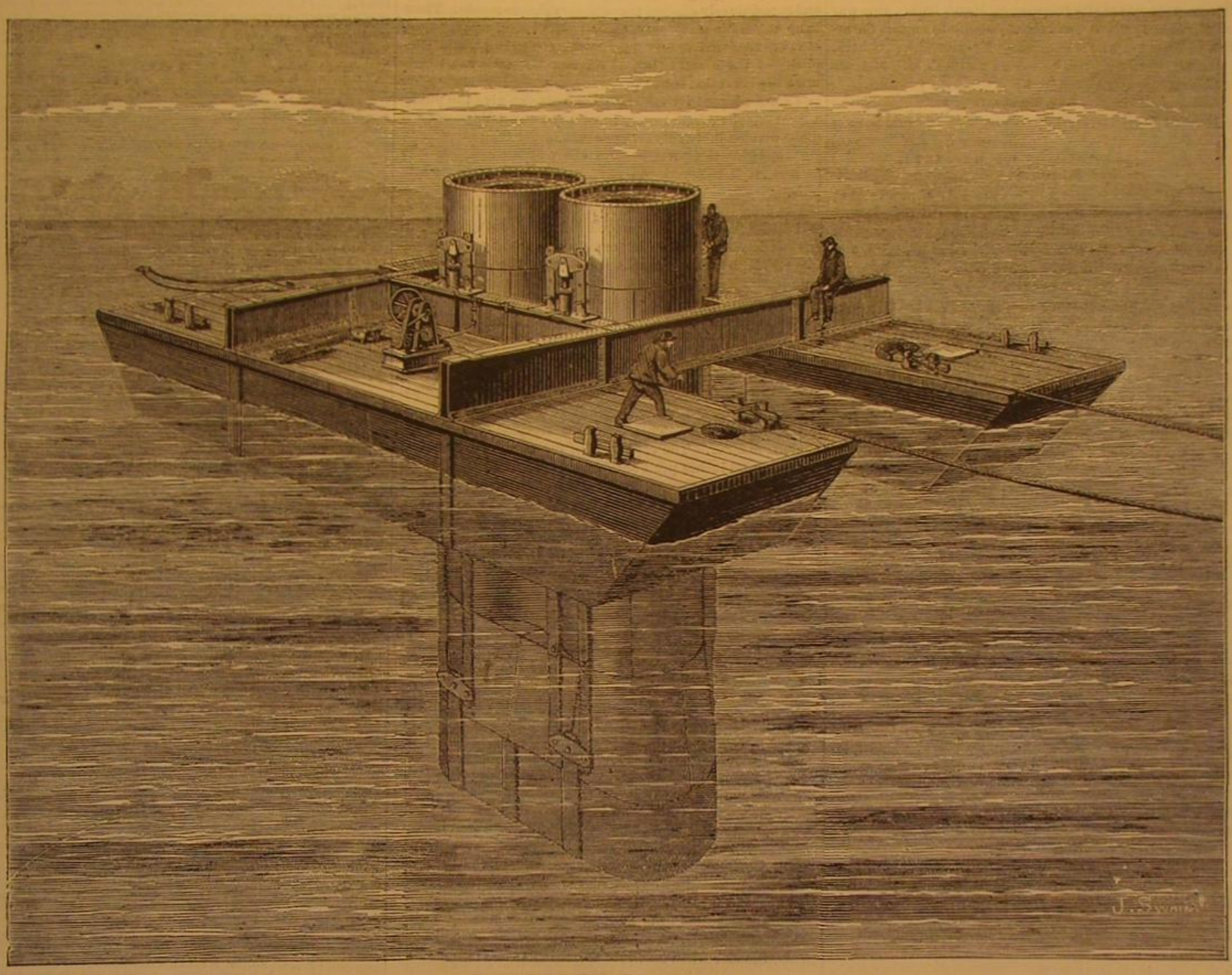
The heaviest piers floated out weighed 145 tuns, and were lowered by six hydraulic rams. The lowering takes place during the ebb tide, and a little before low water the pier is grounded—the exact position having been ascertained by sighting lines from the shore, and a measuring chain from the last pier. During the last half hour of the ebb tide the pier resting on the bottom of the river is carefully watched with a spirit level, and any tendency to sink into the bed of the river unequally is checked by the hydraulic rams being pumped up on the lower side of the pier until the settlement is equal. When the pier has fairly settled, the links are disconnected above water and the pontoons floated away, the links being recovered by a diver.



SINKING THE CAISSONS OF THE TAY BRIDGE.

The construction of the double or combined piers is represented in our engraving, giving half elevation and half vertical section, showing the men excavating the foundation. A wrought iron base, 3 feet high, 22 feet 7 inches long, and 10 feet 6 inches wide, with flat sides and circular ends, is laid on a concrete foundation on the foreshore, dry at low water. This is surmounted by a conical cast iron five feet length, provided with a broad top flange 2 feet 6 inches wide. This forms the working chamber during the time of sinking the pier. On the broad flange the brick work is carried up in two circular towers, 9 feet 6 inches in diameter, surrounded with cast iron cylinders of ¾ inch metal in four segments, each tower having a shaft left open 4 feet in diameter in its center. The brick work is carried up inside the cast iron caissons, a space of 2 inches being left between the brick work and the castings, which is filled in with cement grout, the castings being carried up to low water level. After the piers are in position, temporary cast and wrought iron caissons are put on to about 6 feet above high water, the brick work being also carried up until sufficient weight is obtained to prevent the pier floating when filled with air during sinking to its permanent foundation. Two air bells are fixed, as shown, on top of the caissons, with pumps and engines attached. Air is pumped into the pier until the bed of the river is dry inside, and the excavation is carried out in the ordinary manner, the soil being sent up to the top through lock shoots in the air bells. The man shown in the section of the bell operates the soil shoot on the inside, it being closed by a door inside and out side. These air bells, having to be shifted from pier to pier by a crane working on a barge, were designed by the contractors specially for the work. Lightness being a great object, they are, with the exception of the doors and shoots, made of wrought iron, and have answered the purpose admirably, each bell, with its accompanying boiler and engine, weighing only six tuns. It will be noticed that the 3 feet wrought iron and 5 feet cast iron lengths are hollow, making a working chamber 8 fee

high, sufficient for twelve men to work. As soon as the pier is sunk to its permanent foundation, concrete, in the proportion of one of cement to four of broken stone and sand, is sent in under air pressure, filling the work chamber, the flanges carrying the brick work being carefully packed and run in with cement concrete. The shafts are then filled up, the air bells and temporary caissons removed, and the brick work carried up to about 6¼ feet above high water level. It will be noticed that the two circular shafts are connected with an arched passage immediately above the working chamber, this being provided to give room for packing the concrete under the broad flanges. During the progress of the pier downwards it is steadied by means of two hydraulic



FLOATING THE PIERS OF THE TAY BRIDGE INTO POSITION.

telescopic legs. These are placed on the south side. From the last pier finished, heavy chains are connected with the pier being sunk, which, with the hydraulic legs, effectually steady it during sinking. The superstructure consists of lattice girders continuous over four spans, each set being provided with its own fixed and expansion bearings.

The brick work is built with Portland cement, in the proportion of one of cement to one of sand; and such is the its strength that, after a few months, those cylinders which capsized after being floated on to the foreshore could only be broken up by blasting.

There will be used in the construction of the bridge 3,600 tuns of wrought iron work, 2,600 tuns of cast iron work, 35,000 cubic yards of brick work, 87,845 cubic feet of timber, etc.

The construction is being carried out from the designs of Mr. Thomas Bouch, M. I. C. E., of Edinburgh. The whole of the work was undertaken by Messrs. C. de Bergue & Co., of London, Manchester, and Cardiff.

The Utilization of Coal Dust.

Dr. J. R. Hays, of Washington, D. C., has recently published a paper on a means of using up the dust coal which lies in heaps near the shafts of most coal pits. He mixes the coal dust with clay and coal tar, and estimates that the cost of these, together with labor, will not exceed $1.00 per tun; and if the waste coal can be delivered in the cities at $2.00 per tun, a fuel of great excellence can be easily prepared at $3.00 per tun, which will be an economical improvement of great importance to the poor.

Chemical Action of the Solar Rays.

M. Marchand, says *Les Mondes*, has just completed a long and careful study of the chemical action of solar rays. He exposed to the light a mixture of definite proportions of oxalic acid, perchloride of iron and water. Under the influence of the rays, the perchloride was decomposed and became protochloride; the chlorine, set at liberty, combined with the hydrogen of the water to form hydrochloric acid; and the oxygen of the water, uniting with the oxalic acid, transformed it into carbonic acid, which was disengaged. The quantity of carbonic acid thus given off is proportional to the intensity of the light, and serves as its measure. The difficulty was, however, to determine accurately the amount of carbonic acid without having recourse to mercurial apparatus, very expensive and hard to manage. M. Marchand has found, however, and *Les Mondes* terms it a great discovery in practical chemistry, that, for the determination of the carbonic acid, glycerin may be well substituted for mercury. He has also observed that his mixture, considered as a reagent of chemical rays, differs from the nitrate of silver in the particular that the maximum of its intensity is at the middle of the blue, while that of the nitrate is at or near the violet.

A PATENT CANNON PLOW.

This novel idea is the invention of Messrs. French and Fancher, of Waterloo, N. Y., and was designed at the be-



ginning of our late war, probably as a means of self-protection for farmers against raiding bands of guerillas and bushwhackers. We publish it at the present time, thinking that it may be utilized or suggest a similar or better plan for defending our Western settlers against Indian depredations.

The idea is well explained by our engraving. Two farmers, for instance, are breaking up the prairie soil preparatory to planting their first crop. They are surprised by Indians, who, probably, having just received a new supply of ammunition from Washington, are bent on testing the quality of the same by robbing and murdering such citizens of the United States as may be in the neighborhood.

Naturally, the first thought of the hardy pioneers would be judicious retreat, and such a course they would undoubtedly adopt were they not fortunately provided with the cannon plow. Instead of running away, therefore, they coolly unhitch their horses, load the hollow metal plow beams with a charge of canister, scrap iron, old nails, pebbles, etc., drop a little loose powder in the vents, light their pipes, and seat themselves at the rear of their implements to await the arrival of the unsuspecting "Los." The latter gentry, advancing with the prospect of two easily obtained scalps, are suddenly astonished by a metallic hailstorm, which continues until they recollect a pressing engagement in another vicinity, and find it to their interest to defer their present operations until some more convenient time.

Protecting Iron.

Cast iron water pipes and other articles may be preserved by covering inside and out with pitch, heated to 300° Fahrenheit and kept at this point during the dipping. As the material deteriorates after a number of pipes have been dipped, fresh pitch is frequently added, and at least eight per cent of heavy linseed oil put to it daily; the vessel is also entirely emptied of the pitch and refilled with fresh material, as often as is necessary to insure the perfection of the process. Each casting is kept immersed from thirty to forty-five minutes, or until it attains a temperature of 300°. After the bath is completed, the castings are removed and placed to drip in such a position that the thickness of the varnish will be uniform. It is essential that the coating be tenacious when cold, and not brittle or disposed to scale off. The pitch or varnish is made from coal tar, distilled until all the naphtha is removed, the material deodorized, and the pitch like wax or very thick molasses.

LEPROSY still prevails to an alarming extent in the Sandwich Islands. The doctors can find no remedy. The lepers are isolated and live in large communities by themselves, under rigid laws of exclusion from other mortals.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations, which are only approximate, in the following notes, and for much of the information, I am indebted to students. M. M.

Thermometer.

The highest recorded thermometer at 2 P. M. (up to this date, April 20) is 61° on the 8th and 11th.

The dandelion was first seen in this locality on the 8th, the crocus on the 9th, hepatica on the 13th, and blood-root on the 19th.

Auroras.

The aurora was noticed on the 16th, 19th, and 20th of April.

Meteors.

Meteors were unusually frequent on March 28th. One was reported at 7h. 15m. It was bright enough to attract the attention of a person who was reading by gaslight. Others, less marked, were reported between 7 and 8 P. M. Meteors were also reported on March 31st.

Sun Spots.

On March 17th and 27th, the spots on the sun could be seen with the naked eye.

Positions of Planets for May, 1873.

Mercury.

On May 1st Mercury rises a little after 4 A. M., and sets at about half past four in the afternoon. It is at its greatest elongation from the sun on May 3d, and should be looked for before sunrise. On the 31st Mercury rises at 3h. 58m. and sets at 6h. 30m.

Venus.

On the 1st Venus souths only 16 minutes after the sun, but, being in high northern declination, does not set until about 7h. 40m. P. M.

On the 31st it souths before the sun and sets at 4h. 31m. P. M., so that it must be looked for in the morning. It rises at that time about 3 in the morning.

At this time (April 20th) Venus appears as a very narrow crescent, which can be seen with a field glass.

Mars.

Mars, with its red light, is becoming a conspicuous object in the east during the evening. It rises on the 1st at 6h. 20m. and sets at 4h. 47m. the next morning.

On the 31st it rises at 3h. 46m. P. M., and sets at 2h. 24m. the next morning. It is moving westerly among the small stars of *Virgo* and *Libra*.

Jupiter.

On the 1st Jupiter rises at noon and sets at 1h. 54m. the next morning. On the 31st it rises at 10h. 17m. A. M., and sets at midnight.

On the 3d of April, Jupiter passed over its 1st and 4th satellite. Both became very dim as the planet swept toward them; the 4th, which is usually next to the largest, appearing no larger than the second.

Saturn.

Saturn is above the horizon only nine hours and a half. It rises on the 1st a few minutes before one in the morning and set about half past ten in the forenoon.

On the 31st it rises at 10h. 54m. P. M., and sets at 8h. 24m. the next morning.

Saturn is moving among the stars of Capricornus on the 1st, but becomes stationary on the 12th. It moves among the stars easterly before the 12th and westerly after that date.

Uranus.

Uranus rises on the 1st at 10h. 21m. A. M., and sets before 1h. the next morning. On the 31st it rises about half past 8, and sets about 11 P. M.

Neptune.

May 1st Neptune rises at 4h. 32m., and sets at about half past 5 the next morning. On the 31st it rises at 2h. 35m. P. M., and sets at 3h. 41m. of the next morning.

Progress of the Great Suspension Bridge between New York and Brooklyn.

The work on the foundations for the anchorages for the cables has lately been commenced; the towers on both sides of the river are advancing towards completion. The bridge will be supported by four cables—two outer ones and two near the middle of the flooring.

By a cable is meant six thousand wires laid out straight together and wound round with other wires, the whole composed of galvanized tempered cast steel, having a strength of one hundred and sixty thousand pounds per square inch. The cables have each a diameter of sixteen inches, and go through the tower near the top (together upholding the superstructure of the main span, the aggregate weight of which, including the cables, will be five thousand tuns), are carried straight to the anchorage, entering the masonry at an elevation of eighty-two feet above the river, and, after passing into the wall for twenty-five feet, form a connection with the chains. The latter, consisting of cast steel bars, thirteen feet long and ten inches wide by one and a half inches thick, go through the masonry in a curved line, and are fastened to the anchor plates at the base.

The four anchor plates are to be laid side by side at the base of the anchorage, imbedded in the masonry. One of them was lately finished.

The plate weighs twenty-three tuns, and is of a singular shape. It is seventeen feet and a half by sixteen feet over all, with sixteen radial arms extending from a solid center. In this center piece are eighteen openings through which the links pass, connected with the four cables spanning the river, and the wire work suspended from them will weigh not less than five thousand tuns. The links are held in each anchor plate by two massive iron pins.

Whitney's Gas Carbonizer.

Our attention has recently been directed to a gas carbonizing apparatus, arranged in the form of a neat and ornamental drop light, by the aid of which, it is claimed, a saving of half the gas consumed will be effected, while a better illumination will at the same time be obtained. The gas enters a carbonizing chamber on a stand adapted for the table, from which it has no outlet except through the vertical, perforated walls. In its progress through the latter it passes through fiberous material which is impregnated with benzole, and is thus supplied with sufficient carbon to materially increase its illuminating power. A protecting jacket of incombustible mineral substance surrounds the device, rendering it fireproof, and also serves to protect the hydrocarbon from the injurious effects of a varying temperature outside. Filling is easily and expeditiously effected through very simple means. There is no automatic machinery, and all glass tubes, cocks, gages, etc., are rendered unnecessary by the compactness and simplicity of the construction. Professor Doremus in a report upon the invention states that gas companies, by its adoption in a form adapted for meter attachments, can give the public a light equaling from twenty to twenty-two candle power and make dividends twenty-five per cent larger than at present. By employing the portable form above alluded to, gas consumers, it is believed, can save nearly half their present bills.

The drop lights are of various elegant patterns in plate and bronze, and are so arranged that by turning a key the gas can be changed from common to the carbonized light and *vice versâ*. They are manufactured under the patent of Mr. Samuel Whitney and sold at quite moderate prices by the New England Gas Carbonizing Company, 202 State Street, New Haven, Conn.

Ingenious Engineering.

During the construction of the bridge at Kuilenborg, Holland, says the *Chronique de l'Industrie*, one of the principal traverses, some 465 feet in length, was placed about one inch too far on the piles. This error was rectified in a very ingenious manner. The expansion of the mass of metal was exactly .0394 inches per Fahrenheit degree. At the locality of the work the difference between the temperature of the atmosphere by day and by night was 25° Fah. In the morning the too far advanced end of the traverse was securely bolted down, when during the day the heat of the sun expanded the metal so that the free extremity advanced ·985 of an inch. Then at night the latter end was fastened and the contraction caused a like movement of the opposite free extremity. This operation, twice repeated, brought the traverse into its proper position.

Temperatures at which Calcareous Salts are Deposited.

The temperatures at which calcareous matters are precipitated in boiler waters are as follows:

Carbonates of lime, between.....	176° and 248° Fahr.
Sulphates of lime, between.....	284° and 424° Fahr.
Chlorides of magnesium, between.....	212° and 257° Fahr.
Chlorides of sodium, between.....	324° and 364° Fahr.

In order to free water from these salts, it must consequently be heated to the above temperatures.

MR. CHARLES STODDER writes to explain that when he stated, on page 194 of our current volume, that there was no chemical test for distinguishing flax from cotton, he referred to strictly chemical tests or analysis. The test by dyeing, described by Mr. H. M. Wilder on page 261, was well known to Mr. Stodder when he wrote the first letter.

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.

THE *Springfield Republican* records the death of Rev. P. Shehan, at Hinsdale, Mass., from poison by arsenic, derived from the wall paper of the sleeping apartment of the deceased. The paper was tinted with Paris green. The use of arsenical colors for such purposes should be by law prohibited.

NEW METAL BAND.—For use in collieries, suspension bridges, and for other purposes instead of wire rope, Messrs. Scott, of England, have recently patented a band composed of two or more layers of flat steel, charcoal iron, or other metal, of a suitable thickness and breadth. The layers are each made in one piece and are joined together by brazing, welding, or riveting.

A. K. says: I would not do without your paper for twice its cost now, and I consider that I have lost a great deal by not taking it before.

DECISIONS OF THE COURTS.

United States Circuit Court---Southern District o. New York.

HORSFORD'S PATENT PHOSPHORIC ACID.

THE RUMFORD CHEMICAL WORKS *vs.* JOHN E. LAUER.—SAME *vs.* JOHN HECKER *et al.*

The suit of the Rumford Chemical Works *vs.* John E. Lauer was a suit in equity, brought by the Rumford Chemical Works, a Rhode Island corporation, founded on reissued letters patent granted to the plaintiffs June 9, 1868, for an "improvement in pulverulent acid for use in the preparation of soda powders, farinaceous food, and for other purposes," as assignees of the alleged inventor, Eben N. Horsford. The original patent was granted to Horsford April 22, 1856, and was reissued to the plaintiffs May 7, 1867, and reissued to them a second time June 9, 1868. The infringement alleged in the bill was the making and selling by the defendant of pulverulent acid, in infringement of said reissued patent of 1868.*

The defenses set up were that Horsford was not the original and first inventor of anything which had been made and sold by the defendant, and that the defendant had not infringed the patent. On the question of novelty, the defendant undertook to establish that Horsford was not the original and first inventor of a pulverulent acid phosphate of lime suitable to be used with bicarbonate of soda, as a substitute for ferment or leaven, in the preparation of farinaceous food; and that an acid phosphate possessing all the properties and qualities of the acid phosphate described in the plaintiff's patent was known in the arts prior to the date of Horsford's invention. The article relied on by the defendant as antedating Horsford's acid was what was known as the three fourths phosphate of Berzelius, described in the Hand Book of Chemistry by Leopold Gmelin, volume 3, page 195, published in 1846.*

The conclusion was that the bill must be dismissed.

Before a decree was signed or entered on such decision a motion was made, on the part of the plaintiffs, to open the proofs in the case for further testimony and for a reargument. The ground of the motion was that two of the chemical experts for the plaintiffs did not, in preparing specimens which they produced as specimens of the three fourths phosphate of Berzelius, follow the process of manufacture described in the public works referred to, in that such specimens differed in chemical composition from such three fourths phosphate, and that they boiled the solutions they employed. It was also urged that a three fourths phosphate fulfilling the formula of Berzelius could be produced without the use of heat, and had been so produced by the plaintiffs' expert, and was, when so produced, practically inert and useless as a constituent of a baking powder. The court held that that branch of the case had not been fully developed in the testimony taken for the hearing; that the question as to the effect of using heat in the process had not been gone into to the extent which seemed desirable; that the question as to whether the substance produced as the three fourths phosphate was made by the process of Berzelius was a vital question in the case; and that both parties ought to be allowed to take further testimony as to the novelty of what was covered by the first and second claims of the plaintiff's patent, as affected by the descriptions in the public works referred to, the case to be then heard on the testimony already taken and on the new proofs to be taken.

The case now came on to be reheard.

BLATCHFORD, *Judge:*

"A large mass of further testimony has been taken on all the points involved in the cause, and it has been reargued."

The process of the plaintiffs' specification is fully anticipated by the description of Lawes' process of making a dry superphosphate, which was not before the court on a former hearing. The Lawes process was published in England in 1845, in an article in volume 5 of the *Journal of the Royal Agricultural Society of England*, entitled, "On the action and application of dissolved bones." The article says: "Where calcined bones are used, owing to their containing merely the earthy portions of the bones, and to their being so easily dissolved, a dry superphosphate may be formed." For effecting this Mr. Lawes gives the following excellent and simple directions for making this superphosphate:

"Calcined bones are to be reduced by grinding, to a very fine powder, and placed in an iron pan with an equal weight of water (a cast iron trough such as are sold for holding water for cattle will do). A man with a spade must mix the bone with the water until every portion is wet. While the man is stirring an assistant empties at once into the pan sulphuric acid, sixty parts, by weight, to every one hundred parts of bone. The acid is poured in at once, and not in a thin stream, as commonly recommended. The stirring is continued for about three minutes, and the material is then thrown out. With four common farm laborers and two pans I have mixed two tuns in one day. The larger the heap that is made the more perfect the decomposition, as the heap remains intensely hot for a long time. It is necessary to spread the superphosphate out to the air for a few days, that it may become dry."

The evidence shows that the Lawes process is the same as that of the plaintiffs' patent. In each ground calcined bones are mixed with water and sulphuric acid, the proper chemical action and decomposition are allowed to take place, and the result is a dry product, capable of being pulverized.*

The processes being the same, the natural conclusion would be that the products would be substantially alike. The evidence is to that effect. It shows that the product of the Lawes process, as described, is to all practical intents and purposes the same thing as the product of the plaintiffs' process, and capable of being used for the purposes set forth in the specification of the plaintiffs' patent.*

The first two claims of the plaintiffs' patent are, therefore, anticipated by the Lawes process and product. This conclusion makes it unnecessary to consider any of the other matters discussed on the question of novelty.*

Bill dismissed with costs.

At the same time with the foregoing case the case of the same plaintiffs against John Hecker and George V. Hecker, founded on the same patent, was heard, being argued by the same counsel.

BLATCHFORD, *Judge:*

The patent involved in this case is the same one sued on in the case brought by the same plaintiffs against Lauer, just decided. The present defendants are charged with infringing all four of the claims of the patent. The first two are disposed of by the decision in the case against Lauer.

The third and fourth claims are as follows:

3. I claim the mixing in the preparation of farinaceous food, with flour, of a powder or powders, such as described, consisting of ingredients of which phosphoric acid or acid phosphates and alkaline carbonates are the active agents, for the purpose of liberating carbonic acid, as described, when subjected to moisture or heat, or both.

4. The use of phosphoric acid or acid phosphates, when employed with alkaline carbonates, as a substitute for ferment or leaven, in the preparation of farinaceous food.

The proper construction of the third claim is that it claims the mixing of the acid and the alkali with the flour, in a dry state, and stopping at that point, without applying moisture or heat. In other words, it claims the preparing of self raising flour containing the powder or powders named in the claim, and requiring merely the application of moisture or heat to enable it to be leavened. Against the novelty of this claim the defendants set up a patent granted by the United States May 1, 1849, to John Fowler, assignee of Henry Jones, the inventor. The specification of the Fowler patent says that the invention covered by it consists "in the adding to a certain weight of flour such quantities of alkalines and acids, sugar, and salt, as shall, by the addition of water only, enable such prepared flour to be manufactured into bread, etc., without the use of fermenting matter."*

In view of the Fowler patent it is impossible to see any patentable novelty in the third claim of the plaintiffs' patent. The prepared flour made with the ingredients named in said claim contains the phosphoric acid, or the acid phosphate, as a mere equivalent for the tartaric acid of Fowler's prepared flour; as much so as a screw or a lever is a mechanical equivalent for a pulley. Any pulverulent acid capable, on the application of heat or moisture, of liberating carbonic acid to make the dough porous, is, in the prepared flour, the equivalent of any other pulverulent acid having the like capacity, so far as regards such prepared flour, before heat or moisture is applied. Everything of substantive patentable invention in regard to prepared flour as composed of an acid in dry powder and an alkaline carbonate in dry powder mixed with dry flour is found in the patent of Fowler. Especially is this so in regard to the plaintiffs' patent, in view of the fact that the specification of that patent discloses no mode of practically mixing the ingredients composing the self-raising flour, but merely states that the acid "may be mixed with flour and bicarbonate of soda" as a substitute for cream tartar and tartaric acid "in the practical preparation of self-raising flour."

The fourth claim is a claim to the use of the acid and an alkaline carbonate, as a substitute for ferment in leaven, in the preparation of farinaceous food. This is a claim to the actual use of such acid and alkali in making raised dough. Nothing is shown which anticipates this claim, and the invention covered by it is patentable. Horsford was the first to use phosphoric acid or an acid phosphate for the purpose. It required experiment and invention to find out whether phosphoric acid could be used in place of tartaric acid practically and successfully, and with safety to health. As it is admitted and proved that the defendants have used what is substantially the same acid described in the plaintiffs' patent, mixed with an alkaline carbonate, as a substitute for leaven, in making bread from flour, they have infringed the fourth claim of that patent, and there must be a decree for the plaintiffs for an account of profits as to that claim. The question of costs reserved.*

Whether such infringement has taken place solely by a use of what is named in the fourth claim irrespective of any selling by the defendants of the mixture claimed in the third claim, or whether such infringement has taken place, also, through sales by the defendants of such mixture, in connection with the use of it by the vendees under the fourth claim, will be a question to arise on evidence to be given on the accounting as to the facts attending such sales, in connection with the use by the vendees of the things sold.

William Whiting and *Clarence A. Seward*, for the plaintiffs.
Charles M. Keller, for the defendant.

United States Circuit Court---District of Michigan.

PATENT RAILWAY HAND CAR.—HENRY L. BROWN *vs.* JAMES D. HINKLEY AND HIRAM F. COLE.

Motion for a preliminary injunction to restrain an alleged infringement of a patent right on the bill of complaint and accompanying affidavits. The bill alleges that the invention in question is a new and useful improvement in hand cars for railroads, and that a patent therefor was duly issued to the complainant September 7, 1869, and was reissued in two divisions February 11, 1873. *

LONGYEAR, J.:

The original patent having been surrendered and canceled, all rights under it have ceased, except as they are secured by the reissued patent. Mollit *vs.* Gaar *et al.*, 1 Fish. patent case, 610. Our attention, must, therefore, be confined to the reissued patent.

In order to ascertain what it is that is patented, we look to the claim. Looking at the claims accompanying both divisions of the reissued patent, we find that it covers (as did the original) combinations only, no one or more elements of which are claimed or patented as new. It is a well settled rule of law, which does not need citation of authorities to prove, that the use of any number of the elements of a patented combination less than the whole, or their equivalents, or what is substantially the same thing, is no infringement. The use of two driving wheels of unequal size in the combination covered by division A of the reissued patent is a material element, and those being omitted in the combination used by defendants, and nothing being substituted for them which can produce the same result, there is clearly no infringement of said division A made out by the bill. On the contrary, any such presumption is rebutted by the express allegations of the bill. The bill does however show, *prima facie*, at least, an infringement of the combination covered by division B of the reissued patent. But here we meet insurmountable obstacles to granting the relief by injunction in the present posture of affairs. The combination covered by division B was not covered by the original patent; therefore the complainant's rights and remedies as to it date only from the date of the reissue. As to it complainant is in no better position than if the reissue was an original patent instead. Poppenhausen *vs.* Falke, 2 Fish Pat. Cas., 181.

To entitle a patentee to the extraordinary writ of injunction it is not sufficient for him merely to show his patent and an infringement of it. His right must be further substantiated in one of two ways: First, by a possession accompanied by an actual use and enjoyment of it for a sufficient length of time to afford a reasonable presumption of the acquiescence of the public in its validity; or, second, by a judgment in his favor in a trial at law. The latter, however, is never necessary where the former exists; but I understand it to be essential in all cases that there should be a trial at law in the absence of such use and enjoyment. This has been the rule in England for more than a century, and it has always been the rule in the United States. *

In this case the patent has not been issued quite two months, and confess-

edly complainant has put his rights under it to no use whatever, even during that short time, and there has been no trial at law. I do not think a well considered case can be found in the books where a preliminary injunction has been granted under such circumstances.

The motion for a preliminary injunction is denied, with costs of the motion to the defendants.

Mr. Millard, for complainant.
Mr. Hunt, for defendants.

NEW BOOKS AND PUBLICATIONS.

NOTES ON THE FIRST BOOK OF BENSON'S GEOMETRY. By Lawrence S. Benson. New York: James S. Burnton, 149 Grand Street.

This author is a circle squarer, with at least the usual amount of self-possession; and he devotes as much space to quibbling on Euclid's definitions as Euclid does to his first ten or twelve propositions, which have laid the foundation, for all time, of the science of geometry.

COSMICAL AND MOLECULAR HARMONIES. By Pliny Earle Chase, M.A., Professor of Physics in Haverford College.

The author of this pamphlet discourses on a universal cosmical law. He claims to have found a connection between the wave length of sounds of the highest pitch and those of light, thus establishing a comparable relation between acoustic vibration and the prismatic spectrum.

PROCEEDINGS OF THE CALIFORNIA ACADEMY OF SCIENCES, Volume IV., part 3. Published by the Academy, San Francisco, Cal.

This issue completes the published transactions of the society for the year 1872. The Academy is doing good work in making thorough investigation into the geology, topography, and physical character of our extreme Western States, and exhibits a zeal in the cause that has already been repaid by discoveries of value to science. The zoölogy, botany, conchology, and archæology of California are being exsmined in detail by the Academy, and its labors will probably soon complete a natural history of the State, unprecedented in its extent and accuracy.

VIEWS OF NATURE, AND OF THE ELEMENTS, FORCES AND PHENOMENA OF NATURE AND OF MIND. By Ezra C. Seaman. New York: Scribner, Armstrong & Co., 654 Broadway.

This is a little volume of reflections on the cosmical and vital phenomena of the natural world. Its salient point is doubt of the truth of the vibratory theory of heat, and an assumption or presumption that "caloric is an element," "a subtile fluid," which "permeates everything and combines chemically with nothing." These few phrases will serve to characterize the book and the author, and the courage with which he does battle with Joule, Mayer, Tyndall, and other philosophers.

GEOLOGICAL REPORT OF NEW JERSEY.

Professor Cook, State Geologist of New Jersey, favors us with his annual report for 1872. The mineral resources of the State are succinctly described in this report, and many valuable suggestions as to the best mode of developing them are given. Professor Cook has the happy faculty of presenting a large amount of information in a very condensed form.

THE AMERICAN GRAINER'S HAND BOOK: A Popular and Practical Treatise on the Art of Imitating Colored and Fancy Woods; with Examples and Illustrations, both in Oil and Distemper. New York: John W. Masury & Son, 111 Fulton Street.

This is an elegant little volume of practical and sound information, published by a firm well known in the special industry whereof it treats. It is illustrated with specimens beautifully printed in colors, representing vividly the successful treatment of wood by a skillful grainer. It is a complete and trustworthy manual, and deserves to be read by every one practically interested in the art.

FIRST STUDIES IN DRAWING: Drawings for Little Folks; Drawings of Cottages; Drawings of Heads, Animals, etc.; Drawings of Landscapes. By Benjamin F. Coe, Teacher of Drawing. New York: John Wiley & Son, 15 Astor Place.

We have here five series of drawing lessons, progressively arranged, for the use of beginners and afterwards for more advanced pupils. The copies are admirably drawn and printed, and are accompanied by excellent instruction as to materials and manipulation. The publication is sure to be found useful to many teachers and students.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From April 4 to April 9, 1873, inclusive.

ELEVATOR.—C. Du Bois, Fishkill Landing, N. Y.
MONITOR VESSEL.—L. Goddu, Mass.
PRINTING TYPE, ETC.—W. Shaw, Hollister, Cal.
RAILWAY CARRIAGE, ETC.—W. D'A. Mann (of Mobile, Ala.), London, Eng.
SEWING MACHINE.—J. H. Mooney, C. C. Comstock, Providence, R. I.

Recent American and Foreign Patents.

Method of Flash Signaling by Reflected Light.

Martin M. Kenney, Travis, Texas.—The invention consists in a mirror susceptible of a vertical and horizontal adjustment, and unsilvered as well as uncovered, or one portion of its back combined with an adjustable post for the purpose of verifying the place upon which a flash signal is to be made, and thus enabling the party signaling to be sure that the flash or flashes will certainly come under the observation of the party to be signaled.

Improved Brush.

Philipp Wagner, New York city.—The invention consists in a metallic cap disk, which prevents any ill effect from the shrinkage of the wooden ring that holds the bristles down in the socket. It consists also in forming a rib on the inside of the socket so as to cause the ferule to hold the bristles by a lateral pressure against said rib, thus firmly retaining the bristles in place. It also consists in applying a tapering ferule to the lower end of the handle, to prevent the latter from becoming loose.

Improved Oyster Rake.

Isaac A. Ketcham, Breslau, N. Y.—The invention consists in making the teeth of oyster rakes with an end-bent shank so that they can be readily removed and replaced. It consists also in making the rake bar with a groove for each tooth, so that the same may be prevented from lateral movement when at work. It also consists in a diagonally located plate over each end of the rake bar, to prevent the oysters from slipping off laterally when being borne backward into the bag or net placed to receive them. It consists also in the means employed for holding the lever gage at any position required, and also for holding levers while the rake is being drawn in and over the roller of the boat.

Improved Liquid Measuring Register.

Moritz Springwater, Evansville, Ind.—This invention relates to a new attachment to the tubs or vessels used in distilling or brewing machines with the object of ascertaining and indicating the exact quantity of liquor therein contained during any given length of time, and of thereby preventing or at least detecting fraudulent removal or false returns to the government revenue officers. The invention consists in the arrangement, within such a tub or vessel, of a concealed float or swimmer, which is connected with a locked recording apparatus so as to move the same in ascending, but not during a descent. Every addition of liquor within such tub or vessel will thus be recorded without interfering with the free withdrawal of the liquor.

Improved Machine for Making Spool Blanks.

John T. Hawkins, Salisbury, Vt., assignor of one half of his right to Geo. B. Holt, of same place.—The object of the invention is to furnish an improved machine adapted for turning thread spool blanks and other like articles from a suitable piece of timber, the more important agent for effecting this result being an oscillating reciprocating carriage for supporting and clamping the blank or bar of wood, arranged in such relation to a rotating cutter head as to carry the wooden bar up to the same and hold it till the spool blank is turned, and then into contact with a saw for severing the blank from the bar; the whole mechanism being automatic, and yet adapted to be thrown into and out of gear with the driving shaft.

Improved Hot Air Furnaces.

Dr. Charles L. Pierce, Natick, Mass., has taken out two patents for hot air furnaces.—The invention in the first consists in providing a double and perfectly uniform return draft, thereby greatly increasing the radiating capacity of the furnace and distributing the heat equally over the entire radiating surface. This insures great durability for the radiators which can never be heated red hot. It also consists in so arranging the different flues that each shall be self-cleaning. It also consists in the arrangement of a dust damper, by which the accumulations from the flues are emptied into the ash pit. It also consists in making the funnel project over the air chamber and, by its conical form, reflect the current of heated air back upon the top of the furnace, thus more thoroughly heating said air before it ascends to its destination. The second invention consists in a furnace having an indirect draft from the top of the combination chamber downward through vertical flues to a chamber below the ash pit, and passing thence up though a smoke flue, said flue being all in the air chamber. It also consists in an adjustable smoke flue, adapting the furnace to be properly set, no matter what may be the location which it is required to occupy in the cellar or basement. It also consists in the construction of the base of the furnace so that the smoke flue may be conveniently within the air chamber.

Improved Saw Setting Device.

Johan H. Schmid, Salem, Va.—This invention relates to a new instrument for setting, by one motion, two, four, or more saw teeth, one half into one side, and the remainder to the other. It consists in the application of a series of setting plates to the jaws of a pair of tongs, the plates being laterally adjustable, to be used on teeth that are more or less far apart from each other, and also in the combination of a saw teeth contracting tool with said tongs, the same being in form of projecting ears on the handles of the tongs, with a screw passing through one of the ears. By means of this screw, the tongs can be made to close to a certain distance, to allow the saw teeth to be raised more or less, and evenly, if they have been set too far aside for any one particular object, or if they were not upset quite regularly, the saw teeth being in that case drawn through between the ears.

Improved Hoisting Machine.

Ira Smith, Tomhannock, N.Y.—The object of this invention is to furnish a cheap and simple machine for hoisting weights. A projecting arm and brace are connected together. The post is attached to the side of a building or other fixture by hinges, so that the arm will swing like the arm of an ordinary crane. The hoisting wheel is supported by a shaft near the outer end of the arm. The rim of this wheel is grooved, to guide the hoisting belt. The power is applied to this belt either by hand or by means of a crank pulley, to which one end of the belt may be attached. The other end of the belt is attached to the wheel around which it is wound. A wheel is secured on the arbor which revolves with the main wheel. A belt or rope is wound around the latter wheel as the main wheel is revolved. A grapple is attached to the article to be lifted. The power applied may be greatly increased by means of a crank wheel so that a small boy may raise a heavy weight. This machine may be employed in loading and unloading cars at railroad stations and vessels at the dock, as well as wagons at the farmer's door.

Improved Can Opener.

John J. Reed, Lyons, Iowa.—This invention has for its object to furnish an improved knife for opening tin cans, such as fruit cans, oyster cans, etc. The blade is made with a sharp point, and upon its back, close to its point, is formed a shoulder or notch. The shoulder is intended to keep the blade from being pushed in too far when forcing the point into the can, and also to prevent the blade from sliding forward while making the cut.

Improved Sieve for Separators.

Byron Miller and Major Miller, Lowell, Wis.—This invention relates to a new construction of sieves for threshing machines, and is an improvement upon the Church sieve, patented June 27, 1846. It consists in constructing the sieve so that the tops of the perpendicular and inclined plates are brought into the same plane, while the inclined plates are short, and the adjacent ones in different planes.

Improved Doughnut Mold.

Georg Machlet, Newark, N. J.—The object of this invention is to construct a doughnut mold, by the use of which any desired shape may be given to the doughnuts, and the unsightly irregular form of the same be changed to a regular one, and fancy forms be produced, such as fishes, stars, rings, or others. The invention consists in two rims with handles, which support the two halves of the mold, formed of suitable wire gauze. The molds are connected by guide pins when used for baking the nuts.

Improved Marbleized Composition Stone.

Thomas Carson, Brooklyn, assignor to himself and Thomas F. Attix, of New York city.—This invention consists in the production of mantles, table tops, casings, panels, and the like, of composition stone or marble, with fine marbleized surfaces imitating in appearance the various fine marbles with variagated colors, the said imitation marble surfaces being applied to the surfaces of slabs or other forms of the ordinary composition stone or marble. It consists, chiefly, in first providing the surface to be marbleized with any desired color for the ground color by means of a brush or otherwise; second, immersing the surface to be marbleized in a bath of water, whereon another color—that which is predominate, ground in oil and dammar varnish, mainly the latter—is floated and broken by rapidly stirring, and another veining color, mixed mainly with oil, is also floated and broken; and, lastly, removing the surface and drying the coating so applied, after which a finishing coating of varnish may be applied to render the colors so applied clear and distinct.

Improved Device for Sharpening Scissors.

Thomas Halvorsen, New York city.—The object of this invention is to furnish to tailors, seamstresses, and the public in general, a small and convenient instrument which can be applied to a table or other convenient place for sharpening of scissors and shears. It consists of the arrangement of two files under a certain angle, so that by introducing one blade of a pair of scissors held in position by a strong spring, and sliding the same back and forth, the edge is sharpened rapidly and evenly by the files.

Improved Combined Garden Hoe and Roller.

Edmond Blanchard, Poolesville, Md.—This invention has for its object to furnish an improved tool designed for gardeners' use, which shall be so constructed that it may be used for opening a furrow to receive the seed, covering the seed, and rolling the soil down upon it. The hoe part of the tool designed for opening the furrow, trench, or drill, to receive the seed is formed upon a bend made U shaped, and the ends of its arms are twisted or inclined to give them the proper form for drawing in the soil from the sides of the trench or furrow to cover the seeds. To the arms of the part, at a proper distance from their ends, are rigidly attached two short arms, to the outer ends of which are pivoted the ends of the roller, which, when the arms are being used for covering the seed, follows in the rear of said arms and presses down the soil upon the seed.

Improved Fire Proof Shutter.

Washington M. Vars, Westerly, R. I.—This invention consists in a water tank shutter, and in a water conducting cap to the window or door. The water enters the shutter from the cap, which is opened at the top. The cap therefore acts as a conductor to convey the water thrown against the wall of the building into the shutter. The discharge cock being closed, the shutter may be kept full during a fire. Steam will, of course, be generated, but the water will flow in by its own gravity, while the steam will escape through the opening above. There may be holes through the front plate at the top of the shutter for the discharge of the steam. The windows of the building, therefore, instead of being the weakest and most inviting point for the flames to enter, become the safest part.

Improved Stop Cock.

John P. Mern, New York city.—The object of this invention is to permit the repair of the stop-cock spindle or stem, or its replacement when broken, without requiring the removal or elevation of the cock from or beyond the pipe. The invention consists in fitting into the upper part of the valve or cock a nut, into which the stem is screwed. This nut is confined between two outwardly projecting lips of the valve in such manner that when the stem is broken or requires to be repaired the nut may be turned one quarter of a revolution, and thereby brought with its narrow side between the said lips, so that it can be lifted clear out of the same, thus permitting the bodily withdrawal from the valve of the remaining portion of the broken stem and its detachment from the nut. The nut, and a new or repaired stem, may be replaced without disturbing the valve in the pipe or without opening the pipe.

Improved Breastpin Tongue.

Lewis H. Sondheim, New York city.—This invention consists in connecting the parts of the tongue together by means of screw threads, by which the pin is made detachable, and its full strength secured. The breast pin tongue consists of two pieces—the pin proper, and the plate or hinge socket piece, the latter having an eye by which it is jointed to the inner side of the breastpin by a pintle pin. A screw thread is cut upon the butt end of the pin to fit the hinge socket, and the two parts are screwed together, the screw thread of the pin cutting a thread for itself in the said hinge socket. No heat is required in thus connecting the pin, and the parts may be separated at any time by unscrewing, if desired. This latter feature is not so essential as to avoid the use of heat, although it is convenient to have the pin detachable. This mode of fastening avoids the use of solder or heat and is an effectual fastening.

Improved Locomotive Spark Arrester.

Joseph Gibbs, Opelousas, La.—The object of this invention is to provide efficient means for arresting the sparks and dust which escape from the smoke stacks of locomotive boilers. A hood covers nearly one half of the top of the smoke stack, and rises above it two feet, more or less, with a conical top. It consists of two semicircular recesses, the backs or walls of which are made partly of sheet metal and partly of wire gauze. The air strikes the hood when the locomotive is in motion, which will force the smoke and cinders which rise from the smoke stack into the hood. The smoke, sparks, and dust will slide to the right and left from a central rib, toward the wire gauze. The sparks and dust will lodge against the projecting edges of the gauze and drop by their own gravity into the tank, while the smoke thus purified will find its way through the wire gauze and escape. Water is put into the basin or tank, into which the sparks and dust fall, the sparks being extinguished by the contact. In this manner a railroad train may be relieved of dust and cinders.

Improved Horse Shoe.

Isaac De Mott, Cannonsville, N. Y.—The object in this invention is to so construct the shoes of horses and oxen, and so attach the calks thereto, that the latter may be readily removed for sharpening or renewal without removing the shoe; and it consists in the manner of fastening the calks to the shoe. A lip is turned up from the shoe at the toe and heel, to which the calk is doweled. These lips are turned so as to form angles with the face of the shoe, and the calks are fitted to the angles and are doweled to the lips, while the other branch of the calk is fitted to the face of the shoe, and fastened thereto with a screw. With the lip a single dowel and a single screw is all that is required to hold the calk firmly to its place.

Improved Post Driver.

Isaac V. Adair, Romulus, N. Y.—The invention consists in improving post drivers. Upon the wagon frame is placed a narrow frame resting on false bolsters. The end pieces of the frame are curved on the lower edge, to form a cradle on which the frame can vibrate laterally. Longitudinal displacement is prevented by a tenon on one of the pieces entering a mortise in the false bolster beneath. By a lever and link the rocking frame is connected with the reach of the wagon so that it can, by such connection, be locked at any suitable angle. This is for the purpose of bringing the hammer straight down upon the post, even if the wagon stands inclined. A shaft or windlass is hung in a windlass frame hinged at one end and connected with the spring at the other. By turning the windlass and a cam, which is under a lever, by horse power or otherwise, the lever will be alternately raised and dropped to have the desired effect upon the post under the hammer. The lever can be held elevated while the post is being handled under the hammer. The shaft of the windlass can be made to slide in the bearings and locked by a key and unlocked when the cam is to be drawn out from under the lever, and the operating rope rewound upon the windlass.

Combined Wrench and Grappling Tool.

Simon B. Dexter, Mason City, Iowa.—This invention relates to improvements in a combined pinchers and grappling tool for which letters patent of the United States have been already granted, to the same inventor, the invention consisting in the mode of connecting the shank and wedge shaped slide with the handle, and in the operation thereof. By turning a handle a swivel band is turned, and a swivel and slide is moved up or down on the shank rod. As they slide the long ends of the levers are spread apart or brought together and the jaws adjusted nearer together or further apart, as may be required. In this manner the jaws may be adjusted with the greatest nicety and forced toward each other with sufficient power to make the instrument valuable as a hand vise for many purposes. By suitable arrangements the jaws can be made to clamp and hold an article by simply lifting up the handle. By means of the swivel connection, the jaws are moved and made to compress with great force, and may be adjusted to a bolt head or nut with the greatest precision.

Improved Grapple.

Simon B. Dexter, Mason City, Iowa.—The object of this invention is to provide convenient and simple means for raising or turning stones and other heavy bodies for building or other purposes by means of derricks or cranes; and it consists in an adjustable grappling implement in which the jaws may be adjusted to the size of the stone or other object, as may be required.

Improved Wagon Loader.

Jeremiah Johnson, Iowa City, Iowa.—For loading wagons, carts, and trucks with earth in grading, digging canals, making embankments, and in other work where large quantities of earth are to be removed from one place to another, the inventor proposes to dispense with the laborious and inexpensive method of loading it with hand shovels, by the use of a hoisting and dumping platform in a portable frame and with power hoisting gear, so arranged that he can scrape the earth on the platform by horse scrapers, or draw it on by the scrapers and dump it; then raise the platform, drive the wagon to be loaded under it, and dump the earth from the platform into the wagon.

Adjustable Grain Wheel for Harvester Platforms.

George M. Patten, Auburn, N. Y.—This invention has for its object to furnish an improved device for connecting the supporting wheel of a harvester platform with said platform. An upwardly projecting flange is formed upon the outer end of the platform. To the flange is securely bolted an upright plate, flanged to receive the flanges formed upon the side edges of the face of a block. Upon the face of the plate are formed sets of ratchet teeth, the lower set pointing upward, and the upper set pointing downward. In recesses in the opposite ends of the block are placed pawls, which are held down upon the ratchet teeth by coiled springs. By this construction, one of the pawls holds the block from moving upward, and the other holds it from moving downward. When it is desired to move the block in either direction, the pawl at that end of the block is raised, and a ring or cross head pivoted to its stem is turned across the slot in the said block, which holds the pawl away from the ratchet teeth. To the block is attached the standard of the wheel that supports the outer end of the platform, according as it is desired to use a caster or rigid wheel. This construction enables the platform to be conveniently raised and lowered, to adjust it as may be required.

Improved Children's Swing.

William H. Alcorn, West Hoboken, N. J.—This invention has for its object to furnish a swing for children which shall be so constructed that a child sitting upon its seat and pulling upon a lever can give the seat an oscillating movement. The invention consists of the combination of the levers and connecting rods with the stationary frame and with the seat or carriage suspended by pivoted bars or cranks from said frame. To the sides of the seat or carriage are pivoted the rear ends of the connecting rods, the forward ends of which are pivoted to the levers, the lower ends of which are pivoted to the lower forward ends of the frame. The upper ends of the levers may be so formed as to resemble horses' heads, and may be provided with straps or reins extending back to the seat so that the child, by pulling upon the reins, may give an oscillating movement to the seat or carriage.

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Notes & Queries

E. J. E. asks: What kind of a crucible can I use to melt a few pounds of brass in?

H. R. asks: Will water that has been clarified with alum prove injurious to the health?

D. B. asks: How can I clean out a choked waste water pipe and prevent the smell from rising?

F. S. asks for a simple recipe for a marking fluid for marking boxes with a brush.

C. E. M. asks for a description of the process of galvanizing iron.

J. S. W. asks: What is the best kind of paint for use on tin that is exposed to the weather?

J. E. C. asks: What are the ingredients of a preparation to dip hot steel in before cooling in water, to temper it for drills, chisels, etc.?

Z. T. D. asks: Why is it that hop vines twine around a pole or tree in one direction, and bean vines in the opposite?

N. J. asks: Is there such a thing as an electro-magnetic clock which will keep correct time, and what kind of battery is used for such an instrument?

N. J. asks: 1. How can I lay out a line for a reversible steam engine? 2. Is there any work on the link motion which treats the subject without the use of algebra?

Z. T. D. says: Last winter my apple trees were greatly damaged by rabbits. Some of the trees are peeled completely around the stem. Can I save my trees, and how?

J. D. W. asks for a preparation to be applied to wooden boxes or troughs that shall make them hard and smooth so that any alkali will not penetrate into and raise the grain of the wood.

H. P. L. asks: What is the best material for laying up the arch for a steam boiler? I have one laid in common lime mortar, and it crumbles out. Is blue clay good for the purpose?

H. W. asks: Can any one inform me at what temperature, when regulated by a thermometer, a coiled spring 30 feet long and 2 inches wide ought to be drawn to 10 gage thick to ensure a good temper, one that will not set or break?

G. C. says: 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 end be equally balanced?

G. E. K. says: I am engaged in cutting dog wood timber, and find that it cracks very badly; so much so that I fear it is useless. Can you suggest any treatment by which it can be preserved from splitting? Boiling the blocks in water is valueless. The wood was cut down about the middle of March.

G. D. asks for a formula for finding the length of the braces in a Howe truss bridge, the length of panel and distance between chords being given? The braces are to be cut off at right angles to their own center line, and of such length that their corners shall just touch the chords and tie rods.

J. M. R. says: I would like to enquire what composition would make the best filling between a glass pump chamber and a galvanized iron case (½ inch space). Calcined plaster or hydraulic cement will wash out. A composition of rosin cement and asphaltum is too brittle in cold and too soft in warm weather for ship use.

H. L. asks: 1. If a piston leaks while in motion, would it show in the exhaust or would it cause bumping in the cylinder? 2. What effect would a slight derangement (say a looseness of the jam nuts or any other slight cause) of a slide valve have on an engine while in motion, and would it not give audible evidence of something being wrong?

G. F. wishes some practical individual to describe the process of manufacturing wagon spokes. What is the kind of machinery employed to promote saving of labor, the best mode of polishing, the grade of quartz used, and the length and speed of sand belts? What is the best season of the year for cutting spoke timber? Is there any machinery known that will dress spokes turned in the Blanchard lathe?

S. E. W. says: There is an objection to superheating steam in an upright tubular boiler, on account of the upper end of the flues or tubes becoming red hot, which causes them to leak. Could not steam be superheated in a common horizontal boiler without this fault in the following manner: Take an ordinary horizontal boiler, and run one or more small flues from end to end above the water line, so arranged as not to become too heated until there was a pressure of steam around them?

A. McK. says: I had a very simple and cheap heating furnace in the cellar; it consists of a common strong stove, 14 inches x 3 feet, for wood enclosed with brick 4 inches from the stove all round, with a small opening in front below the door to admit pure air. To heat the rooms above, on each side there is a tin pipe, 6 inches in diameter, from the top of the furnace to a ventilator in the floor of each room. The pipe which conducts the smoke ascends directly above the stove into the hall, and through the upper flat hall, thus serving to heat both halls and the rooms in the upper flat quite comfortably. To prevent too much heat ascending in the smoke pipe, it is necessary to have a tee or four knees above the stove and inside the furnace. The only objection to this simple method of heating is that, when the fuel is being put into the stove, a little smoke escapes through the tin pipes into the rooms. Can you point out some remedy for this or give a simpler method of heating by furnace?

Answers to Correspondents

J. S. asks for a gold dip for brass. Answer: See J. L. B.'s reply to G. W. S., in this column.

J. S. asks what to put into glue to make it adhere to belting. Answer: Try the following composition: Gutta percha, 8 parts, India rubber, 2 parts, pitch, 1 part, linseed oil, 1 part. Cut the rubber in shreds and add the oil, which latter will soften the rubber in a few days. Melt the gutta percha and pitch together, and stir in the rubber solution, apply hot, and press the joined parts tightly together.

G. B. D. asks: 1. Does any body run faster than the water that carries it? What is the principle of the working of the air pump attached to the underground gas machine? Answer: 1. Yes. Boats may be driven by a stream obliquely across the stream, at a faster velocity than the water itself flows. 2. The air pump you refer to is generally of the rotating kind, something like a fan wheel. By its rotation it drives a stream of air through the oil or naphtha; the air takes up a portion of the naphtha, just as a sponge takes up water. And the naphtha inflames at the burner.

J. S. W. asks: What sized feed pipe is required to get the maximum power on an engine, 5x5 and 5 feet from a boiler carrying 100 lbs. pressure, the engine turning a propeller wheel 28 inches diameter? The lead of the wheel is fine. Answer: If our correspondent means to ask what is the proper size of steam pipe for an engine of 5 inches diameter of cylinder, and other dimensions as given, we should say about 1⅜ inches inside, and 1¼ would probably do very well.

J. W. says: I have ten acres of land which are overflowed to four or five feet deep continually, by a creek. A small stream about 1 foot deep and 2 wide falling 1 foot in the 100, runs through this land into the creek. I intend building a bank 6 feet high along the creek to keep the water off the land. Now by what process can I keep this land dry, letting this stream of 1 foot by 2 feet run under this bank into the creek, when the creek is 4 feet higher than the land? How can a sluice be arranged that will keep the land dry under above conditions? Answer: Only by running the sluice back several hundred feet, so as to still give fall enough to carry off its water freely when swollen by heavy rain, we should suppose. Probably no system of pumping would pay in such a case, and our correspondent can best determine the comparative value of the land and of the sluice which he must build.

E. J. E. will probably find the pickle described on p. 283, vol. 28, serve to clean his castings, and a recipe for lacquer in another column of this issue.

A. B. L. says: I contend that there is a point on the circumference of a wagon wheel which stands still when the wagon is progressing. When this point strikes on the surface, it has to stop for a moment until it leaves the surface again; the time that it stops is hardly perceptible, yet it stops, and at the same time the top of the wheel travels twice as fast as the wagon. Answer: We have often answered this question, and our correspondent is correct in his theory.

J. H. K. says: 1. My trade is that of a practical engineer; I have followed it for 14 years as striker, second and first, on high pressure boats, although I was not licensed till 1869, and then as the second engineer. In May, 1872, I applied to the local inspector of this district for a first engineer's license. After asking me some questions about setting boilers and lining engines, he told me that he did not think me competent to take charge of a boat, but that he would give me another hearing in August. He did not come down our way till the following March. I went to him again with an application signed by four out of the six chief engineers there are in this place. He asked me how to set a pair of boilers in a boat. My answer was: Run two lines across the boat parallel with the sheer planks, one at the after and one at the forward end of where you wish your boilers to come. He next asked me about lining up engines, and acknowledged that my way would do, but that it was a very old way. His next question was this: If, after a boat has run some time, the slides should have gone down below the center of the rod on the inside only, or the outer edges gone up, how would you get them in line again? My answer was that I would run a line through the center of the cylinder to the center of the shaft; then run two lines, one at the after and one at the forward ends of the slides, across the center line, and then true the slides to those lines. He contends that I am wrong, and refuses to give me license on the slide question. I have asked other engineers; they say that I am right. I wish you would give me your opinion. There are others besides myself who think that the Inspector is prejudiced against the concern I work for, hence the trouble in getting my license. Aboard the opposition boats, they are short of licensed engineers, and he has given licenses to men that have not been on the river more than eight months, putting them in this position, as I hold, contrary to law, for I believe that the law says that a man has to be three years on a boat before he can get a license. You may think that I should have complained to the Supervising Inspector, but he is 500 miles from here, and I would rather have your opinion. 2. What book should I get that will give me the rules for putting machinery in light water steamers? Answers: 1. Probably the Inspector may have thought that the replies were not full enough. Our correspondent would get his guides right, however. Who is the Inspector who lends himself to such injustice as that complained of? It is the duty of our correspondent to inform the Secretary of the Treasury and the Supervising Inspector General of the facts. 2. Get Bourne's "Catechism of the Steam Engine."

N. P. M. asks how to measure the velocity of the wind with accuracy. Answer: The velocity of the wind can be measured by the use of the anemometer, an instrument sold by dealers in philosophical apparatus for that purpose. It can be obtained with considerable accuracy either with this instrument or by measuring its pressure against a flat surface and deducing its velocity by the method of calculation given recently in these columns.

J. V. says: 1. I have seen in your columns a process for removing incrustation from steam boilers. The substance to be used is a solution of sal soda and petroleum, and is to be put into the boiler after cleaning. Then the boiler is to be filled and the oil, floating to the top of the water, comes in contact with every plate of the boiler. What I want to know is, must not this oil be blown off, before steam is generated in the boiler, and might it not prove dangerous to some extent by the heat of the steam if left there? 2. I would also like to know how a steam gage is tested, so as to ascertain its correctness. 3. What is the reason that the parts which are operated on by steam in the gage become rusty, and the gage consequently becomes useless? Answers: 1. The oil need not be blown out. Use heavy lubricating oil, not naphtha or benzine. No danger of exploding the boilers need be apprehended. 2. Steam gages are tested by comparison with standard gages, which are originally checked by a column of mercury and frequently themselves retested. 3. Because the spring is usually of steel, and steam or moisture are very apt to get access to it.

J. G. says: 1. On page 200 of your current volume, you say that Congress has passed a bill authorizing the President to cause such experiments and such information to be collected as, in his opinion, may be useful and important to guard against the bursting of steam boilers. I wrote to Hon. C. Sumner, on the subject and got no reply. I called on our representative, Mr. Hoar, and he informed me there was no such bill passed by Congress last session. I would like to know how the matter stands. 2. I have three different kinds of boilers that have not made their appearance in the market yet; will you inform me how I can introduce them? Answers: Write to the Secretary of the Navy, to whom, we are told, is intrusted the charge of the matter referred to. 2. To introduce a good boiler promptly and satisfactorily, get some well known and intelligent manufacturer to take hold of it, proving its good qualities by exact methods of test in presence of well known experts, publishing the results in the SCIENTIFIC AMERICAN and its contemporaries among the scientific and engineering journals, with illustrated descriptions where possible. See that every boiler built makes a good record and that the public are made aware of it.

L. W. asks: Does a magnet constantly in use, retain its power for any length of time? Answer: A magnet, kept in use, carrying a constant load, will probably never lose its power of carrying that load. Its strength may be increased to the point of maximum possible strength, or of saturation, as it is termed, by carefully and very slowly increasing the weight carried. It can even be given greater strength, or supersaturated, but the simple removal of the "keeper" or armature will destroy all the surplus strength. Where the use of the magnet involves the frequent removal of the armature, the magnet will gradually lose its strength, if not finally become devoid of magnetism.

R. H. says: I am building a small steam engine and boiler. The size of cylinder is 1x1¼ inches, with a common slide valve. Would it be scientific to connect the governor with the valve stem in such a manner as not to allow the valve to move full stroke (when the engine runs too fast) which would not open the ports to the full, and would not allow the steam to fill the cylinder quite as readily? Would it work well that way? I can fix it in that way much more easily than I can shut off the steam with another valve, moved by the governor. I would like to ask a great many more "bo

questions," but your time must be occupied with other things. Answer: The regulator would probably answer very well, arranged as proposed. We are always pleased to have our younger readers ask intelligent questions, and shall always be glad to reply to them when the subject is one that will interest our readers.

T. A. P. says: On page 74 of your current volume, P. Bros. give you the proportions of their safety valve, which were as follows: Lever, 22½ inches; from center of valve stem to fulcrum, 2½ inches; diameter of valve 2½ inches; action of lever 20 lbs., (meaning, I presume, weight on lever.) He asks you to estimate at what pressure the valve will blow off. You answer that "the pressure on stem of safety valve must be 42×22½ ÷2½=378 lbs. ÷ the weight due to the lever." This is all correct enough, as far as putting the figures together is concerned. But where do you get the factor 42, which goes to make up the result? Of course, you know that as the long arm of a lever is to the short, so is the power to the weight; or you can reverse the language, and have it the other way. Then the result of the preceding combination of figures should be: 20×22½÷2½=180 ÷ weight due to the lever; but you make it 378 by the use of your 42, and I am at a loss to know where it comes from. But again, you contradict yourself on page 106, in answer to McD., who asks for a rule to locate the weight of safety valve, to keep in a given pressure. You answer: To find the total length of safety valve lever for a required maximum pressure, multiply the distance from center line of stem to pin on which the lever is hung, and divide by weight of suspended weight. Of course, this advice should be: Effective area of valve x pressure of steam x distance from fulcrum to valve divided by weight on lever. But you give no rule for estimating the pressure of lever of a given weight on valve; and this is what I want to get at. For example, if a safety valve lever is 40 inches in total length, weight 16 lbs., distance of center of valve stem to center of fulcrum 3½ inches, what will be its pressure in lbs. on the valve? And again, if the above mentioned lever is used on a valve 3 inches in diameter, at what distance from the fulcrum will I have to place a weight of 34 lbs. to keep in a pressure of 55 lbs. to the square inch? I have a way of estimating the pressure due to the weight of a lever. But a safety valve of the kind and proportions I mentioned blew off, by a new steam gage, at 15 lbs. less than I anticipated. And I want also to say that the gage did not indicate a bit of steam in the boiler, when there was actually enough in it to blow the whistle in a lively manner; and on raising the safety valve there was quite a rush out of steam. Was the gage made properly, or was the result due, in some way, to the air confined in the boiler? These difficulties may seem very simple to an expert, but they are somewhat perplexing to a novice like myself. Answer: There was an error in printing the first question referred to. We have not that communication at hand, but presume that 42 pounds was the weight suspended from the lever, and 20 pounds the pressure due the "action of the lever," and that our reply was correct. In the second case, an omission occurred, as indicated by T. A. P., the words "into pressure of steam" should be supplied. To determine the additional pressure due the weight of safety valve lever, balance the lever across a sharp edged or rounded support, and measure the distance from the point at which it balances—the center of gravity—to the pin. Multiply this distance by the weight of the lever and divide by the product of the effective area of valve into the distance of the valve stem to the pin. The quotient is the pressure per square inch due to the weight of lever unloaded. In case supposed, if the lever were straight, the center of gravity would be at its middle point, and this pressure would be 20×16÷3½=91,⅑, which quantity, divided by the effective area of valve, would give the resulting pressure per square inch. The difference noted by our correspondent may be due to the same cause as that referred to at page 74 of our current volume, and not to error in his estimate. Unless a valve is made with a very narrow seat, it is often difficult to determine ecurately its "effective area."

P. B. says, in reply to G. B. L., who asked if the number of teeth in a saw can be reduced with good result: I have run saws in soft pine, oak, walnut, and hard or southern pine, and, according to my experience, reducing the teeth would be bad business; yet it depends on what kind of timber you want to saw. The best rule among the mills sawing hard pine is a tooth for every inch of diameter, but that becomes too many when the saw wears smaller. From 40 to 48 teeth for a 56 inch saw is very good. A fine toothed saw will run longer without filing than a coarse one, but it takes longer to file it; a fine one will run on a stronger feed also. I have one saw now that once had only 26 teeth; the saw was 56 inches. I doubled the teeth, and the change is beneficial in every respect.

J. L. B., says, in answer to G. W. S., who asked what preparation is used for the bright yellow lacquer on brass castings: Take of seed lac, 6 ozs., amber or copal, ground on porphyry, 2 ozs., dragon's blood, 40 grains, extract of red sandal wood obtained by water, 30 grains, oriental saffron, 36 grains, pounded glass, 4 ozs., very pure alcohol, 40 ozs. To apply this varnish to articles of brass, expose them to a gentle heat and dip them into the lacquer. Two or three coatings may be applied if necessary. The lacquer is durable and has a beautiful color. Articles varnished in this manner may be cleaned with water and a dry rag.

J. P. H. says, in answer to W. E. G., who enquired as to the formation of minerals: I would say that you are right according to certain kinds of rocks, minerals, etc., and that your friend is right about some others. Take mineral coal, for instance; it is formed from the *debris* of forests, in swamps and elsewhere, wherever there has been any immense quantity of vegetable matter. This latter has slowly accumulated in vast beds which have in time changed from peat to coal. The limestones are mostly formed by vast accumulations of animal remains, such as shells and bones of extinct animals. The sandstones are formed by the sediment that has been carried down from hills and mountains by water, and deposited in various places to all thicknesses; they are simply the fragments of rocks, both worn and torn off by the action of water; there are seldom found, if ever, any fossil remains in them. Granite and kindred rocks are the only kind which were the foundations of all the other rocks, and in them are found all the best and purest of our minerals, such as the magnetic iron found at Port Henry, N. Y., the copper found at West Farley, Vt., and the gold in California. I would advise both correspondents to read up Dana's "Manual of Geology," or Lyell's "Elements of Geology," both standard works.

J. P. H. replies to N. J. J., who asked how to stock his lake with fish: Try the common perch, rock bass, Saco bass, and lake trout, with plenty of little minnows, shiners, and red fins, for bait and to feed the other fish on. Mr. Seth Green could probably give you all the necessary names and information about the right kinds of fish to plant in your lake.

G. A. H. says, in reply to E. C. M., who propounds the following problem: "A body weighing 5 lbs. descends vertically and draws a weight of 6 lbs. up a plane whose inclination is 45°. How far will the first body descend in 10 seconds?" In solving this problem we shall find in the first place the velocity which is generated in each second, that is, the acceleration; we shall then find the space passed over in 10 seconds by the well known rule that the space passed over in any time is equal to one half of the product of the acceleration into the square of the time. It is now well understood that the proper measure of the moving effect of a constant force which acts on a body, whether at rest or in motion, is the product of the mass of the body into the acceleration; or, as we may express it, force = mass × acceleration. In applying this relation to the problem before us, we must remember that the pound is a unit of mass, not of force, being the quantity of matter in a certain platinum weight kept in London. In this case, then, the mass moved is equal to the sum of the masses of the two bodies, that is, to 11 lbs. We must now find an expression for the force. For brevity, call the body weighing 5 lbs. P, and the other body Q. It is clear that a certain part of the weight of P is neutralized by holding Q in equilibrium on the inclined plane, and that the accelerated motion of P (together with Q) is wholly due to the action of gravity on the remainder of P. By the law of equilibrium on an inclined plane (power : weight :: hight : length) the portion of the weight of P which is required to balance Q is equal to 6 + 4/5 = 4·243 lbs., very nearly leaving an unbalanced weight of 0·757 lbs. to produce acceleration. We are here using the word pound in its secondary and very common sense of a unit of force, or rather of pressure. In this sense it is often called the statical or gravitation unit of force. But the primary meaning of the term is a certain unit of mass, and when employed, as is often convenient, to denote a unit of force, it denotes the pressure produced by the action of gravity on the unit of mass, or pound of matter. The unbalanced pressure, therefore, of 0·757 lbs. is that produced by the force of gravity acting on a mass of 0·757 lbs., and this force is measured in the usual way by multiplying the mass moved by the acceleration due to the gravity, or 32 feet per second, nearly. This gives as the measure of the force 0·757×32 = 25·224. Therefore the value of the acceleration actually given to the moving system of the two bodies is equal to 25·224 ÷ 11 = 2·293 feet per second. The space passed over in 10 seconds will be ½×2·293×100 = 114·65 feet. In general, if P and Q denote the masses of the two bodies, g the acceleration of gravity, a the angle of inclination of the plane, the space passed over in t seconds will be equal to ½[(P−Q)sin.a]÷(P+Q)×gt². In fact, the conditions of motion are very similar to those in Atwood's machine, the only difference being that, in the present case, the motion of one of the bodies is rendered less simple by taking place on an inclined plane. We have supposed the inclined plane to be perfectly smooth. In point of fact such planes do not exist; all are more or less rough, the degree of roughness being expressed by a quantity called the coefficient of friction. If u denotes the coefficient of friction in any case it may be easily easily shown that in t seconds of time: Space passed over = ½[P−Q(sin.a+u cos. a)]÷(P+Q)×gt².

G. H. H. replies to H. M. who asked what was the cause of his journals heating: The tendency of the saw and mandrel is to move forward in the direction of the cut; and of the opposite end, to retreat. In other words, the mandrel would turn horizontally upon some undetermined center were it free from its bearings, like a gyroscope. I have a saw upon short steel mandrel, well balanced, and run by belt at an angle, down and back from the cut; this relieves the journal next to the saw, but keeps the opposite journal hot, and we are unable to prevent it; this journal is also constructed with ¼ more length of bearing surface than the other. H. M. runs his saw mandrel by friction. The driver, we would suppose to be either back of or beneath the mandrel, which will account for a hot journal next to the saw. If he must run his saw by friction, let him shift his driver as close to the free end of mandrel as possible, and add from ¼ to ½ more length to the box next to the saw. Or run by a belt, with the pulley as close to the saw as the business to be done will allow.

J. B. J. replies to W. H., who asked about a coöperative society, that the Fall River Working Men's Coöperative Association, Mass., is in operation.

A. H. G. replies to I. M. I. who asked what will be the resistance of the atmosphere to a flat surface containing one thousand square feet moving at the velocity of thirty miles per hour: The resistance increases as the square of the velocity. A flat surface of one square foot, moving in a still atmosphere at the rate of one mile per hour, is met with a resistance of 1 ×1×·005 = ·005. At thirty miles an hour, we proceed thus: 30×30×1000×·005 = 4,500 pounds, equal resistance of 1,000 square feet. Am I correct, Messrs Editors? Answer: Our correspondent is right, according to Smeat. The maximum pressure of the wind is as great as 55 pounds on the square foot of flat surface, which figure is used in calculating the required stability of tall chimneys and lighthouses. For a cylindrical shaft half the latter is taken.

E. A. G. says, in answer to T. M. S., who asked about the force required to burst out the head of a barrel: I would say that a barrel, as described, would probably burst with 18 or 20 lbs. steam pressure. A well made barrel, ⅞ inch staves, and 1 to 1¼ inches heads, of 28 to 32 gallons capacity, will bear 12 to 15 lbs., and from 45 to 48 gallons capacity, from 10 to 12 lbs. Strength is given mainly by thickness of head, which generally bulges out. Hoops, if good, rarely burst. T. M. S.'s barrel, having 1⅛ inch heads and small diameter, would stand more than the average. The above figures are approximate, though I have burst many a barrel when steaming, preparatory to using for either cider or vinegar.

E. V. says that W. E. G., who believes that a rifle ball is at its highest velocity when it leaves the muzzle of the barrel, is right, and that its speed continually decreases till it comes to a state of rest.

O. B. V. says, in reply to C. E. C., who asked how to anneal gold: After the gold is melted in a crucible, flux it with corrosive sublimate; if it does not work the first time, keep melting until it does.

P. T. says, in reply to L. C. M., who asked how to make bright green pickles: If hard, green cucumber pickles are wanted, salt down in dry salt, putting a layer of salt in a jar, then a layer of pickles, and so on until full. This will produce pickles as green as they can be made, but it is more costly than making brine. If you have stock to feed the salt to, it will be better than the old process. Souring may be done in the usual way. Of course the above process is not calculated for manufacturers for market.

C. M. D. replies to F. S. T., who asked how to make a blackboard on a wall: Make a glue size and go over your wall, then take shellac varnish and lamp black mixed to a thin consistence.

G. W. says that T. A. B., who asked how to soften leather pump valves, should use castor oil freely, and manipulate with the hands till soft. Old boots and shoes can be made as soft as new leather in this way.

G. W. says that J. T. T., who asked how to hang wall paper on a horizontal ceiling: Cover your ceiling with cheap cotton cloth or print, stretched tight and tacked at the edges. Then paper on the cloth in the usual way. Any width of paper will do.

J. T. B. S. says: As many of your correspondents have enquired about machinery for steam launches, I will give some particulars of English practice. The following table gives the sizes of steam launches built by Yarrow and Hedley, of London, who make them a specialty, and build hundreds of boats for use in all parts of the world.

Length of launch.	Beam.	Horse power (indicated).	Draft of water.
23 ft.	5 ft. 3 in.	5	2 ft.
30 ft.	6 ft.	7	2 ft. 3 in.
37 ft.	6 ft. 6 in.	12	2 ft. 6 in.
43 ft.	8 ft.	16	2 ft. 9 in.
50 ft.	9 ft. 6 in.	30	3 ft.

John Penn & Son, of Greenwich, use about the same sizes. More speed can be had by sacrificing room, but the above is standard practice. When light draft is imperative, twin screws are used, in which case each screw has its own independent engine; but in ordinary practice single screws and single engines are employed. I have no data in regard to sizes of screws for the above boats, and know no better rule in designing than those on page 585 of Haswell's "Engineering." It is better to have the screw too small than to have it so large as to overload the engine. The engine illustrated on page 38, current volume of the SCIENTIFIC AMERICAN, is well designed, but there is too much complication. A single engine is much better on the score of simplicity, and can be built for about one half the cost of a double engine of the same power.

F. A. K. says that T. K. B., who asked how to prevent scale from forming on polished steel when hardened, should try the plan suggested to H. B., on page 75 of our current volume.

J. N. S. says that A. W. P., who asked how to soften an oilstone, should try boiling it to extract the oil, if that be the cause of its hardening. He should try a soft water stone, and use oil on it as on a regular oil stone. "I have one of that kind, and it works well. I use carbon oil on it."

N. L. T. says that R. W., who asked for a remedy for screws working out, can always prevent it by cutting a series of notches across the thread, around the screw, in such a manner that the thread will be formed into a series of teeth similar to those of a ratchet wheel. As the screw is inserted, these teeth offer no resistance; but on being turned the opposite way, they catch against the fibers of the wood and prevent the screw working out.

W. A. B. says, in reply to Z. A. S., who asked how to drill holes through glass without a diamond: I have drilled through soft glass, at a tolerably slow speed, with a common drill wet with kerosene or spirits of turpentine; but a better way is to drill with a lead or copper drill, if the hole is to be small, or with a brass or copper tube fed with oil and emery, if large. Do not run it too fast, and use gentle pressure. For the tube, use a wooden support for the bearings and a pulley fitted upon the tube for a driver. Put oil and emery inside, and any arrangement for forcing it down will suffice. It is to be understood that the tube is placed upright; it should have notches cut in the end to catch the emery.

G. W. says to J. H. L., who asked for opinions on his mode of building: If you build your house as proposed, you will have damp walls in wet and frosty weather. But if you put your brick edgewise, leaving an inch space between brick and weatherboarding, and also an inch space between the plaster and brick, lathing and plastering as usual, you will have a warm house with dry walls.

ERRATUM.—On page 282, fourth column, of our last issue, there is an obvious misprint in the answer to F. O. W.'s question. The fractions should be ½×½×½×½×½ = 1/32.

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 New Patent Law in England. By A. V. N.

On the Pulsometer. By J. H. H.

On the Bars at the Mouth of the Mississippi. By C. G. F.

On the Manufacture of Combs. By G. F. B.

On the Power of the Tides. By A. H. E.

On Creeping Rails. By C. O.

On a Newly Discovered Novaculite. By J. M. S.

On Distinguishing Fibers. By C. S.

On Aniline Inks. By G. E. D.

On the Proposed Panama Ship Canal. By S. T. F.

On Saving Life from Shipwreck. By F. D. and by A. R.

On the Wreck of the Atlantic. By J. L. G.

On Steam Boiler Explosions. By B. W.

On Water as Fuel. By W. H.

On the Ocean Tides. By W. H. P.

On the Dimensions of Ocean Steamers. By W. C.

On Terrestrial Retardation by the Ocean Tides. By T. W. B.

Also enquiries from the following:

B. A. C.—M. R.—W. T. V.—J. T.—R. A. B.—J. F. S.—C. R.—A. S.—O. F. C.—A. S., Sr.—W. B. C.—P. Q. L. R.—H. J.—B. & C. H.—A. D. L.—E. N. S.—M. H.—B. W.—P. S.

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

April 8, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Acid phosphates, Storck & Lyte	137,695
Addressing machine, F. A. Darling	137,599
Alarm, burglar, J. F. Coppock	137,582
Animal matter, treating, W. C. Marshall	137,699
Auger, earth, I. M. West	137,744
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Stove draft regulator, Sprague & Osgood 137,632
Sugar cane, extracting juice of, Wilkinson, *et al.* 137,746
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Tin scraps, tin from, H. Panton 137,712
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Trap, insect, J. W. Anderson 137,588
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Valve, safety, E. C. Fernald 137,540
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Vehicle recorder, Guebhard & Tronchon 137,676
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Wagons, seat for, C. H. Howell 137,681
Wagons, unloading, J. K. Wilson 137,584
Warping stop mechanism, Follensbee & Entwistle 137,605
Washer, steam, C. A. Bradley 137,591
Washing machine, P. A. Downer 137,661
Water wheel, H. B. Weaver 137,580
Water wheel, turbine, W. H. Elmer 137,666
Well curb, N. H. Lindley 137,555
Wells, device for cleaning, W. F. Brown 137,529
Windmill, J. B. Park 137,565
Windmill, E. S. Smith 137,729
Window platform, portable, G. H. Peabody 137,714
Window, waterproof, B. Smith 137,572
Wire, etc., cutting, C. M. Spencer 137,630

APPLICATIONS FOR EXTENSIONS.

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

24,734.—PAPER BAG MACHINE.—W. Goodale. June 25.
24,748.—PAINT CAN, ETC.—J. W. Masury. June 25.
24,773.—HOLLOW AUGER.—A. Wyckoff. June 25.
24,905.—PIANOFORTE.—J. U. Fischer. July 9.
25,191.—PAPER BAG MACHINE.—W. Goodale. August 6.

DISCLAIMER.

23,625.—CANAL LOCK GATE.—C. W. Williams.

EXTENSIONS GRANTED.

8,654.—IRON FENCE.—H. Jenkins.
21,642.—OBTAINING FIBRE FROM FELT.—J. F. Greene.
23,643.—DISINTEGRATING FELT.—J. F. Greene.
23,972.—COOKING STOVE.—P. P. Stewart.
23,625.—CANAL LOCK GATE.—C. W. Williams.
23,598.—SCREW PROPELLER.—J. Montgomery.

DESIGNS PATENTED.

6,558 to 6,560.—CARPETS.—R. B. Campbell, Lowell, Mass.
6,561.—CARPET.—R. Carlton, Liversedge, England.
6,562 to 6,571.—CARPETS.—J. M. Christie, Brooklyn, N. Y.
6,572.—TRIMMING.—J. B. Clarke, Brooklyn, N. Y.
6,573 & 6,574.—PRINTING TYPES.—J. M. Conner, N. Y. city.
6,575 & 6,576.—CARPETS.—J. Hamer, Lowell, Mass.
6,577.—FORK HANDLE.—M. H. Mossman, Waterbury, Ct.
6,578 & 6,579.—CARPETS.—C. A. Righter, Philadelphia, Pa.
6,580.—PLANT STAND.—J. R. Robertson, Syracuse, N. Y.
6,581.—CARRIAGE POLE.—A. Searls, Newark, N. J.
6,582.—BOTTLE STAND.—T. P. Spencer, Morrisania, N. Y.
6,583.—PAPER FILE.—E. J. Steele, New Haven, Conn.
6,584.—HANDLE SOCKET.—J. S. Bay, East Haddam, Conn.
6,585.—KNIFE, ETC., HANDLE.—W. Rogers, Hartford, Conn.

TRADE MARKS REGISTERED.

1,199.—HAMS, ETC.—W. G. Bell & Co., Boston, Mass.
1,200.—BRANDY.—Cazade & Crooks, New York city.
1,201.—GLASS WARE.—T. G. Cook & Co., Philadelphia, Pa.
1,202.—PAINTS, ETC.—Harrisons & Co., Philadelphia, Pa.
1,203.—BAKING POWDER.—J. H. Lippincott, Pittsburgh, Pa.
1,204.—BITTERS.—J. Cleve, Boston, Mass.
1,205.—TRIMMINGS.—Erskine & Co., New York city.
1,206.—MEDICINE.—J. H. Hopkins, Providence, R. I.
1,207.—WHISKY.—Morehead & Co., St. Louis, Mo.
1,208 & 1,209.—RUBBER PAINT.—Rubber Paint Co., Cleveland, Ohio.
1,210.—LOZENGE, ETC.—Townsend & Co., New York city.

SCHEDULE OF PATENT FEES:

On each Caveat	$10
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On appeal to Commissioner of Patents	$20
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On application for Extension of Patent	$50
On granting the Extension	$50
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VALUE OF PATENTS

And How to Obtain Them.

Practical Hints to Inventors

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

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

HOW TO OBTAIN *Patents*

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

How Can I Best Secure My Invention?

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

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

Preliminary Examination.

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

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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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, New York, for full particulars.

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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 fomer, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row, New York.

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

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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.

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

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

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

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

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

Foreign Patents.

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

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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.

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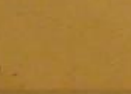
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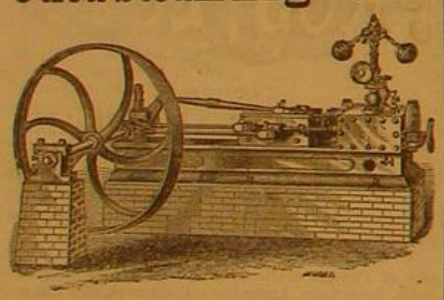


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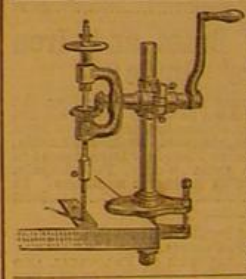


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SCIENTIFIC AMERICAN

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

Vol. XXVIII.—No. 20. [NEW SERIES.] NEW YORK, MAY 17, 1873. [$3 per Annum, IN ADVANCE.

IMPROVED BOLT HEADING MACHINE.

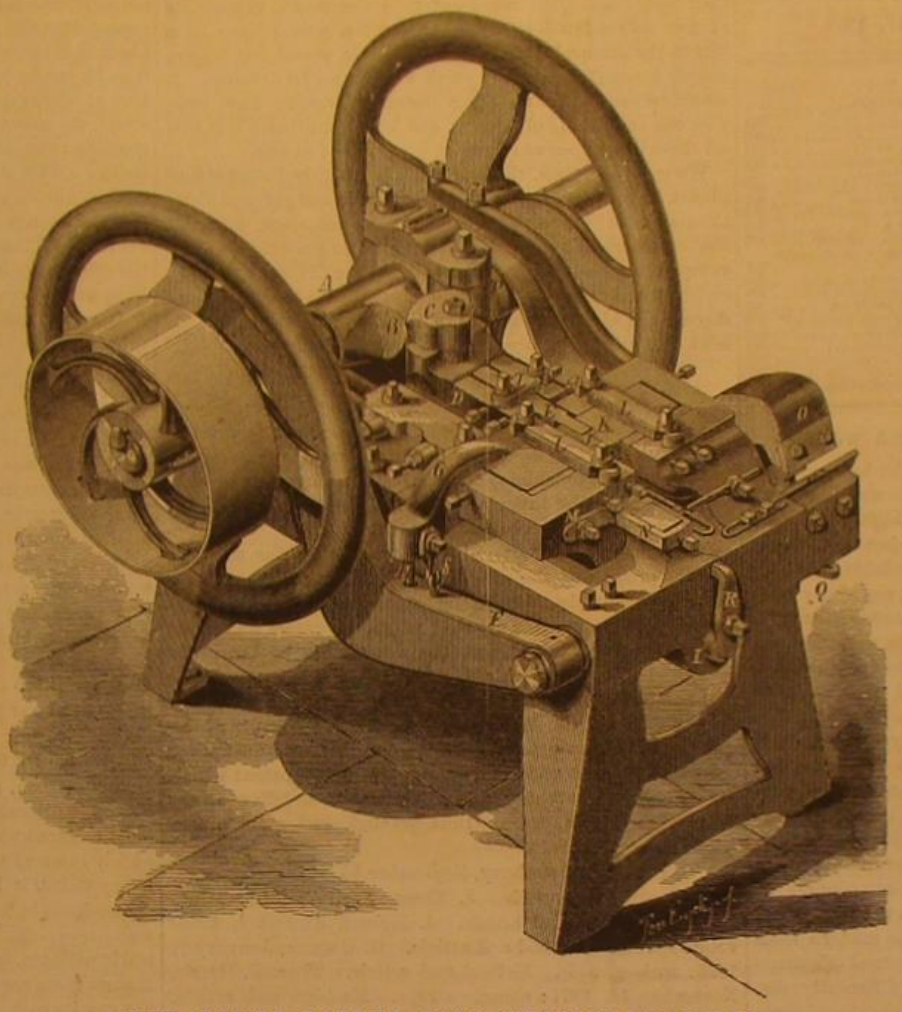
We present herewith an engraving of the Lewis bolt heading machine, an apparatus which is claimed to be capable of making square, hexagon, T, button, countersunk, and, in fact, any variety of bolt head; also boiler rivets, splice bar bolts, carriage bolts and spikes, etc., of any dimensions, from half inch to 20 feet long, or from three sixteenths to one and a quarter inches in diameter. Further, it is stated that the invention, for any length of bolts of the same diameter, accomplishes its work without change of tools; that it can produce a hexagonal or square headed bolt with the same tools, or every alternate bolt may be square or hexagonal as desired, without regard to length, or headed in assorted lengths without the slightest alteration of implements.

In our illustration, A is the driving shaft, running upon bell metal bearings and supporting the two heavy fly wheels, as shown. B is a cam upon said shaft, which takes against the block, C, which actuates the heading ram, D, containing the heading punch or tool, E. Another cam on the shaft, A, which is not represented, lifts the side lever, F, by which the grip lever, G, is moved through the medium of the toggle pin, H. The grip lever or movable die bed, G, vibrates on two steel center pins, one of which is shown at I. J and K are the dies for gripping the blank, and in which the bolts are formed or squared. L L L are clamps which hold said dies and the heading tool. M is an inclined plane or wedge-shaped rubbing block, by which the strain or shock of the heading is thrown on the bed of the machine. N is a steel band for taking up any wear or slack of the last mentioned portions. At O is the shear lever operated by the eccentric, P, and provided with a gage at Q. R is a clamp for taking up the wear of centers, and the hook, S, serves to connect the grip and side levers, and thus insures the opening of the dies.

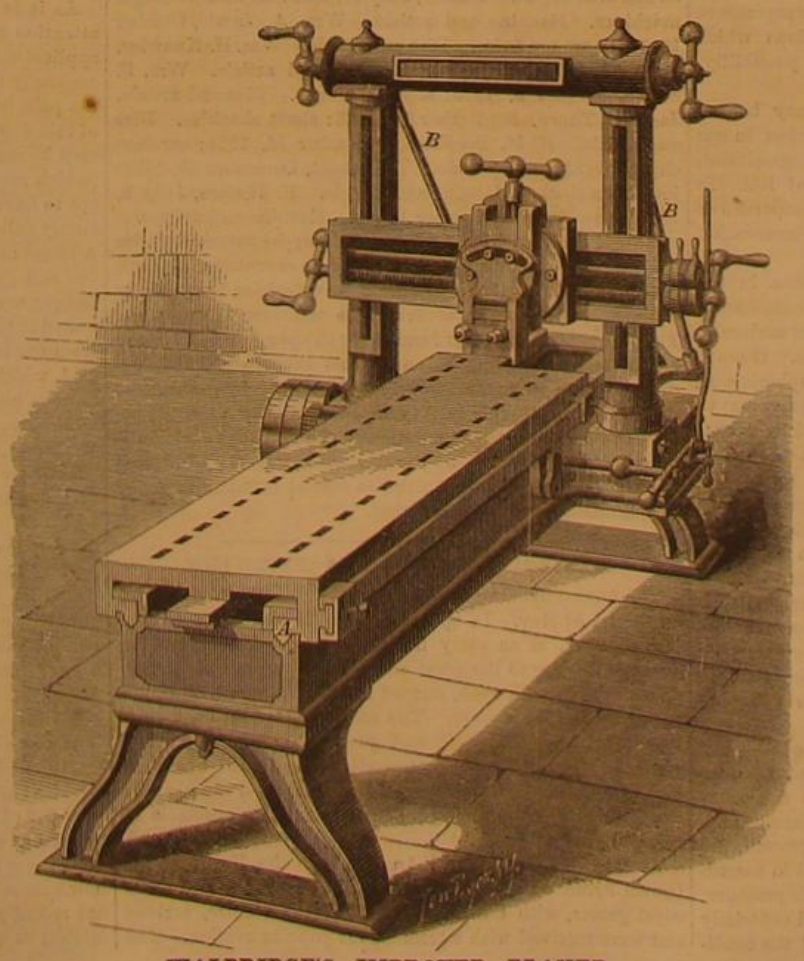
The machine is driven by a six inch belt and at about 100 revolutions per minute. The heated blank, on being drawn from the furnace, is placed between the dies. The movable die, J, actuated by the lever, G, then closes and firmly holds the blank until the head is formed by the heading ram, which is immediately set in motion. This operation completed, the same cam that brought the heading block forward strikes a tappet and carries it back. The dies open, the bolt is released and falls into a receptacle placed below; for countersunk, round button heads or rivets, the work is now done. For square or hexagonal heads, the blank is turned, one fourth for the former and one sixth for the latter, for a few turns, when a perfect head is forged, no flash or burr remaining to be dressed off. Very short bolts are headed on the rod and cut off to length by the shears.

Among the advantages claimed for this machine are the length of time which it can be run without repairs, and the provisions made in its construction to prevent breakage in event of an undue strain. It will be noticed that the toggle, H, bears the whole force of the grip, and should the operator, by accident or carelessness, get a blank foul in the dies, the toggle will bend and yield before a casting will break. It can be straightened and replaced, however, in a few moments, as it is but a piece of rough seven eighths round iron, with the ends slightly rounded, and of about four inches in length.

The castings are well fitted up with gun metal and steel, and the metal parts subjected to friction are chilled. The dies are of steel and are so constructed and held in position that they can be dressed down a great number of times. There are no cogs or springs, by the absence of which it is claimed that increased efficiency in many particulars is secured. No special implements are needed for the fabrication of the tools. As regards the amount and quality of work the apparatus is capable of performing, we are informed that, in ten hours, it makes 1,800 square ended bolts of one inch, or from 5,000 to 6,000 of one half inch in diameter, with other sizes in proportion. Experiments at the Cincinnati Exposition proved that one inch bolts, ten inches in length, could be turned out at the rate of eight per minute, or about as fast as they could be heated. For further particulars address the manufacturers, Messrs. Lewis, Oliver & Phillips, Nos. 91 and 93 Water street, Pittsburgh, Pa.



THE LEWIS PATENT BOLT HEADING MACHINE.



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Pneumatic Foundations.

General W. S. Smith, of Maywood, Ill., recently read before the American Society of Civil Engineers, in this city, a paper on the subject of "Pneumatic Foundations," in which the following conclusions are deduced: In sinking the foundations, the greatest difficulties to be overcome are, first, in keeping the pile vertical; for this it should be made to follow the excavation, without a reduction of air pressure; and, secondly, in righting the pile when inclined; for this, wedging under the bottom, or propping the top on the lowermost side, and drilling through the uppermost side, are the best means yet tried. The "air lift" is the cheapest and most efficient method of removing sand or mud from within a pneumatic pile or caisson.

A strong and reliable pier can always be built of pneumatic piles; their number, diameter, and the thickness of metal, being determined by the conditions of the case. In cold climates, these piles may be fractured by frost, to prevent which a filling below the frost line, from two to five feet deep, of asphaltic concrete is recommended. Where suitable timber and stone are to be obtained at reasonable prices, a single pneumatic caisson can be sunk with greater certainty and at less cost than a pier of three or more pneumatic piles, where it has to be sunk for a considerable depth through a soft material to a hard one. A pier of masonry on such a wooden caisson, cellular, with its walls well drift bolted and its interior carefully filled with concrete or rubble, is the cheapest and best bridge foundation yet devised.

Concrete does not "set" well under air pressure; the water should be let in through a pipe inserted therefor in the cement, to cover the successive layers as put down; usually, cement five feet in depth will seal the pile, the remainder being added in the open air.

IMPROVED PLANER.

It is a fact well known to machinists and tool makers that, in order to insure correct work upon a planer, accurate ways are necessary. It is a common trouble, however, with machines having ways on top of the bed, that such portions, after oiling, become receptacles for dust, chips, and other substances swept from the table, which, as the latter passes to and fro, cause constant grinding and wear.

Our illustration represents a machine in which this difficulty is claimed to be obviated by the use of an arrangement of underneath ways, shown at A, which, while they are, by their construction, protected from dust and chips, allow of the table being made deeper, consequently stiffer, and therefore less liable to bend or lop when it runs off the bed. The device also admits of gibbing to prevent the gear raising the table or in planing underneath a flange. Another improved feature is the mode of constructing the uprights, which, instead of being flat bolted pieces, which often allow the tool and crosshead to dodge sideways when the latter is up to the top, are hollow pillars, and therefore much more rigid. They are supported by the braces, B, from bed to cap, the screws and shafts for raising and lowering passing through the centers.

For further information address the inventor, Mr. A. S. Walbridge, Mystic, Province of Quebec, Canada.

Vermilion.

To the uninitiated, the manufacture of color by chemical processes is one of those astounding mysteries which are most entrancing to witness. Take vermilion, for instance. By subjecting a mixture of quicksilver and sulphur, placed in strong retorts, to heat, a combination is formed, which produces a sulphuret of mercury or bright vermilion, in a powder, the shades varying in depth according to the heat,

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VOL. XXVIII., No. 20. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, MAY 17, 1873.

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IS THE EARTH THE ONLY INHABITED WORLD?

The idea that in other worlds life may exist in conditions widely different from those prevailing on this world in which we live, however plausible at first, becomes highly improbable when tested by the light shed on this subject by the accumulated knowledge of modern research in the fields of astronomy, geology, spectroscopy, and chemistry, especially that branch of the latter science pertaining to organic compounds. Thus it has been suggested that—granted even that when the temperature of the moon, and other satellites of planets has been cooled to such a degree as to freeze all water—living creatures may exist there, having a liquid in their arteries and veins as uncongelable as mercury, glycerin, alcohol, etc.; or, inversely—granted that the planet Jupiter is red hot, and the sun much hotter—living beings may exist, consisting of fireproof materials, and of such an organization as to feel happy and comfortable in an atmosphere of superheated steam, as in Jupiter, or even while swimming on a surface of melted lava, surrounded by an atmosphere of white hot iron vapor, as would be the case in the sun.

Astronomy, now so powerfully aided by the modern tools of the scientist, having proved that the terrestrial elements exist throughout the whole universe, only differently distributed, and chemistry having studied the behavior of these elements under extremes of temperature, we know now that the possibilities of the existence of organic life are comparatively within very narrow limits and confined to a range of not much beyond 100° among the 6000° or 8000° to which our investigations have extended. We have learned that the wonderful properties of that common but most marvelous substance, carbon, aided by liquid water, at a temperature below 110°, are the absolute and essential conditions which make the development and continuation of life a possibility. Without these, no life can exist.

It may be objected that in other worlds there may be another substance, as effective in its function as carbon in our regions, and that therefore we cannot make any conclusion as to the necessity of carbon for the existence of life. In order to meet this argument, let us consider the properties of carbon, which, by modern scientists, has rightly been called the great organizer.

A substance, in order to take the place of carbon in the economy of organized existence, must be able to combine in different proportions with itself, to form a complex molecule, in order to enter again into complex combinations. It must exist as a solid, but also easily pass into the atmospheric condition by combination with another substance, equivalent to oxygen, so that all vegetation may be surrounded by an atmosphere containing carbon in such a state that the plant may obtain it, and complete, with this substance as a solid basis, its organic tissues. We may go on and sum up other conditions which this supposed substitute of carbon would have to fulfill, in order to take its place; but then we should in the end be driven to the conclusion that a substance which possesses all the properties of carbon would be carbon itself. But now comes the spectroscope and teaches us that even the comets consist chiefly of carbon dust, and that their purpose may be to supply the planetary atmospheres from time to time with some of this necessary element, when sweeping close along them, as is often the case.

As the latest investigations prove the identity of the elementary matter in our whole planetary system (and this even extends to a great number of the fixed stars), we can come to no other conclusion than to accept a unity of chemical operations, of crystalization, cell building, organic growth, and organic life in general, of course greatly modified in accordance with the conditions of gravitation, atmospheric pressure, distribution of elementary matter on surface, and especially of temperature. If now we look carefully on all the conditions required to make life possible on the surface of a planet, we see that these conditions are very complex, that not only the elementary matter, possessing the different required qualities must be present, but also in the exact relative quantities, in order not to annul the results of this distribution. Let us, for an example, only consider the amount of hydrogen present on our earth's surface. We know that nearly all of this element is combined with oxygen, forming the extensive oceans, rivers, lakes, clouds and moisture in general; in fact, the only source from which we can obtain this element is by decomposing water. This compound is indeed burnt up hydrogen, and this burning up, of course, took place at an early geological period of our earth's history. Therefore all the hydrogen has thus been burned up, consuming an equivalent amount of oxygen; and the latter now forms eighty-eight per cent of all the terrestrial water. But suppose that there had been some more hydrogen, just enough to combine with the small portion of oxygen (21 per cent) contained in the atmosphere; the result of the combustion would then have been some more water in the ocean, raising its surface only a few feet, while no oxygen would have been left in the atmosphere. In this case, life would have been simply impossible, and the earth would now be desolate. It would be easy to adduce other instances proving how complex the conditions of life are, and how improbable it is that all these conditions are fulfilled everywhere at once.

We conclude, then, that our earth is a highly distinguished planet, at present favored above hundreds and perhaps above thousands with conditions which have not alone rendered the existence of vegetable and animal life possible, but developed it to the highest stage of organic existence: namely, civilized and enlightened human races, able to investigate and discuss the highest problems in the universe, which are the laws of its creation, progress and ultimate purposes.

A NEW RULE IN RESPECT TO CAVEATS.

Among the recent decisions of Commissioner Leggett is one restricting the descriptive matter contained in caveats. For instance, in machinery for making lightning rods of a peculiar pattern, the inventor describes the peculiarity of the rod, and the new machinery for its manufacture. Whereupon the Commissioner of Patents decides that the machine and the product of the machine shall be classed as separate inventions, and that, before the papers submitted for caveat can be filed, the party must elect which invention he wishes protected by the caveat, and the description of the other invention must be struck out.

It has been a common practice of the Patent Office to require a model of the machine used in the manufacture of the *article* on which a patent is sought, and it is not unusual for the office to grant under a single application a patent which covers both the machine and the article. The following are a few examples of patents thus granted, and many others might be cited.

J. S. and T. B. Atterbury, September 15, 1868: glassware. Process, mold and article. J. Treat, April 7, 1868: volute spring. Method and article. J. Hobart, August 4, 1868: volute spring. Method and article. G. Hopson, January 7, 1873: spring heads. Method and article. Theo. E. Harris, November 14, 1871: shingle straps. Machine and article. S. N. Smith, September 13, 1870: shoe stays. Machine and article. W. Acheson and W. H. Ridley, May 28, 1872: manufacture of hoes. Machine and article. Thomas C. Croven, May 21, 1872: gin teeth. Method and article. J. C. Richardson, June 15, 1869: fork blanks. Method and article. C. T. Beebe, December 19, 1871: barn forks. Method and article. Jacob Reese, July 10, 1869: bands for shingle machines. Machine and article. Wm. A. Lewis, October 10, 1871: wagon axles. Dies and article. Wm. H. Knowles, June 27, 1871: carriage clip. Dies and article. Wm. B. Smith, August 9, 1870: shackle blanks. Dies and article. Jas. P. Thorp, September 18, 1866: shaft shackles. Dies and article. H. M. Beecher, September 12, 1871: carriage clip. Machine and article. T. Diebold, December 10, 1872: jeweller's stock. Machine and article. E. Waters, July 9, 1861: manufacture of paper boxes. Machine and article.

Now if both machine and article may be patented under one patent fee, they may legitimately be caveated under one caveat fee. The Commissioner's new decision is evidently erroneous, and from it, we trust, he will gracefully recede. The patent laws were not formed for the purpose of exacting double fees or drawing revenue from inventors, but to encourage them in making original discoveries by granting to them every reasonable facility in securing, for a limited period, the fruits of their inventions. The present decision is contrary to the spirit of the laws. It imposes additional burdens, and needlessly multiplies official ceremonies in the simple business of filing a caveat.

OPENING OF THE VIENNA EXPOSITION.

The formal opening of the Vienna Exposition took place on the 1st of May. In spite of the overcast and threatening weather, at an early hour a vast crowd thronged the avenues leading to the great edifice, and, when the twenty doors were thrown open, surged into the immense hall, filling every available space. The scene is described as one of wonderful impressiveness and grandeur; the motley costumes of the multitude, representative of almost every nation, the brilliant decorations of the throne and the gigantic proportions of the building together forming a spectacle of imposing magnificence.

At noon the Emperor of Austria, with the Empress, the Crown Prince of Germany, the Prince of Wales and other royal guests, with the high officials of the empire, arrived and were received with a tremendous popular ovation. The Arch-Duke Charles Louis, Patron of the Exposition, opened the proceedings by delivering an address, which was responded to by the Emperor, who, in a few words from the throne, welcomed the visiting nations and declared the Exposition open. Other speeches, by the President of the Imperial Council and the Burgomaster of Vienna, concluded the ceremonies, when the Imperial party made a tour of the building and departed.

As is usually the case in great fairs, the preparations for the opening day were far from complete. The bare frescoed walls were covered with an oozing dampness and but very few of the exhibits had been finally arranged in their places. Many were still covered with their cases and wrappings, and in nearly all the departments confusion and misplacement seemed to be the general rule. The American section was closed and is described by a correspondent as "looking battered and dingy, like an abandoned railway town on the plains." Even our flag was ominously hoisted with the union down. Judging from the mismanagement which has characterized the doings of the suspended commission and the obstacles in shape of inexperience and the absence of records with which the body which has superseded it in its labors has had to contend, a not much better condition of affairs could have been anticipated. As matters now stand, the new officials, aided by the exhibitors, are doing all possible to organize and complete the United States arrangements. The displaced commissioners protest vehemently against the summary action of the government and assert their innocence of the charges. A recent cable dispatch exonerates all the members but two, but no definite details of the offences alleged, or the evidence sustaining the same, have as yet been received.

As regards the probability of the United States, through the various causes which have occurred to discourage exhibitors and produce other unfortunate results, falling below other nationalities in the variety and magnitude of its representation, we do not acquiesce in the desponding view taken by many of our contemporaries. Already some seven hundred exhibitors have entered goods; and even if more do not take advantage of the month's extension of time granted by the Director of the Exposition, enough to fill up our allotted space, the country will be fully represented by large numbers of the articles contributed by other nations. It is a well known fact that nearly all of the most important American inventions are manufactured extensively abroad, and the quantity and variety of these, which are sure to be displayed, even if made by foreign workmen, will be ample to demonstrate to the world the industrial genius and advanced progress of our people.

A NEW SPECIFIC FOR RHEUMATISM.

Rheumatism, notwithstanding that it is one of the most obstinate diseases, some forms of which baffle the skill of the most eminent physicians, is, from a medical point of view, highly interesting; the late Dr. Valentine Mott used even to say that "it is one of the beauties of rheumatism that it shows itself in such a great variety of forms." It is a fact well known among the medical profession that many rheumatic patients, in the impatience produced by their affliction, change from one physician to another; at length the disease has run its course, the patient gets well, and the last doctor whom they then happen to have, earns the credit of the cure.

Without intending to trespass on the domain of the physician, it may be well to give, for the benefit of all, some information concerning the nature and treatment of this malady.

As it is a constitutional disease, proper diet and close attention to the general health are of more benefit than local applications, which may be useful in exceptional cases, but generally they give only temporary relief, and often drive the pain from one part of the body to another. In all cases of this disease, the blood is in an abnormal condition, and may be considered to be poisoned; persons who live high (which means, live on rich and highly nitrogenized food) are apt to have this disease in a peculiar form, which is commonly called gout, of which the chief seat is in the joints. A lower mode of diet is then advisable. Persons who live low and get this disease by exposure, combined with over fatigue, are apt to suffer from the so called chronic form chiefly seated in the muscles, and in these cases, the system may suffer from one of two opposite causes, an excess of either alkali or acid, which, when neutralized, ends the disease. Hence the curious and formerly unexplained fact that sometimes acid treatment, as with lemon juice, and at other times alkaline treatment, as with Rochelle salt, etc., has produced a cure.

There is one very severe form of rheumatism called acute or inflammatory, which is a most formidable disease, and which in olden times was treated by blood letting. This disease has the remarkable feature of suddenly leaving one part of the body to appear in another. If, by blood letting, the heart receives a sudden shock by the withdrawal of a quantity of blood, the malady is very apt to settle there and produce disease of the heart, which is a very common cause of death among persons who once have been treated for rheumatism by blood letting. The latter operation relieves the patient; but, considering the often fatal results, it is now abandoned by all enlightened physicians, and the treatment by colchicum wine and opiates is used instead. Besides the derivatives of opium, morphine and codeine (see page 273 of our current volume), sal ammoniac has been often praised as an effective remedy when others failed; but perhaps these derive their efficiency from their similarity to a new substance, a derivative of opium and ammonia, which has recently been found as effective a specific against rheumatism as quinine is against fever and ague. This substance

is propylamin. It is a volatile, watery liquid, with a strong odor of herring pickle, and was found by Dr. Winckler in distilling a watery extract of ergot with potassa, also in distilling cod liver oil with ammonia. But the most effective way of obtaining this substance is that of Wertheim, who prepared it by the decomposition of narcotine and codeine by alkalies. Its name is based on its chemical composition; it is a combination of the third member of the hydrocarbon series (methyl, ethyl, propyl, amyl, etc.) with a derivative of the ammonia (amidogen, mentioned on pages 20 and 144 of our current volume). There is, however, still some doubt about its true chemical composition, so that some chemists suppose it to be trimethylamin; in the mean time, its specific effect on most forms of rheumatism has been established. By taking five drops in a tablespoonful of peppermint water every two hours, the pains usually abate after twelve doses.

NATURE AND ART--THE MYSTERY OF THE MAGNETO-ELECTRIC MACHINE.

In the SCIENTIFIC AMERICAN, volume XVI, page 406, we quoted from an English contemporary a description of the electric machine of Professor Wheatstone; and a reader, who evidently preserves his copies of our paper, requests us to explain the action of that class of machines more fully.

The development of a current of electricity by a machine without either a voltaic battery or preëxisting magnetism as its primary source is so remarkable that our correspondent is justified in viewing it with wonder and in considering the mystery to be equal to that of the Giffard injector, described on page 48, current volume, and we are justified in the endeavor to make its operation clear.

The generation of electrical currents by the relative motion of a conductor and a magnet was discovered many years ago, the earliest known "magneto-electric machine" being constructed in 1832 by Pixie; and improvements were made by Ritchie, Saxton, Clarke, Henry and others, all of whom used permanent magnets, in front of which they rotated bobbins wound with conducting wire, covered with silk or other material to secure proper insulation of the several portions of the wire from each other. Subsequently, Siemens devised an improved form of bobbin, on which the wire was wound longitudinally, instead of transversely. This invention is a cylinder of soft iron having deep grooves cut on opposite sides, and the two grooves are connected at each end by similar transverse cuts. The insulated wire, forming the conductor, is wound upon the core in these grooves, and lies buried in the cylinder, confined by three or more bands; a brass disk, at one end, carries the commutator, by means of which the currents, which reverse their direction at each half revolution of the bobbin, are so sorted out that the same external wire always conducts from the machine a current of the same kind while the machine continues in motion in one direction, the positive currents going through one conductor and the negative through the other.

This form of bobbin allows the use of a large number of small magnets, side by side, in place of one very large; and since small magnets are far more powerful in proportion to their magnitude than large ones, it follows that the Siemens armature allows the machine to be made far more efficient.

The next important step in the improvement of these machines was made by a British inventor, Mr. Wilde, who constructed machines of, until his time, unprecedented power. Instead of using directly, the induced current of electricity, which he obtained from the permanent magnets, he led it through the coils of great electro-magnets, thus producing a new set of magnets, for induction, of immensely greater power. This current, obtained from the new "magnetic battery," was, in one instance, used in a similar manner upon a still larger electro-magnet, and this process of intensifying the power of the machine could of course be carried to any extent. The current generated in the armature of the last set of electro-magnets was applied to the production of light or heat, or in electro-plating, as might be desired. From the largest of Mr. Wilde's machines, a powerful electric light and tremendous heating effects were obtained. This machine had coils 4 feet high and 10 inches thick on the large electro-magnet, the coils containing 1,400 pounds of copper wire. The armatures were driven by a steam engine of 15 horse power.

The electric light obtained from the machine was so powerful as to cause the flame of the street lamps of Manchester, (England) to cast a shadow at the distance of a quarter of a mile (London *Athenæum*). The heat could be felt at a distance of 50 yards, and long wires and thick rods of iron, a foot long and two tenths of an inch in diameter, were raised to a white heat and melted by the current. A rod of platinum, the most infusible of all metals, was melted down. Several of these machines were used, or proposed to be used, in foreign lighthouses, but the expense of the apparatus and of its accompanying steam engine, as well as the necessary skilled attendance, were serious objections.

The well known electrician, Moses G. Farmer, in a letter addressed to us and published in the SCIENTIFIC AMERICAN, pointed out the fact that, could this method of producing light be perfected so far as to avoid the loss of more than three fourths of the energy condensed in each pound of coal, the electric light would cost but about one tenth of a mill, per candle power per hour. He estimates that a pound of coal carbon, converted into light without loss, would, if burned in one hour, yield a light equal to that of 12,410 candles

It is evident that inventors who are familiar with the science of electricity have before them a field in which they can labor with profit to the world, if not to themselves, and we expect ere long to see the pound of coal which, consumed in one hour today, gives us about 15 or 20 candles, made to surrender a much larger percentage of the figure, given above as possible.

Improvements in the construction of the magneto-electric machine have progressed as described, but a single step remained to be taken to bring it to the latest form now known, is that which appears so mysterious in its operation.

Professor Wheatstone and Mr. Siemens both suggested, at about the same time, that, if a part of the induced current were diverted and made to excite a separate small electro-magnet, the latter might be substituted for the equally feeble permanent magnets, in which the whole energy of the apparatus originated, and thus a machine might be made of equal efficiency and without permanent magnets. Such a machine would, at first glance, seem very like a perpetual motion apparatus, and the scheme a most absurd one. The thing was done, however, by the invention of the Wheatstone-Siemens machine, as built by Mr. Ladd, of London. It consists simply of an electro-magnet, with a Siemens armature, containing two bobbins, of different sizes. The wire from the smaller bobbin connects with the electro-magnet, its current keeping that excited, while the current induced in the larger bobbin is used for other purposes as may be desired. The armature is driven at a high speed by means of a crank and a band wheel carried in bearings on the electro-magnet.

The electro-magnet almost invariably contains enough residual magnetism to start the action of the machine; and, during its operation, it simply furnishes an illustration of the conversion of the mechanical energy into electricity, light and heat. We cannot, however, as in the case of the Giffard injector, trace every step in the process with mathematical exactness; and the conversion of the one form of energy into the other is to us, and to men of science, as well one of those great mysteries of nature which we are everyday fathoming more and more deeply, and which still present as wonderful a depth of the unknown as ever.

THE MOVEMENTS OF THE STARS.

We are but upon the threshold of the vast store house of which that most wonderful of modern discoveries, the spectroscope, has given us the key. Each day brings us nearer and nearer to the solution of problems which have vexed the master minds of the world for centuries, and science is permitted to advance still further into the realms of the unknown, pressing closer upon those which it is impossible for the human mind to transcend. We have placed other worlds as it were in the balance and weighed them by our infinitesimal standards; by the aid of light originated when our earth was but an unpeopled mass, we have recognized the components and structures of orbs beside the magnitude of which we are as a grain of sand; we have determined and set bounds to the wanderings of the vagrant spheres which circle round our sun; extending further into the infinite, we have looked upon the nebulous chaos which was in the beginning, and lastly, armed with precepts drawn from analogy and theory, we have boldly traced, to a glimmering star in the Pleiades, the central point of our material universe.

With the erratic motion of the planets astronomers have long been familiar, and the name itself, derived from the Greek verb meaning to wander, was given in contradistinction to that of those stars to which the term "fixed" was applied. But later discovery overthrows this discrimination. The fixed stars are known no longer to be motionless, but to travel over distances so great and at such rapidity that the mind fails in their contemplation; and yet the observations of centuries have failed to detect real changes in position other than are extremely small—so minute indeed that only about 30 stars have, by astronomical calculation, been shown to have moved more than one second of arc annually, while in others a motion of but a few seconds in a century has been detected. In the year 1868 Mr. William Huggins, a noted English astronomer, while comparing the spectrum of Sirius with that of hydrogen, by means of a spectroscope of large dispersive power, found that a line on the stellar spectrum was displaced by about $\frac{1}{2\frac{1}{2}\frac{1}{0}}$ of an inch. This displacement occurring toward the red end of the spectrum, showed that the refrangibility of the light of Sirius was diminishing, as the red rays are the least refrangible. The star, therefore, was receding from the earth. Following out the calculation and allowing for the movement of our sphere, Mr. Huggins found that Sirius was moving through space, directly away from us, at the rate of 24½ miles per second, or, taking the resultant of this motion with the transverse movement of the star, previously observed and approximately calculated by other means, the real motion of Sirius was computed at 29 miles per second, or 900,000,000 miles per year, while its distance is estimated at over 128 trillions of miles—numbers of which we can obviously form no conception.

The want of instruments of sufficient delicacy and exactitude has until quite recently prevented further researches, but the necessary implements have at length been made, and we are in possession of the more accurate results. The motion of Sirius has been determined as less than that above given—22 instead of 29 miles per second—the difference being due to the more perfect instruments. Other stars, however, however, have also been examined and their movements relative to the earth fixed. The lines of sodium and magnesium were compared with similar lines which indicated the presence of these terrestrial substances in the spectrum of Betelgeuse, (*α Orionis*), and the star was found to be receding at a velocity of 22 miles per second. The spectrum of Rigel was compared with that of hydrogen and indicated also retrograde motion, of 15 miles per second. The double star Castor, Regulus, *β* and *δ Leonis*, *β*, *γ*, *δ*, *ε*, *ζ*, and *η* of the Great Bear, Spica, *α* in *Corona Borealis*, were all examined in connection with the spectrum of hydrogen and found to be receding at rates varying from 15 to 23 miles per second. In the case of the stars that appear to be approaching the earth, the velocity is much greater. Arcturus, the spectrum of which was compared with that of magnesium, travels at the rate of 55 miles per second: Vega at 50 miles; *α Cygni*, 39 miles; Pollux, 49 miles; *α* of the Great Bear, 61 miles; and *γ Leonis*, *ε Bootis*, *γ Cygni*, *α* and *γ Pegasi*, and *α Andromedæ* were undetermined. *γ Cassiopeiæ* is believed to have a very slow movement from the earth. In making the calculations the velocity of light was taken at 185,000 miles per second, and it is stated that the above given velocities, in relation to the movement of the stars relative to the earth, are equally true as to their motion in regard to the sun. It is interesting to notice that in general the stars which the spectroscope shows us are receding from the earth (Sirius, Betelgeuse, Rigel, Procyon) are situated in a region opposite to the constellation toward which the sun is advancing, while those near to the former (Arcturus, Vega and others) are approaching our globe. "There are, however," says Mr. Huggins, "exceptions to this rule:" and in his memoir to the Royal Society, he points out that the movement of the sun is not the only nor even the principal cause of the true or apparent motions of the stars. "It is hardly possible to doubt," he continues, "that the stars have two distinct motions, one common to all stars of a certain group, and another confined to each particular star. Remarkable examples of this fact are shown in the group *β*, *γ*, *δ*, *ε*, *ζ*, of the Great Bear, which have a common movement, while *α* and *η* of the same constellation have a proper motion in an opposite direction. Again and more remarkable is it that the five first mentioned stars recede from the earth, while *α* is approaching; and *η*, although apparently receding, is at too great a distance from *α* to permit us to consider the two stars in connection.

SCIENTIFIC AND PRACTICAL INFORMATION.

AN EXPERIMENT WITH PHOSPHATE OF LIME.

If a small quantity of phosphate of soda is added to a dilute solution of chloride of calcium, a white precipitate is formed which dissolves on stirring. The addition of more phosphate of soda forms a permanent precipitate; if now a current of carbonic acid gas be passed into the liquid in which the precipitate is suspended, the precipitate dissolves again, in the same way as carbonate of lime does in water containing excess of carbonic acid. The addition of a fresh quantity of phosphate of soda produces a fresh precipitate, which can be again dissolved by carbonic acid. There is, however, a limit to the operation, for having repeated it a few times, crystals form which do not dissolve, and which may be caught on a filter and washed. They consist of the bibasic phosphate of lime with four molecules of water of crystalization. If these crystals be put in water freed from carbonic acid by boiling, and frequently shaken for 24 hours, a salt is formed which contains three equivalents of phosphoric acid to four of carbonic acid ($4\,CaO,\,3PO_5$): a salt richer in phosphoric acid than the bibasic salt with which we started, yet not so rich as a monobasic salt.

ACTION OF SULPHUROUS ACID UPON INSOLUBLE SULPHIDES.

Langlois having proved that alkaline sulphites are converted into hyposulphites by the action of sulphurous acid, another chemist named Guerout has repeated the experiment with the sulphides of other metals, and finds that the sulphides of copper, silver, gold, platinum, and mercury are not attacked. The sulphides of manganese, zinc, and iron readily dissolve in a strong solution of sulphurous acid, being at the same time converted into hyposulphites. The sulphides of cobalt, nickel, cadmium, bismuth, tin, arsenic, and antimony are slightly soluble and undergo the same change into hyposulphites; varying quantities of sulphuretted hydrogen are evolved, and sulphur separates. Further experiments, however, indicate that the sulphides are not converted directly into hyposulphites, but are first converted into sulphites which are afterwards changed into hyposulphites.

This easy and rapid method of preparing hyposulphite of iron, zinc, etc., having been discovered, it remains to apply it to new and important uses, and such we doubt not will soon be found.

THE PHOTO-HELIOGRAPH.

A correspondent of the *Photographic Bulletin* describes a new instrument made by Dallmeyer, of England, and called the photo-heliograph. It is to be used during the coming transit of Venus, and consists in a telescope, mounted for photography, about eight feet in length and having an object glass of four inches in diameter and five feet focal length. At the focus is placed an instantaneous shutter which serves to increase or diminish an aperture, behind which is placed a combination of lenses, corrected for the chemical rays. The image passing through is enlarged to four inches. The instrument is mounted on an equatorial stand and actuated by suitable clock work. Five have been ordered by the British government, to be supplied to the different observing stations.

OZONE.

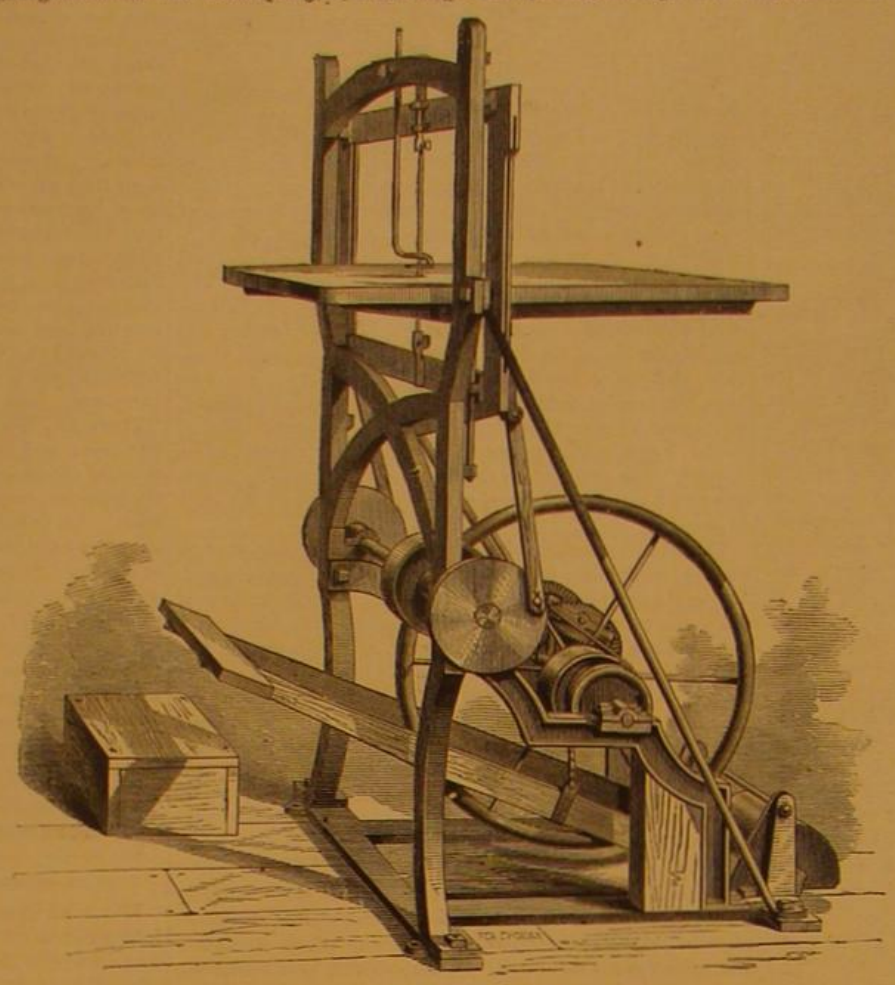
M. Boillot, on submitting pure oxygen and atmospheric oxygen alternately to the action of the electric current, has discovered that 58 cubic inches of pure oxygen yields but ½ of a grain of ozone, while the same amount of atmospheric oxygen gives ¼ of a grain. Oxygen mingled in the air is therefore in a condition more favorable for its transformation into ozone.

FOOT POWER JIG SAW.

It will be remembered that, towards the beginning of the present volume, we presented an application of the "vertical multiplier" to the band saw. We now lay before our readers still another arrangement of the same ingenious and labor-saving device, this time, however, in connection with the jig saw.

The machine is fully represented in our illustration; and as a detailed explanation of the multiplier, without the aid of which the operation by foot power of the saws to which it is applied would be practically impossible, can be found in Volumes XXII. and XXVI. of this journal, we have only in the present article to refer to the general capabilities of the invention. Forty steps of the treadle produce 546 and a fraction movements of the saw; or, in other words, the motion transmitted by the gearing is as 1 to 13·6, about. At a trial in our presence the blade made its way through work of two inches in thickness, hard ash wood, with great rapidity, and was actuated by the sawyer merely throwing his weight upon the treadle, a motion which, we were informed, could be continued for a long period without fatigue.

This device, as indeed are all applications of the multiplier, is especially designed to meet the wants of shops in which there is no steam power. It occupies but two and a half by three and a half feet of floor space, has two feet swing, is four and a half feet high, and is strong and durably constructed. The low price at which the manufacturers offer it will render it particularly adaptable to the needs of amateurs and mechanics and cabinet-makers. For further particulars address the Combined Power Company, No. 23 Dey street, New York city.



FOOT POWER JIG SAW.

Uses of Bisulphide of Carbon.

Until the year 1850, the only industrial application of bisulphide of carbon was the dissolution and vulcanization of india rubber. Since that time it has been applied to the following uses: 1. The complete extraction of the fatty matter from bones used in the fabrication of bone black. 2. The extraction of oil from grain and olives. 3. The removal of sulphur from earth in which it is contained and also bitumen from bituminous rocks. 4. The scouring and elimination of greasy substance from wool by the Seyferth and similar processes. 5. The extraction of the soluble principle of spices. 6. The fabrication of yellow prussiate of potash, and of sulphocyanide of ammonium, for making Pharaoh's serpents. 7. The preparation of Greek fire; a solution of phosphorus in the bisulphide is used for filling inflammatory rockets or shells. 8. For silver plating; a small quantity placed in the bath increases the brilliancy of the deposit. 9. For the destruction of vermin. 10. For filling glass prisms, on account of the brilliancy of the colors of its spectrum. 11. For driving by its vapor all classes of engines, with or without expansion.

TAYLOR'S PATENT FIRKIN HEAD.

Our engraving represents an improved firkin head which



is claimed to save cooperage and to facilitate inspection of the contents, a fact of importance when the latter contains butter, fruit, or other perishable substance. It is depicted in the illustration as applied to a butter keg, which may be thus caused to serve as a "return pail," an especially advantageous arrangement for shippers and commission merchants. The invention is equally adapted for barrels, etc.

The head consists of two pieces of wood, A and B, cut as indicated by the inner dotted lines in Fig. 2. At one end and underneath, they are connected by a strip of springy wood, C. To the piece, A, are secured the cleats, D, below and, E, above the device. The portion, B, is held only by the wood spring, C, and a single nail passing through both cleats, and shown at the right in Fig. 2, so that it is movable and may be brought nearer or further from the part, A, thus narrowing or widening the space between. On the upper side of this part, B, is pivoted a button, F, the inner end of which is rounded and takes against the edge of the cleat, E. By moving the outer extremity of the button, its inner end pushes upon the cleat, E, and thereby forces the two portions of the head apart.

To operate the device, a groove is previously made as usual, within the inner upper part of the barrel. The hand grasps the head, as shown in Fig. 1, the button, F, being turned parallel to the cleat, E, and the fingers pressing the parts, A and B, together. When the head is placed in the groove, it is expanded as above described by moving the button, F, so that it lies at right angles to the cleat, E. The edges of the cover are thus forced tightly into the groove, and the apparatus thus completely closes the barrel, effectually preventing the entrance of dirt or insects. A screw or nail through the outer end of the button, F, holds all the parts firmly in place during transportation. To remove the head, the operation above described is simply reversed.

Patented March 26, 1873. For further particulars relative to sale of rights, etc., address the manufacturers, Messrs. Taylor & Co., Ashland, Va.

The Loss of the Steamship Atlantic.

We continue to receive a multitudinous correspondence on this subject, and are pleased to find that our editorial, on page 241 of the current volume, has elicited the attention of inventors. We make the following extracts from letters received during the past few days:

F. D. J. suggests the construction of boats, one for each passenger, of rubber, with sides and ends of double material, air tight, with a tube for inflating the bag-like parts above the water line, all around the boat. Stationary ribs (of rubber?) could be stretched from gunwale to gunwale, and a passenger could secure himself in the boat, and be thrown into the sea or swim away from the wreck, and continue to float even when perfectly exhausted.

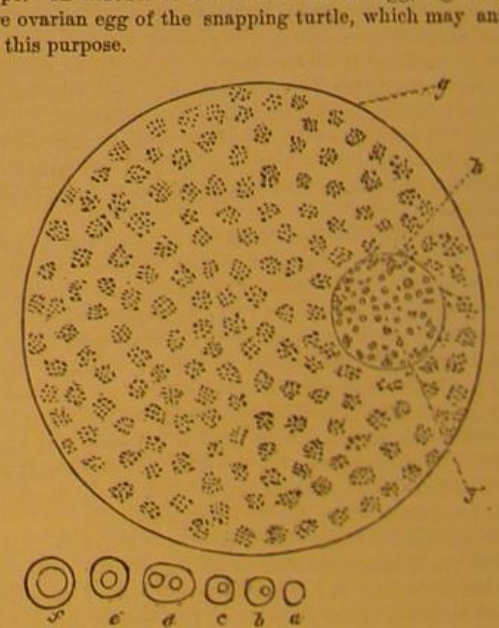
"A Riveter" speaks of the much vaunted water-tight compartments of which ship owners talk largely in advertisements. He worked in a ship-building yard at Port Glasgow, Scotland, for ten years, and he states that he has never seen a ship built with water-tight compartments. With regard to one vessel in particular, every one employed on her expected she would sink; and when finished, she sailed for India with a cargo of railroad iron and went down four days after leaving port. Another ship built in Glasgow, in 1865, was described by the men employed on her as "a coffin for somebody;" she was built of bad iron and badly put together. The correspondent has also worked on coal boats, built at Chester, Pennsylvania, which were constructed with poor materials and workmanship. He speaks highly of the metal used in iron boats built at Buffalo, but utterly condemns their workmanship. He also censures the building of the steamers of the American line from Philadelphia to Liverpool, stating that they are not well riveted, and that some of them are not caulked above water line, and that their bulkheads will not be water-tight. Putty is used in coating them, and the writer would not like to risk his life in the vessels.

J. L. G. dissents from our opinion that boats are not to be depended on, and would limit our statement to boats heretofore in use. He censures the life-boats carried by ocean steamers, as they do not right and bale themselves instantly; and asks us to publish a description of any that fulfills these requirements. "But it may be said that the difficulty exists in launching the boat safely. Very truly, a life boat to be depended upon must have the capacity of launching itself; or, in other words, an officer must be able to launch the boat safely and instantly, with himself and several seamen in it, in any kind of sea, in such a way that there is no possibility of mishap either in crushing the boat against the side of the vessel, in swamping, or in carrying a line. Some four years since, another inventor and myself turned our attention to this subject, and, by costly experiments and great labor, finally succeeded in doing two things; the first was the production of such a boat and means of launching it, as above described in every respect, to the entire satisfaction of the Board of Supervising Inspectors of Steam Vessels, who said in their report that the boat was perfect in all that the inventors claimed for it. The second thing we accomplished, still more effectually, if possible, was to so thoroughly impoverish ourselves that any further inventions from us are out of the question, as is also pressing our invention into use: although its superiority is not questioned by any who see its operation, nor are we able to resist the attempt, that has been and is now being made by government officials, to appropriate the result of our labors to their own credit. From this showing, you will see that you are wrong in the last two sentences of the article referred to, that, 'after being invented and proved capable, the law is strong enough to compel its introduction into general use.'"

THE WONDERS OF THE EGG.—SECOND LECTURE.

[BY PROFESSOR AGASSIZ.—CONCLUSION.]

If we pass now to the bird, we find in the ovary eggs which can in no way be distinguished from those observed in the ovary of the mammal, only we find in the former a much larger number. Besides those very small ovarian eggs, there are larger ones—eggs rising to dimensions so considerable that they are not only visible to the naked eye, but may be handled with facility. A mature egg in the ovary of the hen is about the dimension of a small walnut. It has no shell, no white; but it is a bulk of yolk inclosed in a vitelline membrane, containing a germinative vesicle with germinative dots. The amount of yolk is very great. If we examine the yolk, we find that its whole substance is made up of cells. This fact at once suggests a further inquiry as to the constitution of the fluid contained in the vitelline egg of the mammalia. The question would be answered differently by different investigators. But unquestionably the mature ovarian egg of the bird differs from that of the mammal in the larger amount of yolk it contains, and in the fact that the whole mass of yolk consists in the accumulation of cells in such numbers that they are counted by myriads. These cells may be traced under the microscope. In absence of a well drawn hen's egg, I give a mature ovarian egg of the snapping turtle, which may answer for this purpose.



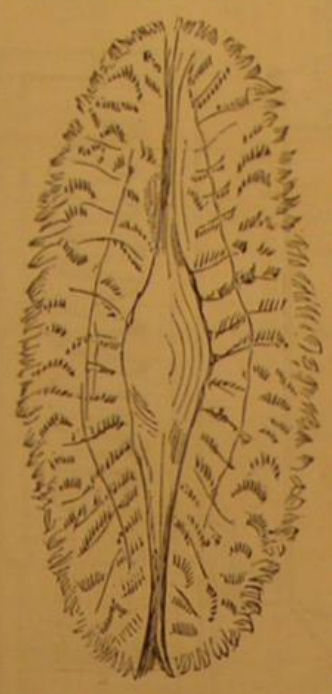
(a, b, c, d, e, f, Mesoblasts or contents of Purkinjean vesicle, magnified 100 diameters. g, Vitelline membrane. h, Purkinjean vesicle. i, Contents of Purkinjean vesicle.)

Suppose I should represent an ovarian egg of the hen enlarged so that the germinative vesicle alone would appear as large as a whole ovarian egg at the time of maturity: we should find that the whole of the yolk consists either in little granules or in little vesicles resembling each other so much as almost to force us to the conclusion that these vesicles are

only granules which have swollen and become hollow. By the side of these smaller vesicles are others somewhat larger, containing themselves a vesicle and granule, that is to say, having the true character of ordinary cells. The whole mass of the yolk consists of such granular vesicles and true cells. The yolk is, in fact, an accumulation of cells in various stages of growth. This large yolk, this large ovarian egg of a hen, with its contents, was itself at one time so small as to escape the natural power of the human eye. We can place a portion of the ovary of the hen under the microscope and have at the same time in the field small eggs which cannot be seen with the natural eye and other eggs perceptible in different degrees; and we find that the smallest are just like the eggs of mammalia, containing a transparent fluid with granules floating in it, while others contain cells already to be distinguished, and others are full of cells so large as to make the whole mass opaque. The peculiar color of the hen's egg in all its stages leaves no doubt that the cells —at least those within the egg—are formed by the swelling of the yolk particles and their subsequent growth into larger vesicles containing a fluid in which the elements of a perfect cell are finally matured. We are certainly justified in saying that they are cells, and that the vitelline cells are of the number which arise from the enlargement of solid granules, these granules being animal particles secreted by the organs in which they arise.

At this stage of the ovarian egg, that is, when it has acquired the vitelline membrane, the germinative vesicle and germinative dot also acquire certain dimensions differing in different animals and are or may be fecundated. This fecundation consists in the contact of sperm cells with the yolk bag. What the influence of that contact is, nobody has been able to trace. (The way in which the spermatic particles reach and penetrate the egg we shall consider hereafter.) It is from that time that the changes date which lead toward the formation of a new being. But the egg of the hen when fecundated has not yet completed its growth. The hen's egg, as we know it, has a shell, and a delicate membrane lining the shell, and a layer of white albumen surrounding the yolk. All these parts are formed after the egg has been fecundated. So you see that the life of the egg, in this class of animals, is something independent, as it were, within certain limits, from the growth of these essential portions of the egg which lead to the formation of the new being. Why is it that the egg must be laid in that condition in order to lead more directly to the growth of the young: why it is that in the bird the germ lies dormant in the egg, after the egg has been laid, until a certain temperature is applied to it: I cannot explain, but those are conditions which always accompany the formation of the germ in birds, and its final development into a new being. In mammalia—to show you how great a contrast exists between these two classes—the ovarian egg is not dropped when the germ begins its growth, but is retained until the germ has acquired certain dimensions, a certain stage of development which varies according to species. Every one knows that our opossum brings forth young so delicate and so imperfectly developed that they require protection from the mother long after birth. They become attached to the teats of the female and hang there for a number of weeks before they are capable of shifting for themselves. Other animals are born already covered with hair, but are blind, as in the case of cats; while others are born so that they are capable of walking away at once, as is the case with horses or cattle. However great may be the similarity between the eggs of different animals, there are marked specific differences in their subsequent development. And these are not variable features; they are implied in the very existence of the species in which they occur. They are specific differences in the growth and development of animals, as characteristic as any ultimate differences in their adult condition. Let us now pass to the class of reptiles. The scaly reptiles—that is, turtles, lizards, and serpents—bring forth eggs similar to those of birds. They arise in the ovary in a similar way and produce by successive growth yolks of a similar bulk, as do the birds. While, however, all these eggs are surrounded with a shell after fecundation, the egg is not necessarily laid, as in birds, in order to bring forth the new being. The bird brings forth its young by incubation, setting upon the eggs, and transmitting to them by its own warmth the temperature needed for their final development. For the egg of the reptile, that temperature is usually derived from surrounding conditions. It is true that a few kinds of reptiles, the python for instance, set upon their eggs and transmit to them a higher temperature from their body; but this is not usually the case. Some reptiles deposit their eggs in the sand, where they are hatched out under the influence of the summer heat; others do not lay their eggs until the young have completed their growth, when the new being is born, and the egg shell afterward or about the same time. Others lay eggs from which the living young are hatched in a very short time. The European viper can readily be made to lay its eggs or to retain them and bring forth living young, by a simple increase or diminution of the temperature to which it is exposed at a certain stage in the growth of the germ. The egg-laying animals are called oviparous; but those reptiles which bring forth living young are as much oviparous as the rest, for the process of growth is the same, whether the egg is hatched out in the mother or not. The other reptiles, such as frogs and salamanders, spawn. That is, they lay eggs of small dimensions in large numbers, surrounded only by the albuminous envelope, without a shell, and these eggs are fecundated after they are laid. You see here what a marked difference there is between those naked reptiles and the scaly reptiles. On account of this and other differences, they have been separated into two classes—the scaly reptiles as reptiles proper, and the naked reptiles as batrachians or amphibians.

When we pass to the eggs of fish, we find there marked differences also, and the most striking are those to which I have already alluded, among the sharks, skates and chimeras, the eggs of which are enveloped in a horny covering, formed after fecundation. We have among these animals the same differences as obtain among scaly reptiles, namely, that with some the egg is laid, and the process of hatching takes place a considerable period after the laying, while in others the egg is not laid until the young has completed its growth and may be born in a condition capable of swimming.



EGG OF THE CALLORHYNCHUS.

I will show you some of these curious eggs. This is an egg of the callorhynchus, the central part of which is pea shaped or cylindrical, as is the cavity in which the yolk is contained, and there is a flat appendage to the egg case by which the egg is enabled to attach itself to submarine bodies. In a good many of the sharks and skates, as already remarked, the egg is not laid before the young has completed its growth and so far completed it as to have acquired its full form. The yolk may then hang like a bag below the body, and be gradually absorbed into it, serving as nourishment for the young until it entirely disappears. [This was illustrated in the last lecture, page 276.] You may see here the intimate connection which exists between the egg and the embryo, and you may that say the embryo grows out of the yolk. In those animals which have coverings or shells protecting the yolk, there are always peculiar organs to secrete these cases. In sharks and skates, for instance, there is a peculiar gland upon the track of the oviduct in which the egg envelope is formed. The egg is received in the sack in which it is first surrounded by only half the shell case, then the other half is formed, and the egg is complete.

STEVENS INSTITUTE LECTURES.—GOLD MINING IN CALIFORNIA.

BY PROFESSOR SILLIMAN.

The third lecture of the spring course before the Stevens Institute of Technology was by Professor Silliman, of Yale College, on the "Dead Rivers of the Sierra Nevada and Hydraulic Mining for Gold." He began by describing the characteristics of the country, along the line of the Union Pacific Railroad, through which the traveler passes in his journey to the gold regions of the far West. Our notions of the Rocky Mountains receive a rude shock on beholding the almost insensible slope which leads us for more than 800 miles along the valley of the River Platte, where the ascent is not over 12, 14 or 16 feet to the mile, and we advance towards the summit without being aware of mounting unless we have perchance an aneroid barometer to tell us so. Yet our government was induced to pay a subsidy of $16,000 per mile for the construction of the Union Pacific Railroad on account of imaginary difficulties. This was as far as Cheyenne, where, it was agreed, the Rocky Mountains really began. From that place to the Black Hills, the subsidy amounted to $32,000 a mile; but the traveler, unaided by the barometer, would be utterly unable to discover the fact that he was not upon a level plain. Passing through the Great American Desert, we come to the continental divide at Sherman, about 9,000 feet above the sea level, to the head waters of the Green River, and arrive in the plain of the Great Salt Lake, joining the Central Pacific at Ogden, still over 4,000 feet above the level of the sea. On examining the sloping banks of the great basin before us, we can distinctly trace the successive outlines of the ancient shores of the great inland sea, which must have risen about 1,200 feet above the present level, and whose waters, by concentration of their saline matter, have produced the present Salt Lake. Continuing our journey, we pass lofty ranges of mountains, some of them 10,000 feet high and running parallel in a northeastern and southwestern direction. Finally we come to the majestic snow-capped wall of the Sierra Nevada, which separates us from the Pacific Ocean. This region we find characterized by precipitous ascents, majestic pine forests and deep cañons. Here we meet with real engineering difficulties. In a country where a slight fall of snow is 16 feet and a heavy one 100 feet deep, and where huge avalanches slide down the rocks, the railroad tracks have to be protected by means of snow sheds of solid timber, which, however, as effectually shut out the view from the passenger as though he were a letter in a mail bag. Smooth and rounded rocks everywhere bear witness to the action of glaciers, which existed there on a vast scale. Along these rugged mountains, the perseverance of the early miners constructed roads for the transportation of all the necessaries of life to the seemingly inaccessible regions where their claims lay, and these roads will ever be monuments to their herculean energy.

In one of the basins left by an ancient glacier, is situated that magnificent sheet of water known as Lake Tahoe. So clear are its waters that fish can be seen swimming in it at a depth of fifty feet, and that the photograph exhibited upon the screen by the lecturer clearly showed the boulders on the bottom. Von Schmidt has contrived a plan to supply San Francisco with water from this lake, whose surface is over 6,000 feet above the level of the Pacific.

Passing, in our downward course, through the Bloomer Cut, we see rising above us on both sides huge walls of gold-bearing gravel; but gold is present in such small quantities that a cubic yard scarcely yields over twenty cents' worth. Before considering the means by which even so small a proportion is made to pay, the lecturer threw on the screen pictures of the early methods employed by the California miners. At first, a pick, a shovel, an iron pan and a rifle were all the necessary outfit, and the gold seeker would take his panful of gravel to the nearest running water. Here the gravel was washed out and the grains of gold, which sank quickly to the bottom of the pan by reason of their greatly superior weight, were gathered. Sometimes the gravel was winnowed in a blanket, where water was scarce. The first improvement was to separate the coarse from the fine by means of a rocking sieve, through which running water washed the gold into a trough beneath filled partly with quicksilver. The gold combined with this, and the sand was carried off by the water. When enough gold was collected in the quicksilver, it was strained through a buckskin bag, and then the gold which remained in the bag was separated from the remaining portion of the mercury by heat.

It soon struck the more intelligent miners that they were only gleaning in a field where nature herself had reaped before; that the streams of water in those regions had been cutting their way through auriferous rock and washing it on a grand scale; and that, by turning these rivers from their course, they would find the results of nature's washings. This grand conception was carried out in many instances, and the professor's views upon the screen amply illustrated the immense labor expended in the construction of ditches for turning rivers from their course and laying dry their former beds. The water of the rivers being forced into a narrower channel accumulated sufficient force to drive water wheels for pumping out the deep places of the river beds and laying bare the accumulated treasures.

When we come to the valley of Dutch Flat, we see for the first time extensive operations for the working of deep lying hill diggings or "placers." Enormous amounts of money have been expended in bringing from a distance the water power which is so necessary everywhere for the washing of the gravel. Sometimes flumes or aqueducts were constructed, 140 feet high upon timber, each stick of which represented the full length of a mountain pine. Water companies were formed, which derived enormous incomes from the rents paid by miners to whose placers the water was distributed. Now, however, the precarious wooden structures have been replaced by huge pipes of boiler plate iron; and with the supply from these, the miner washes out the gravel of his claim clear down to the solid rock, using what is called the "water gun," a knuckle-joint nozzle throwing a solid stream six inches in diameter for a distance of 200 feet, with about one tenth the velocity of a cannon ball. The washed out gravel is no longer sifted by hand; it passes along its natural course with the water through sluices made of wooden blocks and furnished with quicksilver, into which the gold rapidly sinks, while the sand moves on.

The lecturer then cast upon the screen a drawing of the famous Table Mountain of Calaveras, whose steep walls reminded me of the Palisades. This flat mountain is composed of basaltic rock, filling up the channel of an ancient river which formerly rolled over golden sands. The Table Mountain may be considered as nature's monument to this "dead river." The hidden river channel was discovered by some of the earlier miners; and, by a divination which was almost inspired, these untaught men formed correct notions as to the geological character of the mountain, and expended thousands of dollars in getting at the gold on the river bottoms by means of laboriously constructed tunnels through the hard rock.

The deposits of auriferous gravel are so vast in extent as to be almost inexhaustible; but so small is the percentage of the gold they contain that the adventurer no longer finds any chance of getting rich quickly, and the deposits can be worked profitably only by associate capital, where a legitimate outlay of money will bring a legitimate return.

The lecture was profusely illustrated by means of views upon the screen.

SCIENCE RECORD.—NEW EDITION.

The first editions of 1872 and 1873 having both become exhausted, a new edition of each has just been published. The demand for the work has been very great, and universal praise has been bestowed upon it. Condensed descriptions and engravings of the most important inventions and discoveries in science in the years 1871-2, with steel plate portraits and biographies of a number of men distinguished in science, are contained in these annuals, of over 500 pages each. Price by mail, cloth, $2.00; library binding, $2.50. In ordering, state for which year. Price for both, when ordered together, cloth, $3.75; library, $4.50. Address Munn & Co., publishers, office SCIENTIFIC AMERICAN.

OIL OF VITRIOL.—The manufacture of Nordhausen sulphuric acid is still going on in Bohemia, at the works of Von Starcu, where large quantities of iron pyrites are transformed into so called "stone of vitriol," from which the oil of vitriol is derived by distillation in clay retorts. About 1,500 tuns are annually produced

PAPER MAKING.

Mr. Carl Hofmann, of 406 Walnut street, Philadelphia, late superintendent of paper mills in Germany and in this country, has recently published a valuable and exhaustive work on the manufacture of paper. He has not only drawn upon a long practical experience for his facts, but has gathered an immense amount of information by visiting all the prominent paper mills in the United States. The work, the price of which is $15, will doubtless form a complete guide for those desiring to build mills, as it contains descriptions and engravings of every variety of new and improved machinery, prepared in many instances with the elaboration of working drawings. We cull from its pages the following interesting particulars:

STRAW PAPER.

One of the best articles of this description is made by the Manchester Paper Manufacturing Company, near Poughkeepsie, N. Y. Rye straw, delivered by farmers from the adjoining country in perfectly clean bundles, is exclusively used. It is first chopped in pieces of about three fourths of an inch in length, by means of a cutter, during which operation all weeds and impurities are removed by hand. Cleaning, to get rid of grain and dust, follows, and then the straw is passed through a pair of heavy iron press rolls, which open out the tubes and knots. It is then passed into horizontal rotary boilers, in each of which is sixty gallons of a solution of caustic soda for every hundred pounds of straw. These boilers are walled in, heated by direct fire to a pressure of about sixty pounds above the atmosphere, and kept so for six or eight hours. The stuff is discharged into a tub with a drawer bottom, where the liquor is washed out, and thence to a chest serving as a reservoir to a Kingsland engine, in which any knots or bundles of fiber, which may remain, are completely removed. It is then conducted into drainers, where it remains until dry, when it passes to an ordinary washing engine, in which it is rewashed, bleached with a solution of chloride of lime, and sent to a second set of drainers. Mixing with size, color, and clay follows, then another passage through a Kingsland engine, and, lastly, the material is run over a Fourdrinier paper machine.

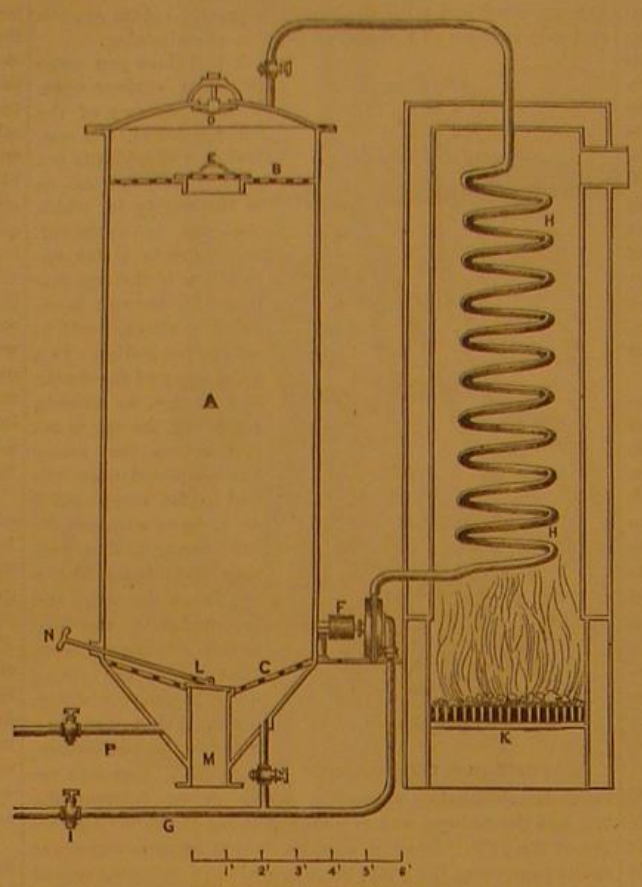
The paper made by this process is soft, clean, and white, and finds a ready market for book printing. Since the works of the company above referred to have been reconstructed, superheated steam is used instead of direct fire in the boilers. Nearly fifty per cent of paper from straw and sixty per cent from esparto is obtained. This is a very extraordinary yield, as it is the experience of many manufacturers that not over thirty-three per cent in good white paper can be obtained from straw in the rough condition in which it is received at the mills. The author considers that there are but two ways in which fifty per cent of white paper can be obtained from straw alone: either by the production of paper of inferior quality, containing much of the inter-cellular matters, or by not counting the clay and size which have been added in sufficient quantity to make up for the lost fibers.

STRAW BOILER.

We select from the pages of the work under examination the accompanying engraving of Dixon's straw boiler, which, the author states, has been found practically successful. The boiler, A, is cylindrical, stands upright, and is carried by flanges riveted to the shell in any desired place and supported on solid framework or walls. It is located so that its upper part projects a few feet above the floor, where the straw is stored, and a man standing there can easily open the man hole, D, lift the cover, E, from a corresponding opening in the upper diaphragm, B, and fill the boiler through them alternately with straw and caustic liquor. The straw, which has been previously cut, is supported by the lower funnel-shaped diaphragm, C, and broken down to such an extent while being packed in, that a boiler of six feet diameter and fifteen feet hight between diaphragms will hold from 4,000 to 4,500 lbs. A rotary pump, F, fed from the liquor tank through the pipe, G, forces the balance of the caustic solution through the coil, H, to the top of the boiler above the diaphragm, B; and after the apportioned quantity has been pumped in, the communication with the tank is cut off by closing the stop cock, I. The caustic solution percolates through the straw, collects under the diaphragm, C, and returns through pipe, G, to the pump, F, which forces it again through the coil and on top of the diaphragm, B. The coil, H, is made of extra heavy two inch wrought iron pipe, placed in a brick furnace and heated from the grate, K. The steam which is thereby raised creates a pressure which can be regulated by the fire, and observed on gages and safety valves connected with the upper part of the boiler. The boiling being finished, the slide valve, L, is opened by means of the handle, N, from the outside, when the contents empty themselves through the channel, M, into the chest or tank below. A pipe, connecting with the steam boiler, enters below the diaphragm, C, and is opened whenever the compact mass of straw requires to be loosened; it is also used before the circulation of the liquor is retarded, and facilitates percolation, as the steam penetrates through and raises the straw bodily.

WOOD PAPER.

The new works of the American Wood Paper Company, at Manayunk, Pa., have a capacity of fifteen tuns of white wood pulp per day. The material is brought to the works as cord wood of five feet length. It is first cut into thin slices of about half inch thickness, and then by large steel knives chopped into small pieces, forty cords being thus treated daily. The material is then boiled with a solution of caustic soda in upright boilers, heated by steam circulated through a jacket, and in which it is confined between perforated diaphragms. To every two boilers is connected, by a capacious pipe, a large sheet iron cylinder, which receives their contents, pulp, liquor, and steam. The liquid solution of pulp flows from these receptacles to flat iron drainers mounted on wheels, each of which is large enough to hold the contents of one boiler. The tracks on which these cars run are underlaid with sewers which receive the

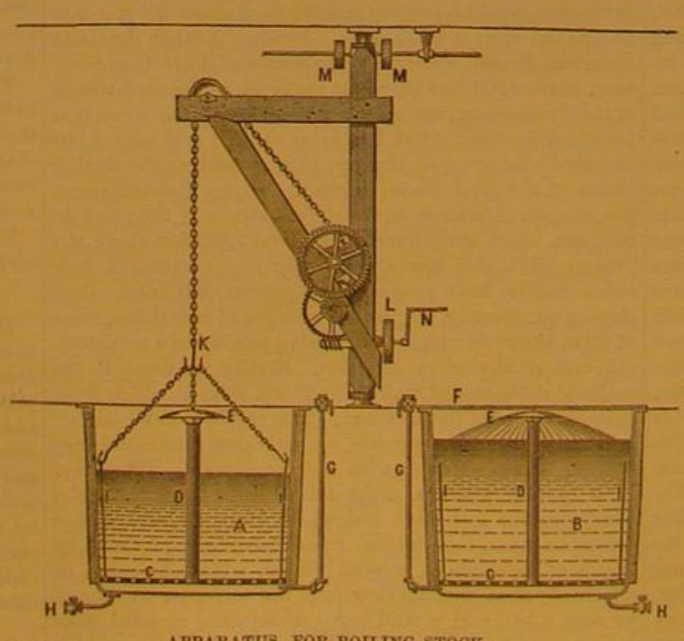


DIXON'S STRAW BOILER.

liquid as it drains off from the pulp. The latter then goes to washing engines, thence to stuff chests, and from there is forwarded by pumps to wet machines, the screens of which retain all impurities derived from knots, bark, and other sources, and the pulp or half stuff so obtained is perfectly clean and of a light gray color. It is bleached in engines with a solution of bleaching powders—like rags—emptied into drainers, and kept there from twenty-four to forty-eight hours. The liquid drained from the pulp is gathered in the pipes under the track and evaporated to regain the soda. The finished pulp is of soft white spongy fiber, and, mixed with rags, is worked into book and fine print paper. Poplar furnishes very white fibers, and is preferred to other woods. Its fibers are, however, short, so that it is often found expedient to mix them with those of spruce or pine. The author adds a tabular statement of the per centage of pulp in different kinds of woods, in which we find that hemlock has 45 per cent, the largest proportion, then dry walnut, 42 per cent, and least of all, lignum vitæ, 15·8 and ebony, 14 per cent. About 28 per cent from young and 30 per cent from old poplar wood, one cord of which weighs from 2,800 to 3,400, lbs. is obtained at the Manayunk works.

BOILING STOCK.

After the materials for paper making are dusted and sorted, the next process is the extraction of ink and fat by boiling. Writing ink can be extracted with water alone, but a solution of soda is required for printing ink. Our illustration annexed represents an arrangement of boiling tubs in connection with a hoisting apparatus, as used in some of the most successful mills. The tubs, A and B, are of light boiler iron, eight feet deep, eight feet in diameter of bottom and eight and a half feet at the top, and are covered with a mantle of wood, which prevents the escape of heat. The false bottoms, C, are perforated, and carry in the center upright pipes, D, overtopped by bonnets, E. The steam enters from the pipe, G, into a coil (not shown) below the false bottom, from which it is evenly spread through all parts of the tub by means of a large number of small holes. The liquid can be drawn off through the pipe and valve, H. A flat iron cover, F, in one or two pieces, is laid over the top.



APPARATUS FOR BOILING STOCK.

The tub is first one quarter or one third filled with a solution of soda; steam is then turned on, and the liquid brought to the boiling point, when, rising through the pipe, D, it strikes against the bonnet, E, and is spread over the whole surface of the tub. As soon as this takes place, the papers are gradually thrown in so that all will be soaked before they reach their resting place. About 4,000 pounds of material can be placed in each tub, in which it is distributed as uniformly as possible.

After the mass is boiled, it is hoisted out by means of cranes. The false bottom, C, is fastened to a strong frame of iron bars and can be lifted clear of the tub by the hooks, K, which connect, by means of chains, with rings or hooks at the upper ends of the rods, I. The pulley, L, of the crane is then connected by a belt with the pulley, M, or the crank, N, is turned by hand, until the whole mass appears above the floor, when the crane is moved around on its pivot to a place where the false bottom can be deposited. Another spare false bottom can be at once attached to the hooks, K, lowered into the tub, and a new operation started. The papers come out as a solid mass, looking like a very large cheese, and the time of the operation varies from fifteen to twenty-four hours.

HOW "GREENBACK" PAPER IS MADE.

All the paper for the money issued by the Government is manufactured on a 62 inch Fourdrinier machine, at the Glen Mills, near West Chester, Pa. Short pieces of red silk are mixed with the pulp in the engine, and the finished stuff is conducted to the wire without passing through any screens, which might retain the silk threads. By an arrangement above the wire cloth, a shower of short pieces of fine blue silk thread is dropped in streaks upon the paper while it is being formed. The upper side, on which the blue silk is dropped, is the one used for the face of the notes, and, from the manner in which the threads are applied, must show them more distinctly than the lower or reverse side, although they are embedded deeply enough to remain fixed. The mill is guarded by officials night and day to prevent the abstraction of any paper.

PAPER BOARDS.

The largest manufactory of binders' boards in the country, and probably in the world, is W. O. Davey & Son's board mill, situated on Jersey City Hights, opposite New York city. The refuse of the oakum factory, which forms part of the establishment, and tarred ropes which cannot be otherwise utilized make up the hard stock. The ropes are cut into pieces by a machine like that used in machine shops for cutting sheet iron. The stock is not washed in engines but ground on elbow plates arranged in an effective and improved apparatus. Three cylinder machines are supplied, on which the pulp is transformed into boards of almost any thickness, which are afterwards subjected to five or ten minutes pressure in a hydraulic press. The boards are then placed in a peculiarly constructed heater which consists of a number of flat hollow plates of metal in which steam is admitted and between which the boards are arranged and allowed to remain until nearly dry. They are then removed to a drying house, which is warmed by steam pipes, and afterwards calendered. About four tuns of boards per day are produced at the above mill. Straw boards, which are now applied to a great number of uses, particularly paper car wheels, are formed, dried, and cut on machines like ordinary paper.

LEATHER BOARDS.

A very hard variety of boards is manufactured partly from leather clippings. The leather for this purpose is cut into small pieces like rags, reduced in the engine with about the same quantity of bagging and waste paper, and made into boards on a cylinder in the ordinary manner. The boards acquire the appearance and to some extent the properties of leather. The material requires considerable time for washing and grinding, and size is unnecessary in its manufacture.

OTHER VARIETIES AND USES OF PAPER.

Roofing paper is made principally from woolen rags mixed with a sufficient quantity of hard stock to give it the necessary strength. The material used is of a porous nature, and its quality depends upon the amount of tar, or similar substance, that it can absorb. Most of the processes of its manufacture are protected by patents. Parchment paper is made from unsized rag paper, the cellulose of which changes its nature if it is for a short time immersed in diluted sulphuric acid and then again well washed; it becomes tough, water tight and transparent, like animal parchment. Tobacco paper for cigarettes is produced by mixing manilla fibers with liquor in which tobacco stems are previously boiled. It burns when dry with a white ash, like a tobacco leaf, which it resembles closely. Cotton waste yields from 30 to 50 per cent of paper of an inferior quality, principally used for blotting. A bogus manilla paper is sometimes made from old wrapping paper and straw, colored with Venetian red in the engine. Real manilla fiber is the strongest known, but the supply is small, and so-called manilla paper is often made from butt ends of jute. Collar paper, for paper collars, is cotton and linen, with a large

admixture of the former. Hemp bagging and a small proportion of cotton canvas are used for tissue paper, the fibers of which are very strong. For bank note paper only the best of white linen, imported from Scotland and Ireland, is used. The dried paper is passed through animal size and the sheets are pressed between fine paste board to give them a dead finish.

Sewing on Buttons.

That facetious editor of the *Danbury News*, whose funny sayings are so widely copied, thus describes the male process of sewing on buttons:

It is bad enough to see a bachelor sew on a button, but he is the embodiment of grace alongside of a married man. Necessity has compelled experience in the case of the former, but the latter has always depended upon some one else for the service, and, fortunately for the sake of society, it is rarely that he is obliged to resort to the needle himself. Sometimes the patient wife scalds her right hand, or runs a sliver under the nail of the index finger of that hand, and it is then that the man clutches the needle around the neck, and, forgetting to tie a knot in the thread, commences to put on the button. It is always in the morning, and from five to twenty minutes after he is expected to be down street. He lays the button exactly on the site of its predecessor, and pushes the needle through one eye, and draws the thread after, leaving about three inches of it sticking up for lee way. He says to himself: "Well, if women don't have the easiest time I ever see." Then he comes back the other way, and gets the needle through the cloth well enough, and lays himself out to find the eye, but in spite of a great deal of jabbing, the needle point persists in bucking against the solid parts of that button, and finally when he loses patience his fingers catch the thread, and that three inches he had left to hold the button slips through the eye in a twinkling, and the button rolls leisurely across the floor. He picks it up without a single remark, out of respect for his children, and makes another attempt to fasten it. This time when coming back with the needle he keeps both the thread and the button from slipping by covering them with his thumb, and it is out of regard for that part of him that he feels around for the eye in a very careful and judicious manner; but eventually losing his philosophy, as the search becomes more and more hopeless, he falls to jabbing about in a loose and savage manner, and it is just then the needle finds the opening, and comes up through the button and part way through his thumb with a celerity that no human ingenuity can guard against. Then he lays down the things, with a few familiar quotations, and presses the injured hand between his knees, and then holds it under his arm, and finally jambs it into his mouth, and all the while he prances about the floor and calls upon heaven and earth to witness that there has never been anything like it since the world was created, and howls, and whistles, and moans, and sobs. After a while he calms down, and puts on his pants, and fastens them together with a stick, and goes to his business a changed man.

Is Rowing Healthy?

Dr. J. E. Morgan has recently published, in England, a work entitled "University Oars," in which he considers the hygienic effects of the rowing contests which for the past forty years have been carried on between the great English colleges. The author is not only an eminent and scientific surgeon, but an oarsman himself of no small repute, so that his qualifications are in every respect adequate to the task which he undertakes. The plan pursued in compiling the facts is worthy of notice, on account of the immense labor it entailed in seeking out the men, who have rowed in these inter-university contests, wherever they might be and obtaining their verbal testimony if living, or that of their friends if dead, as to the results, entailed by work at the oar, upon their constitutions and frames: 294 men had thus to be discovered, and Dr. Morgan states that 245 were found to be living. The results elicited by his inquiries he tabulates as follows: Benefited by rowing, 115; uninjured, 162; injured, 17. The benefits considered are increase of strength and stamina, of energy to undertake, and of power to undergo physical exertion: increase of fortitude to encounter and to submit to trials and privations and disappointments. Those termed uninjured are men who state they have "never felt any inconvenience from rowing," while the injured all assert with more or less distinctness that their exertions have proved harmful. It is concluded, on an examination of the latter class and the nature of the evil results, that the proportion is very small when the number of men is taken into consideration, and that no other pastime, hunting, ball or cricket, would, if closely scrutinized, yield so small a percentage of harm.

AN IMPROVEMENT IN VENETIAN BLINDS.—A novel application of colored and ground glass, instead of wood or iron laths, for Venetian window blinds is worthy of notice. The glass strips are bound round with brass, to preserve their edges; and heavy blinds are simply wound up and down with something like a clock key. The play of colors may thus be managed so as to give beautiful effects: outside by night and inside by day, windows with these blinds affixed will look as if they were illuminated. These blinds, we need hardly say, are expensive, compared with those now generally used; but where cost is not a matter of chief consideration, they are likely to be appreciated.—*Hardware, Metals and Machinery.*

WHAT an ass the fellow must have been who made a donkey engine and expected to get horse power out of it!

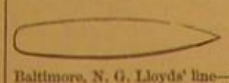
Correspondence.

The Proportions of Ocean Steamers.

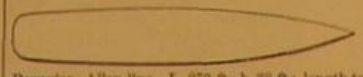
To the Editor of the Scientific American:

In view of the attention now being attracted to the exaggerated length of some of the steamers on the lines between this country and Europe, the annexed diagrams may be of interest sufficient to warrant publication. I have selected the individual ships from the different lines quite at random, and the figures used are taken from Hartshorne & King's "Register." WM. CUNNINGHAM.

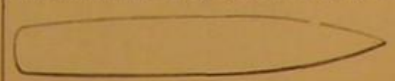
Baltimore, Md.



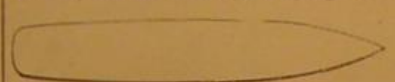
Baltimore, N. G. Lloyds' line—L. 185 ft., b. 29 ft.; length to breadth, 6·38.



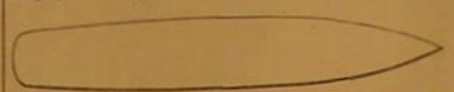
Peruvian, Allan line—L. 270 ft., b. 38 ft.; length to breadth, 7·11.



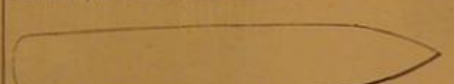
Moravian, Allan line—L. 290 ft., b. 39 ft.; length to breadth, 7·44.



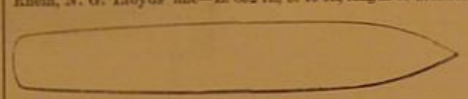
Leipzig, N. G. Lloyds' line—L. 290 ft., b. 39 ft.; length to breadth, 7·44.



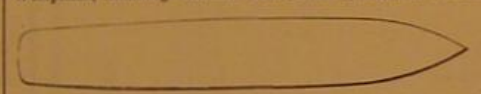
Minnesota, Williams & Guion line—L. 332 ft., b. 42 ft.; length to breadth, 7·90.



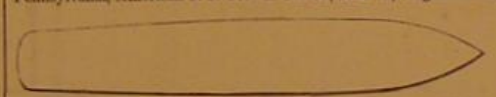
Rhein, N. G. Lloyds' line—L. 332 ft., b. 40 ft.; length to breadth, 8·30.



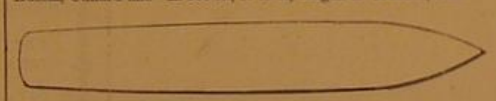
Westphalia, Hamburgh line—L. 340 ft., b. 40 ft.; length to breadth, 8·50.



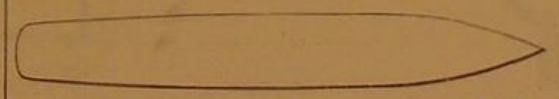
Pennsylvania, American S. S. Co.—L. 343 ft., b. 43 ft.; length to breadth, 7·91.



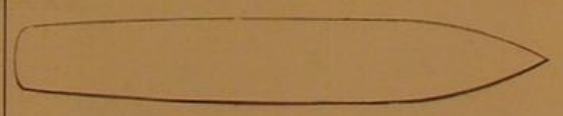
Russia, Cunard line—L. 358 ft., b. 43 ft; length to breadth, 8·33.



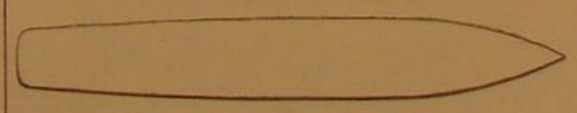
Queen, National line—L. 358 ft., b. 41 ft.; length to breadth, 8·73.



Ville du Havre, French line—L. 423 ft., b. 49 ft.; length to breadth, 8·63.



City of Montreal, Inman line—L. 433 ft., b. 44 ft.; length to breadth, 9·84.



Atlantic, White Star line—Length 435 ft. beam 41 ft.; length to breadth, 10·61.

Appleton's has a timely article on the length of ocean steamers:

"It will be of interest to some to understand how it is that iron, which is between seven and eight times as heavy as the water in which it floats, is not only itself buoyed up, but is able to carry a considerable load in addition. If we place in the water a bar of iron eight feet long, six inches wide, and six inches deep, we know that it will sink at once. But let this bar be rolled into a thin plate sixteen feet long and twelve feet wide, and have an edge turned up all around, forming a box a foot in depth. If it then be placed in the water, it will require to be loaded with a weight of nearly eight thousand pounds before its top edge will sink to the water level. This is because water presses on the bottom of a body immersed in it with a force equal to the weight of the water that the body displaces by its immersion. It is easy to see then, that, with a given weight of material to be used in the construction of a vessel and a given load to be carried, it is only necessary to spread out the material so as to have sufficient surface for the water to press upon and buoy the vessel up.

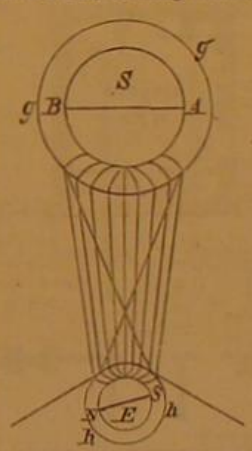
The use to which a vessel is to be subjected will have a great influence on the determination of the breadth. A ferry boat or river steamer, for example, which can have but a limited draft of water, and is loaded mostly above the deck, with varying weights on either side, is generally made of great breadth. A sailing vessel, which is to be propelled by the wind acting on the sails with great leverage, requires sufficient stability to counteract this force. An ocean steamer depending largely on its engine for propelling force and carrying but little sail in proportion to its size, with the greater part of the cargo below deck and with considerable draft of water, can have sufficient stability without great breadth. It is also easy to see that great breadth is far from desirable in an ocean steamer. If the width is great it will take a considerable disturbing force to "heel" the vessel, and it will right itself with great violence also, or, in other words, it will roll very heavily. This can be observed in the case of ferry boats and river steamers, which are occasionally subjected to forces causing them to roll. It seems impossible to build a vessel for ocean service that will not roll under certain circumstances, and it is desirable, especially in the case of passenger steamers, that this rolling motion should be made as easy as possible, and hence great breadth should not be given."

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

To the Editor of the Scientific American:

The usual explanations of the method by which the earth is heated by the sun are unsatisfactory. By many persons the sun is considered to be an incandescent body, diffusing radiant heat; but, while approaching a heated substance the sensation of heat is usually increased, on leaving the earth's surface, to approach the sun, a feeling of intense cold is soon perceived. Neither can the heat on the earth's surface be accounted for on the supposition that the heat rays are reradiated; because, on a hot day, a thin screen interposed between the person and the sun greatly diminishes the sensation of heat.

I think it may be accounted for by the fact that the atmosphere is a lens, whose tendency is to concentrate the rays of heat on that part of the earth's surface which is nearest the sun. This is a lens (convexo-concave) of peculiar refracting power. Its density continually increases from the convex to the concave surface. A ray of heat, then, on entering the atmosphere will be continually passing from a rarer into a denser medium, and will consequently follow a curved line, bending towards the axis of the lens.



S is the sun; B A, its axis; *g g*, its atmosphere; E, the earth; N S, its axis; *h h*, its atmosphere. It is supposed to be winter in the northern hemisphere.

But the atmosphere is also a good reflector; consequently many rays which strike the air at an acute angle will be thrown off, and thus add to the intensity of winter.

If the sun has an atmosphere, the converse of all this would apply to rays leaving his surface. Consequently it would not be necessary that the heating and illuminating substance of the sun should occupy his whole surface, in order that the whole disk should appear illuminated to us. An equatorial belt would suffice.

If these views are correct, the warmth of the surfaces of the planets need not be affected by their relative distances from the sun, and Jupiter and Mercury may have the same degree of heat as the earth.

Newton's explanation of the movements of the solar system is probably correct in theory, but it is deficient in one important particular: it fails to account for the motive power. The attraction of gravitation we all understand; but what is the counteracting force? An original impulse will not answer, for a transient force cannot successfully contend with a constant force of anything like equal intensity. I do not believe that attraction of gravitation is simply due to mass, otherwise a body would weigh heavier at the poles, where there is no opposing force, than it does at the equator. I think that the analogy of magnetic attraction, which depends more on surface, affords the best solution. An equatorial current of magnetism, then, sweeping round the sun from west to east in the plane of the ecliptic, with immense velocity, would account for the motion of the planets in their orbits, and of the sun on its axis. Such a current is no more inconceivable than is the attraction of gravitation, which acts at such great distances and with such vast power. W. F. QUIMBY.

Wilmington, Del.

Clarifying Water.

To the Editor of the Scientific American:

I noticed in your issue of April 5, an article on water in Kansas city, in which you call for a plan for clearin the water of the Missouri river. I think the following would prove successful:

Let there be a reservoir and clarifying tank constructed, the tank on higher ground than the reservoir. Then pump the tank full of water, and put dissolved alum into the water, say at the rate of one pound of alum to twenty-five barrels of water. This will cause the impurities to settle to the bottom; the clear water can then be drawn off into the reservoir, the tank cleaned and the operation repeated. Perhaps it would be best to have two tanks, so that one could be filled while the other was setling. I think this plan will prove successful unless the alum in the water should prove to be unhealthy; and even if it could not be used for cooking and drinking purposes, it could be used for washing instead of the sooty water now used. HARVEY RAY.

COUNTRY HOMES—RURAL COTTAGES.

Homes in most new villages, such as are continually springing up in all parts of the country, lack both taste and convenience in their ornamentation and arrangement. We present herewith a few designs which, though capable of execution at no great cost, show what may be done to make a cottage home an object of beauty and refined taste. Our engravings are selected from a large number in the pages of Downing's "Cottage Residences," an excellent work published by John Wiley & Son, of New York city, which will be found more fully noticed elsewhere in this paper. The object in view in designing the cottage represented in our first illustration (Figs. 9 and 10) is internal convenience. There are many families, some composed of invalids or persons advanced in years, who have a strong preference for a plan giving the kitchen and at least one bedroom upon the same floor with the living rooms, and in which there is little or no necessity for ascending or descending stairs. A glance at the plan of the first floor will show how this idea is carried out. The second story contains two large and two small bedrooms. The elevation is in the English cottage style, so generally admired for the picturesqueness evinced in its tall gables ornamented by handsome verge boards and finials, its neat or fanciful chimney tops, its latticed windows and other striking features. The material for the construction is brick and cement, colored in imitation of Bath or Portland stone, or smooth brick colored after some soft neutral tint. The window frames, porch, veranda and verge board may be painted the same as the walls, and sanded or else grained in imitation of oak. About an acre and a quarter of ground would be a suitable plot for this dwelling. One half of the area in the rear might be devoted to a garden for fruits and vegetables, and the remainder laid out as a lawn with shrubbery and flower beds.

In our second design (Figs. 81 and 82), a very tasteful and pretty cottage, suitable for a country clergyman, is represented. Here there is a conveniently arranged study opening directly on the veranda, a parlor, dining room, and other apartments, all on the first floor. Above are five good bedrooms with a closet in each. For the exterior of the cottage, to be covered with vertical boarding, a simple rustic style has been chosen. The veranda and trellises over the windows are intended for vines, not merely as supports, but rather as thereby giving an air of rural refinement and poetry to the house without expense. They should be constructed of cedar poles with the bark on, and, if neatly put together, will be much more becoming to such a cottage than the most elaborate carpentry work.

The design headed "a river cottage" (Fig. 132) is, as its name indicates, a very pretty Gothic dwelling intended to be located on the bank of a river or sheet of water. It has, therefore, a road front and a water front; the former having the entrance porch extended out beyond the line of the house, to answer the purpose of a *porte-cochere*, and the latter provided with an ample veranda, connected with the lower lawn by a flight of steps. There is a basement, and above, on the first floor, a large parlor with a bay window to command the view, and also dining room, library, etc. The second story contains six rooms. The walls of the basement are of stone, above which the building is of wood filled in with brick. The detail of the finish, both on the exterior and interior, is intended to be plain, leaving the good effect to depend rather upon well balanced proportions than embellishment.

In the next engraving (Figs. 105 and 106) we present a plan for a plain house where abundance of room is more of an object than elaborate ornamentation. The decorations are few and simple, and in keeping with the general effect of the structure. The veranda at the entrance is very broad, and the entrance hall large and roomy. The dining room has a bay window and is conveniently situated as regards the kitchen. The second story contains five chambers, and the attic may be divided off into three large rooms. The cellar extends under the whole house. A few vines may be trained to climb the walls, and some rustic vases and other ornaments arranged before the front will give a tasteful appearance to the building.

We add one more design (Figs. 36 and 37), that of a cottage villa in the bracketed mode, the strongly marked character of which is derived mainly from the bold projection of the roof, supported by ornamental brackets, and from the employment of brackets for supports in various other parts of the building. This mode of construction will be found especially suitable in the Southern States, owing to the coolness and dryness of the upper story during hot weather, afforded by the shade of the peculiar shaped roof. On the second floor are five bed rooms. There is a handsome balcony which is entered upon from a casement window at the ends of the hall in this story, shaded by the broad overhanging roof, and two balconies which accompany, in a similar manner, the large windows in the two chambers at either side of this hall. There are three chambers in the attic story. In the basement story, which is raised about three and a half feet above the ground, are kitchen, laundry, store room, and cellar. The materials for

A COTTAGE IN THE ENGLISH OR RURAL GOTHIC STYLE.



Fig. 9.

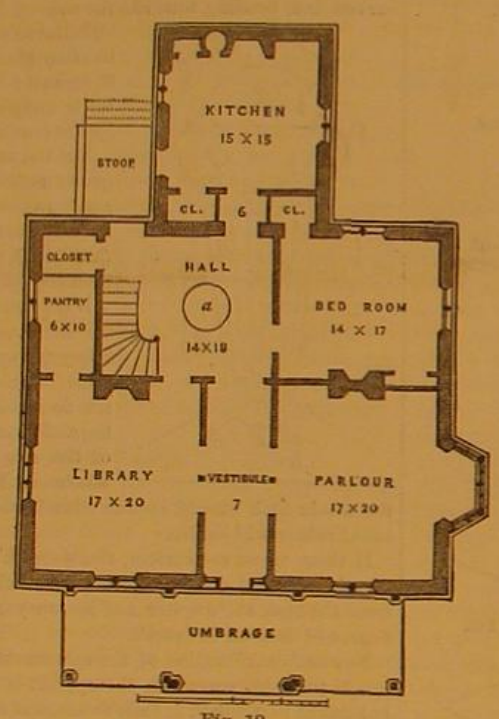


Fig. 10.

A COTTAGE FOR A COUNTRY CLERGYMAN.

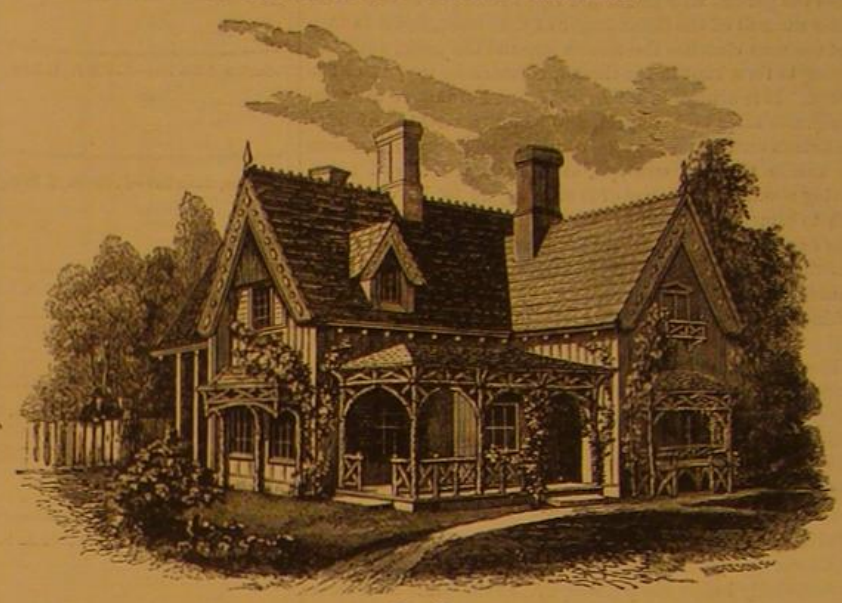
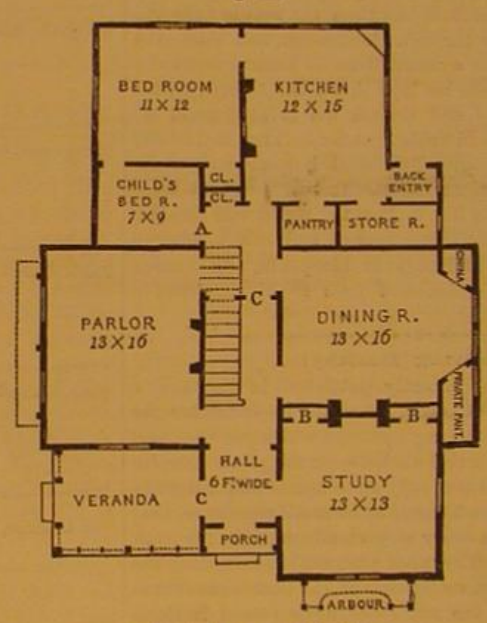


Fig. 81.



Principal Floor.—Fig. 82.

A RIVER COTTAGE.



Fig. 132.

A PLAIN HOUSE.



Fig. 105.

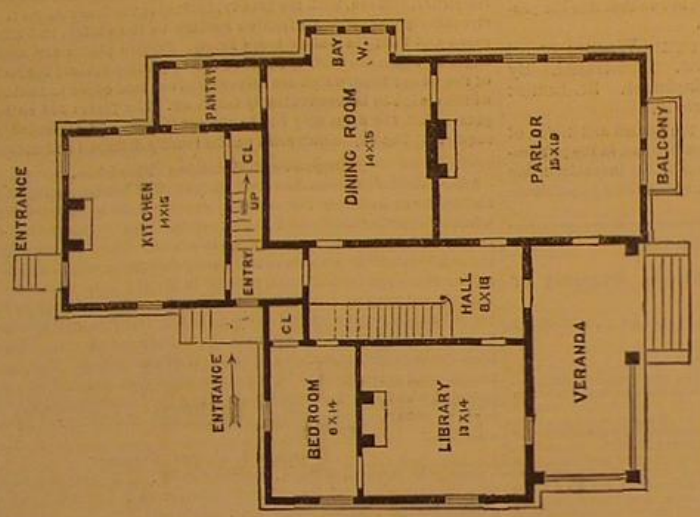


Fig. 106.

A COTTAGE VILLA IN THE BRACKETED MODE.

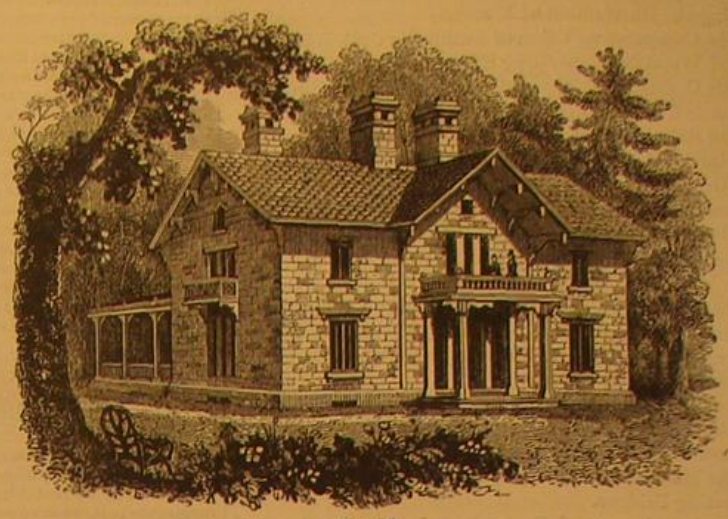


Fig. 36

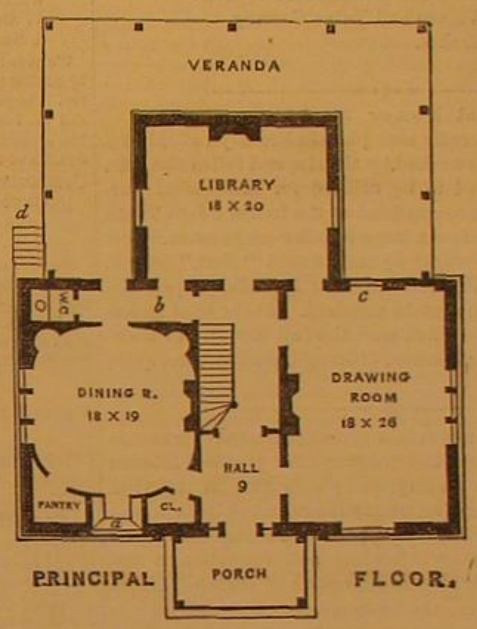


Fig. 37.

construction are brick and stucco or simply wood—the latter being employed with excellent effect.

FRUIT FORK.



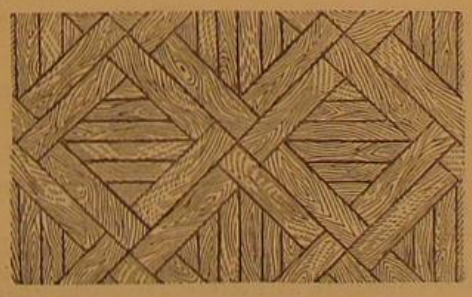
This invention is designed to afford a means of conveniently holding ripe fruit, so that in eating the same the juice will not soil the fingers or come in contact with clothes or carpet. It consists of a fork having a suitable number of prongs, of proper length and shape, which project from the middle of a bowl in which the liquid flowing from the fruit is caught. A handle is connected with the lower side or, if desired, with one edge of the cup.

The device may be made of silver plate of any tasteful pattern, and form a very convenient and handsome article of table ware.

It was patented on February 18, 1873, by Mrs. Isabella C. Draper, of corner of 106th street and Third avenue, New York.

Substitute for Carpets.

With properly laid floors, carpets may easily be dispensed with altogether for four or five months in the year in the extreme Northern States, and much longer in the South. With merely a plain floor, a small hall or a small room may be made to look very pretty indeed, and even elegant, by means of a good sized piece of carpet, with a handsome border in the center, and a few rugs displayed here and there. In almost any hall a rug or two will alone be necessary, either for comfort or ornament, if the walls or ceilings are properly decorated, and sufficient furniture of good pattern and a few pleasing pictures are introduced. The following is a style of parquetry that is elegant enough for any house, large or small. It is of course more costly than ordinary flooring, but it is not beyond the reach of persons of moderate means, especially if they conclude to economize in the matter of carpets.



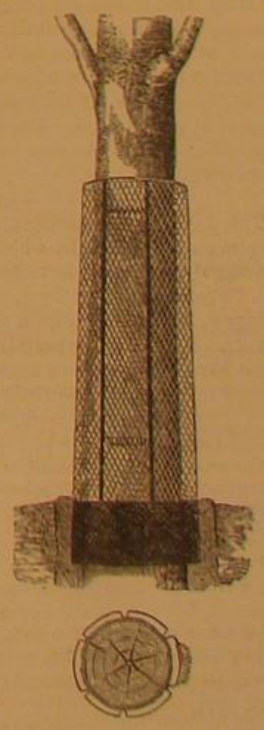
Even this, however, may involve an outlay that some cannot afford, and we accordingly suggest the following as being less expensive, and scarcely less elegant.



This floor may be made either of one wood, or of two kinds—a light and a dark laid alternately. If this is too costly, and a variety is still desired, every alternate board may be stained, so as to look very nearly as well as genuine dark wood. Such a floor as this, smoothly planed and well oiled, is very stylish, and is not difficult to keep clean—indeed, so far as cleanliness is concerned, an uncovered floor has many advantages over a carpeted one. In Europe parquetry floors are polished by being frequently rubbed with wax, and they are much more beautiful when treated in that manner than they are when simply oiled. We need not expect, however, that waxed floors will be common in this country until the servant girl problem is nearer a satisfactory solution than it appears to be at present.—*To-Day.*

TREE PROTECTOR.

Mr. Charles Ayers, of Farmington Center, Wis., has recently patented the device shown in our illustration, for protecting the bark of trees against gnawing animals, boring insects, and the worms which climb and destroy leaves and branches. The invention consists in a wrapper of wire gauze or other reticulated substance, provided with ribs inside to rest against the tree, holding it therefrom, so as to allow a space for the circulation of the air. This envelope is made large enough to overlap considerably, so as to allow of the growth of the tree, and is held together by elastic fastenings. The lower end is sunk a few inches into the ground and packed with wood ashes. For a short distance above the surface, a coating of tar or other adhesive material is applied, to which insects will stick fast. Above the tar, the wire is painted to protect it from the weather.



This device will be appreciated by all farmers and nurserymen, to whom the beauty of the foliage of the trees and the immunity from damage of fruit are important considerations. Patented February 11, 1873.

M. ABERLIN, of Stockholm, places children afflicted with capillary bronchitis or croup in small rooms where there are vessels in which water is kept continually boiling. This treatment, it is stated, if prolonged for days or even weeks, eventually produces a cure. The mortality from the disease in Paris, *Les Mondes* says, has been thus reduced from 48 to 18 per cent.

LYE, OIL, and sugar is the latest patented compound to prevent boiler incrustation.

A. R. M. M. A.

The American Railway Master Mechanics' Association meets this year at Baltimore, Maryland, May 13. The subjects to be reported on and discussed are:

1. Locomotive Boiler Construction.
2. The Operation and Management of Locomotive Boilers, including the Purification of Water.
3. The Comparative Value of Anthracite Coal, Bituminous Coal and Wood for Generating Steam in Locomotives.
4. The Construction, Operation and Cost of Maintaining Continuous Train Brakes.
5. The Relative Cost of Operating Roads of Gages of 3 feet 6 inches or less, and those of the ordinary 4 feet 8½ inches Gage.
6. The Construction and Operation of Solid-end Connecting Rods for Locomotives.
7. Resistance of Trains on Straight and Curved Tracks, and on Wide and Narrow Gage Roads and with Four and Six Wheeled Trucks, and with Long and Short Wheel Bases.
8. The Efficiency of Check or Safety Chains on Engine, Tender and Car Trucks in Lessening the Danger Resulting from Running Off the Track.
9. The Machinery for Removing Snow from the Track.
10. The Machinery and Appliances for Supplying Fuel and Water to Locomotives.
11. The Machinery and Appliances for Removing Wrecks and Erecting Bridges.
12. The Best Form and Proportion of Axles for Cars and Locomotives, also whether there is anything to be gained by the use of Compound Axles and Loose Wheels.
13. Anti-Friction Valves and Valve Gearing.
14. Compression Brakes.
15. Steel Tires.

Tidal Power Machine.

A practical trial recently took place in Brooklyn of Edward W. Morton's machine worked by the rise and fall of the tide, the power thus derived to be utilized for mechanical purposes. The contrivance was tried at the foot of South Tenth street, East River, before a large number of persons interested. The machine works by means of a "float," which, as it rises and falls with the waves or the tide, propels the machinery to which it may be attached. At the trial it was geared to a saw, and worked with the full rapidity of a circular saw run by steam power, although, perhaps, not quite so uniformly.

PROFESSOR HENNEBERG, in a recent sanitary report made at Cassel, makes some observations of a practical interest with regard to water consumption by animals. In the vital process, the water perspiration (by lungs and skin) is in proportion to the water consumption. With increasing perspiration, moreover, there is an increased formation of carbonic acid, and (therefore) consumption of carbon. Hence the more water is taken, the less carbon containing food is utilized for nutrition. Further, the more water drunk by an animal, the more albumen is discharged by the urine. It is, on these accounts, uneconomical and injurious to give animals large quantities of water with their food, or to allow them to perspire in hot stables, etc. Bipeds as well as horses will take notice.

BY a new railway law in Massachusetts, all roads communicating with Boston are obliged to run early morning and evening trains for the benefit of workmen, at reduced rates. The working men's train on the Eastern Railroad now runs six cars instead of two, with which it began. The only law of this kind in New York State is the clause contained in the charter of the Broadway Underground Railway, New York city, which fixes a low fare between the hours of 5 and 7, morning and evening.

THE JAPANESE GOVERNMENT has founded a College of Engineers at Yeddo, in which natives of Japan are to be thoroughly instructed in technology and practical engineering. Professor Henry Dyer, formerly of the University of Glasgow, Scotland, has been appointed chief of the new institute. Several other prominent English professors are to assist him. Japan is making rapid strides in the acquisition of practical arts and knowledge.

THE postal cars are to be run directly into the basement of the new Post Office building in Boston. The new Post Office building in New York was also constructed, so far as the basement portion is concerned, with special reference to the running of the postal cars over the Broadway Underground Railway, directly into the Post Office. The building has a front of three hundred and forty feet on Broadway.

AT A CONVENTION in which twenty-seven trades' unions were represented, recently held in New York city, it was resolved to postpone the contemplated strike for eight hours until 1874.

A BILL is before the New York legislature to authorize the formation of a corps of sappers and miners, with power to blow up buildings during an extensive conflagration.

A. BIRNEY, of Jersey city, N. J., has patented a new mode of using coal dust as fuel. He blows it into the fire by air pressure, through perforations in the grate bars, which are hollow.

ON Church Island, which stands in the middle of Salt Lake, some veins of copper ore have been discovered. If silver could only be found, the salt now wasted on the desert air might be made useful.

NEW BOOKS AND PUBLICATIONS.

DOWNING'S COTTAGE RESIDENCES. By A. J. Downing. New Edition. Edited by George Harney, Architect, etc. Illustrated by numerous Engravings. New York: John Wiley & Son, 15 Astor Place.

On another page of the present issue, the reader will find a selection of cottage designs taken from this excellent work, which may be considered as specimens of the numerous finely executed engravings which embellish its pages. Many of the structures represented have been erected in various parts of the country, so that the author draws from actual experience for the advice and information which he gives relative to their proper construction. Each design—there are twenty-eight in all—is accompanied by plans and such other figures as are necessary to exhibit the details of the work, together with general specifications and builder's estimates of cost. In addition to describing the dwelling itself, the author furnishes valuable hints for laying out and decorating the adjoining grounds, giving plans of paths, roads, beds, &c., lists of flowers, shrubs and trees suitable to different localities, and, occasionally, sketches of rustic arbors, furniture, vases, and other articles of rural ornamentation. The volume is one which we do not doubt will prove a convenient and reliable hand book to all owners of country property desirous of learning how to improve and beautify the same in the cheapest and yet most effective manner. It is handsomely bound, finely printed on heavy paper, and is issued generally in the usual excellent style of the well known publishing house from which it emanates.

PROTECTION AGAINST FIRE, AND THE BEST MEANS OF PUTTING OUT FIRES: with Practical Suggestions for the Security of Life and Property. By Joseph Bird. New York: Hurd & Houghton. Cambridge: The Riverside Press.

We have received advance sheets of this work, in which many little known and interesting facts about fires are collected. The book, when published, may be read with interest by the whole community; and the suggestions in it, if not very original, are practical and have been, for the most part, tested in actual conflagrations.

THE POETRY OF ARCHITECTURE: Cottage, Villa, etc. To which is added "Suggestions on Art." By Kata Phusin. With Numerous Illustrations. New York: John Wiley & Son, 15 Astor Place.

We have here an æsthetic treatise on the beauty and grace which may be, by skillful hands, given to the cheapest and lowliest forms of house building. The publishers attribute the authorship of the work to Mr. Ruskin: and the inimitable style in which it is written will justify the assertion. The originality of idea throughout the whole book shows that it is the production of a practical man and a practised writer.

COMPOUND METALLIC COLUMNS, OF EITHER WROUGHT OR CAST IRON, FOR BUILDING PURPOSES. Illustrated. By John A. Kay, Architect and Civil Engineer. St. Louis: H. R. Hildreth, Olive and Second Streets.

We published, on page 47 of our current volume, the system and design of Mr. Kay's improvements in iron building. The author has, in the publication now before us, given an elaborate description of his inventions, and has added tables and data by which architects can adapt them to buildings of all sizes and for all purposes.

DECISIONS OF THE COURTS.

United States Circuit Court,---Southern District of New York.

PATENT FOR GLASS BUTTON.—ALBERT M. SMITH *vs.* WILLIAM W. MCFARLAN *et al.*—SAME *vs.* SAME.

[In Equity.—Before Judge Benedict.]

These were two causes, in which all the parties are glass manufacturers. The complainant claims to be the inventor of a new article of manufacture in the shape of a glass button with a metallic back, of wire cloth or perforated metal, for giving strength to the button. Letters patent were granted to him for this invention, as well as for another, consisting of a die and press for stamping these buttons out of molten glass, January 28, 1873. He claims that one of the defendants was a workman in his employ, and that he, after acquiring all the necessary knowledge about these buttons and presses, left the complainant's factory, and with the other defendant set up a rival manufactory of their own, in which they use presses and make buttons which infringe the complainant's patents. The cases came on, upon a motion for a preliminary injunction to restrain the defendants from using the presses and making the buttons which are claimed to infringe. The defense set up was that the grant of the complainant's patent was of too recent a date for him to have acquired the exclusive possession which the law requires, and that the defendants had made such changes, in the construction of their presses and buttons since the patents were issued, as to avoid the patented features. The proofs submitted by them established this state of facts to the satisfaction of the court, and the motion for an injunction in each case was denied.

J. W. Fisher, for complainant.
B. F. Valentine, for defendants.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

FROM April 14 to April 17, 1873, inclusive.

CLIPPING MACHINE.—J. W. Guernsey, Winchester, Mass.
CUTTING SCREW THREADS.—P. Hickey, Auburn, N. Y.
EQUILIBRIUM PISTON VALVE.—T. Critchlow (of Baldwin, Pa.), London, Eng.
PUMPING MACHINERY.—E. Cope *et al.*, Hamilton, Ohio.
RAISING WEIGHTS, ETC.—T. A. Weston, Ridgewood, N. J.
TELEGRAPH.—M. Gally, Rochester, N. Y.
TRIMMING BOOT SOLES, ETC.—S. H. Hodges, Lynn, Mass., *et al.*

Recent American and Foreign Patents.

Improved Ant Trap.

Theodore G. Ames, Kosse, Texas.—This invention relates to a new annular sheet metal pan arranged so that it can be used advantageously for the purpose of catching ants. In use this trap is placed upon the ground over and around an ant hill, and earth is piled around. Within the trap moist soil is by preference piled, the moisture being for the purpose of not choking the entrances into the ant hill. All ants that may attempt to reach the entrance to the hill may, or will, pass over the upper edge and drop into an annular chamber, and all those attempting to leave the hill will pass into the same chamber. On the smooth metallic inner faces of these plates ascent will be impossible to the ants, and they therefore will be securely caught and retained.

Improved Adjusting Attachment to Reversing Levers, etc.

George W. Jordan, Passaic, N. J.—This invention consists of a worm wheel and turning gear to work it, and a toothed face on the quadrant bar for holding the lever of a reversing apparatus, throttle valve, and the like levers, so combined with the lever and the said holding bar that the lever can be shifted by the worm when it is desired to adjust it nicely, while at the same time the worm wheel, which also serves for the holding catch, can be disengaged by the ordinary catch lever, in the same manner that the ordinary catch is, when the principal lever is to be shifted to any considerable extent.

Improved Collar.

Andrew Flatley, Brooklyn, N. Y.—This invention has for its object to improve the construction of linen and other collars to adapt them to receive an ornamental clasp. The invention consists in forming an obtuse salient angle on each of the inner sides of the lappets of a "Byron" collar, thus forming a triangular space above and below the same when the collar is adjusted for wear.

Improved Ash Sifter.

Samuel Smith, Brooklyn, N. Y.—This inventor proposes to furnish to the public an ash sifter supplied with a mechanism by which the dust so annoying in sifting is entirely obviated, and at the same time the danger of fire incident to the present mode entirely avoided. In using this sifter the main vessel is uncovered, the sieve with the ashes to be sifted is placed on the lugs made within, the cover replaced, the hand lever inserted through a slot into the holes provided in the sieve and projecting band, then the sieve is thoroughly shaken till the pieces of coal and ashes are separated, when the hand lever is taken out, the vessel uncovered, the sieve with the unburned coal removed, and the main vessel with the ashes placed in readiness for carting off.

Improved Fire Extinguisher.

John C. Meehan, Springfield, Mass.—The invention consists in the improvement of fire extinguishers. A pipe, connecting with the boiler of any kind in which steam is maintained, is arranged to extend around the room. A valve case is arranged with a cap, having several nozzles pointing in different directions, to deliver the steam escaping from the pipe in jets when the valve is open. The stem of the valve connects with a lever, which is caused to hold the valve shut by a stick placed under its free end, and resting on an adjustable seat. This stick is hollow, and filled with powder or other explosive material, with which a fuse connects, which is to be so extended about the room, and so disposed that it will be ignited quickly in case of fire in the room and explode the stick, so as to free the valve and allow the steam to open it and escape into the room. A bell cord is attached to an extension of the lever for transmitting an alarm to other rooms or frequented places.

Improvement in Incasing Caustic Alkali.

George W. Humphrey, Pompey, assignor to himself and J. Munroe Taylor New York city.—This invention consists of an improvement in the mode of incasing caustic alkali (soda or potash) in hermetically sealed envelopes, so as to secure it most perfectly against atmospheric deterioration and deliquescence, which also renders its highly corrosive nature harmless. The inventor uses for this purpose india rubber cloth, cut into suitable sized pieces. When thus enveloped with india rubber the whole is wrapped with common Manilla paper.

Improved Churn Power.

William A. Lewis, Springfield, Vt.—The object of this invention is to improve the apparatus employed in rotating the dashers of churns, and consists, first, of a clutch by which two gear wheels are fastened so as to revolve together. It also consists in the mode of confining the wheels to the arbor. When it is desired to give the dasher a more rapid motion, the one wheel is detached from the arbor and placed upon a stud, which enables the two wheels to mesh together and increase the motion of the dasher.

Improved Friction Clutch.

Samuel B. Alger, Oswego, N. Y.—This invention has for its object to furnish an improved friction clutch grasping the pulley promptly and firmly. The invention consists in certain combinations of parts, as hereinafter described. The loose pulley is kept in place upon the shaft by means of a collar and by the center piece of the clutch, which center piece is keyed with said shaft, and is made in the form of a disk of a less diameter than the pulley, and has a wide transverse groove formed across the middle part of its outer side. The side edges of the center piece are notched at the ends of its transverse groove to receive blocks, the ends of which are pivoted to the outer edges of the plates of expanding arms. The outer edges of the pivoted blocks are curved to correspond with the curve of the flange or of the pulley, and are, with the groove, formed in the inner surface. This construction gives a greater friction surface to the clutch, and enables it to grasp and hold the pulley more firmly. Double plates are arranged, the edges of which are slightly inclined to fit squarely against the inclined sides of the wedge keys, which are driven between said edges to enable the wear of the clutch to be conveniently taken up. The plates are so secured together that the arms may be readily contracted and expanded, as may be required. The expanding arms can be readily attached and detached.

Improved Washing Machine.

Price C. Dillan, Villisca, Iowa.—This invention has for its object to furnish an improved machine for washing clothes quickly and thoroughly, and without injuring them, and the apparatus may be used as a receptacle for unwashed clothes and as a wash stand. The invention consists in the combination of a concave stationary rubbing surface, and a vibrating rubber of corresponding form, pivoted in slotted bars, which are provided with lateral arms or extensions, hinged to the side of the tub or box so that the rubber may move up and down to adjust itself to the thickness of the clothes. By suitable arrangements the rubber can be conveniently turned back for the ready insertion and removal of the clothes. The machine may be operated when desired by a person sitting at the end of the box, the cover of which may be turned back into a horizontal position to serve as a table to hold the clothes when being put into and removed from the machine.

Improved Horse Power.

George M. Branch, Winona, assignor to W. A. Moore, Magnolia, Miss.—This invention has for its object to furnish an improved horse power for driving cotton gins and other light machinery. To the middle part of the base of the frame of the machine is attached a step in which a pivot formed upon the lower end of a vertical shaft revolves. The upper end of the shaft is pivoted to the upper part of the frame. To the lower part of the vertical shaft is attached a sweep, to the end of which the power is applied. To the shaft and sweep is attached a large horizontal wheel which gears with another wheel attached to a horizontal shaft of which the bearings slide up and down in grooves in the inner sides of upright bars attached to the upper part of the frame. By adjusting wedges the said bearings may be adjusted as required. The teeth of the gear wheel also mesh into the teeth of another small gear wheel attached to a shaft to which is attached the band wheel from which the power is taken to the machinery to be driven. By this construction, the power, being applied to the large wheel, is applied at great advantage, so that more work may be done with a less expenditure of power than with machines constructed in the ordinary manner.

Improvement in Extracting the Juices of Sugar Cane, etc.

George Wilkinson, Antonie L. Possoz, Jean P. Lafargue and Auguste E. Dutreih, Paris, France.—This invention is a process and apparatus for extracting juice from cane and other sugar-containing matter. The cane in the form of chips is fed continuously through vats provided with agitators which carry the chips back and forth. The liquid forming the extract is, by the arrangement, constantly becoming stronger, as the newly admitted liquid comes first into contact with the spent chips of cane or other material. The inventors claim: 1. The mode of extracting the saccharine matter of cane and other saccharine substances, by subjecting the same, when suitably prepared or divided, to the action of heated saccharine juice, followed by washing in a mixture of dilute juice and pure water, said operations being conducted in the apparatus specified. 2. The combination of two or more macerators, substantially such as described, into and through which the prepared cane or other saccharine substance is successively passed, as set forth, the liquids with which said substance is treated during its passage through said macerators being obtained and supplied to and discharged from said macerators. 3. An apparatus for extracting the juices of sugar cane and other saccharine vegetable substances, the parts of which are constructed, combined and arranged for operation.

Improved Upright Piano Action.

George C. Manner, Mott Haven, N. Y.—This invention is an improvement in the class of pianoforte actions wherein what is known as the French action is adapted to upright pianos. The improvement consists mainly in the arrangement of hammer and rebound cushion with the main lever of the French action on which the key operates. The damper, which, in position of rest is held by a spring constantly against the cord, is supported on a lever by a sliding rod so that when said lever is swung up by the action of the key it will in the first place act upon the hammer, secondly, push the damper off the cord, and, thirdly, carry a cushion forward to receive the hammer when it drops back from the cord.

Improved Machine for Cutting Hoops.

Augustus G. Parkhurst, Appleton, Wis.—This invention relates to a new improvement in machines for cutting beveled pieces or sheets from blocks of wood; and consists in the arrangement of the cutting knives in a sliding frame. The piece of wood to be cut is placed on a bed, against vertical ribs, and between adjustable pieces. Short knives are arranged which may be set to any required angle with a long knife. As the knives are brought down upon the piece of wood, the ends are cut to a bevel simultaneously, and then the sheet which is cut from the piece by the long knife will be evenly beveled at each end, so that they may be lapped on each other and fastened when formed into boxes or cylinders for various purposes.

Improvement in Dental Gold.

R. S. Williams, New York city.—In this invention, two or more sheets of plain foil with an outer sheet of frosted gold are rolled into a cylinder over a mandrel, and the lapping edge of foil caused to adhere by passing it over the flame of an alcohol lamp. The frosted gold, by its greater stiffness, will prevent the several folds forming the coil from adhering.

Improved Washing Machine.

George Seymour, Boone, Iowa.—This invention has for its object to furnish an improved washing machine. The sides and bottom of the tub are made of sheet metal, the end edges of which are bent over the curved edges of the lower parts of the vertical ends. The upper edges of the sheet metal are secured to bars attached to the lower edges of the upper side parts of the ends which project beyond the curved sides to enlarge the upper part of the tub. Side boards are attached to the edges of the bars and ends. To a bar at one side of the tub is attached a board, to serve as a shelf and also to prevent the water from spattering out. To another bar is attached an ordinary rubbing board to enable such parts of the clothes as may be very much soiled to be rubbed by hand. In the inner surface of the ends parallel with and at a little distance from the sheet metal plate is formed a groove, which, at the side of the tub next the rubber board extends up to the upper edge of the said ends. Rollers, which are made in the form of cylinders with longitudinal grooves formed in them, are slid into the grooves. Stationary rubbing bars are alternated with the pairs of these rollers. An oscillating rubber is arranged to adjust itself to the thickness of clothes being operated upon, and to turn the clothes completely over at each stroke.

Improved Churn.

Henry A. Hincheer, Hustonville, Ky.—This invention has for its object to furnish an improved churning apparatus. The mode of operation of this invention is as follows: As the dasher moves down and expresses the cream, through a cylinder within the churn, at side perforations which are below the dasher and at the open and raised end of said cylinder, the vacuum created above the piston is filled by the ingress of cream from upper part of churn. The strokes of the dasher following one another in quick succession, a circulation of the cream in currents, in and out of cylinder, is produced and continuously maintained until the butter comes.

Improved Door Spring.

Leonard J. Higgins, Mount Desert, Me.—This invention relates to springs for closing door and gates; and consists in the mode of applying the arm or lever which connects the spiral spring shaft with the door or gate, said arrangement allowing the tension of the spring to be varied to prevent slamming, or to ensure an entire closing of the door or gate.

Improved Lifting Jack.

James S. Haldeman, Kansas city, Mo., assignor to himself and Harry E. Clark, of same place.—This invention has for its object to furnish an improved jack for lifting heavy weights, which shall readily adjust itself to the movement of the end of the heavy body being raised. To lugs formed upon the upper side of the foot plate are pivoted the lower ends of two bars, the upper ends of which are connected and held in proper relative positions by pins which pass through lugs formed upon the edges of said upper ends. The front pin is provided with a roller to prevent friction as the lifting bar is raised and lowered. The lifting bar is made of such a size as to fit into the space between the two bars, and of such a length that its upper end may be kept in place by the roller and pins. To the lower end of the bar is attached a cross pin, the ends of which enter and move up and down in longitudinal slots in the said bars. Upon the forward side of the lower end of the lifting bar is formed a shoulder or step upon which the object to be raised rests, and upon the rear side of the bar are formed ratchet teeth to receive the end of the operating lever to raise the body. The lever is passed through a loop or stirrup pivoted to the rear pin to serve as a fulcrum. A pawl is pivoted to the rear pin and is held forward against the teeth by a spring, to hold the lifting bar in place while the lever is being adjusted for another stroke. Upon the pawl is formed a projecting hook to serve as a support when the bar is to be lowered.

Improved Rice Huller.

Milton E. Stacy, Thomasville, Ga.—The invention consists in the improvement of rice hullers. The bed or mortar is made of a single block of wood or of several blocks secured to each other. In the upper side of the bed is formed a ring groove, the inner side of which inclines toward the center and the outer side rises more abruptly. The block or bed is surrounded by a frame or crib. A shaft passes through and works in a hole in the center of the bed, and its ends work in bearings in the frame of the machine below and above, being so arranged that the shaft may move up and down, as more or less rice may be in the groove. To the shaft above the bed are attached radial arms, to the ends of which are pivoted wheels in such positions as to roll along the ring groove and operate upon the rice in said groove. To arms attached to the shaft is rigidly attached a scraper to push the rice from the inclined middle part of the bed down into the groove, so that all parts of the rice may be operated by the wheels. With one or both the arms is connected a scraper to smooth down the rice in the groove and bring it into better position to be operated upon by the wheels, which may be raised into a horizontal position when desired. The rice is fed into the groove from a hopper. In one or more points a discharge opening is formed in the bed through which the rice when hulled is drawn off, and which is closed with a gate.

Improved Furniture Caster.

Cevedra B. Sheldon, New York, N. Y.—The above inventor has recently patented three inventions relating to the construction of casters for furniture, safes, trunks, and for all the purposes for which casters are used. The first consists in a conical shaped cup, made of a single piece of metal, with an enlargement or channel around the base, and with a cavity at the center or apex. A series of friction balls are arranged around the caster ball, and the screw is fastened to the shell of the caster by means of a square head and a cup shaped nut, which nut screws, by means of an independent screw thread on body of the screw, down on the back of the shell. An elastic lining is provided between the cup and the casing to prevent their contact and lessen noise. The object of the second invention is to improve the means of protecting trunk casters from injury; and it consists in securing the cup, in which the caster ball is placed and customarily revolves, in a cavity formed in the bottom of the trunk, by means of tongues or clips struck up from the sheet metal, lining said cavity. The third invention consists in the arrangement of a series of friction balls in a casing on and above the stand and between said stand and the cup or socket that is applied to the furniture leg, the construction being such that the friction is greatly reduced and the caster wheel made to readily turn and conform to the motion of the piece of furniture moved.

Improved Moth Trap for Bee Hives.

Leroy Gates, Pleasant Hill, Mo.—This invention consists in a new construction of moth box or trap. The base is attached to the brood chamber by hooks. The top of the moth trap forms the lighting shelf or platform for the bees, directly beneath which are the moth entrances. Inclined planes are arranged down which the moths slide to the center, which center is provided with a removable pan containing water or other liquid, or a slide, or both, by means of which the moths are destroyed. The comb cuttings from the brood chamber pass down through an orifice in the top into the moth trap. The bottom of the brood chamber has an orifice of similar size covered with wire gauze, to prevent millers reaching the upper chamber of the hive. The comb frames stand vertically and slide in from the rear on raised wires. Each frame has a groove in its bottom to receive the wire, and on top a projecting wire at each end. At one end the wire enters the front of the hive; at the other end it receives a hinged strap of iron, which is perforated for each wire. The frames are held in a vertical position by this means.

Improved Basket.

William C. Higgins, North Blandford, Mass.—The object of this invention is to furnish a strong and durable basket—one which, while being elastic and yielding, will retain its shape and still be light and handy to use. The body of an ordinary basket is of any desired size and form. The outer stays extend across the bottom and to the top of the basket. The inner and outer stays are arranged opposite each other, and are, consequently, equal in number, and riveted firmly together through the basket. A central band passes around and another band is placed near the bottom of the device. These bands are within the outer stays, and are confined by a nut at each intersection. The basket rim consists of three horizontal thicknesses, and is securely nailed or riveted to the vertical stays of the basket. A sectional band fills the space between the outer vertical stays, and gives a smooth finish to the top of the rim. A foundation cross is fitted over and riveted through the stays, and hand holes are arranged on opposite sides of the basket.

Improved Railroad Rail.

H. Gates Angle, Chicago, Ill.—This invention is an improvement in the class of rails formed of wooden stringers or timbers, and metal angle plates applied thereto. Wood stringers or sleepers are to be arranged along the ties, and butted together end to end to support the rails. These stringers are rounded at their upper inner corner. Angle bar shaped rails are supported on these stringers, the part which is thick and strong being on the top to receive the treads of the wheels, and the part which is thin and light being arranged on the inside of the stringer to receive the lateral thrust of the flanges, and also to sustain the weight of the train. The corner is rounded to correspond to the shape of the tread of a car wheel. A strengthening rib is formed along the lower edge to prevent the breaking laterally by the vertical strain. A lip is turned down on the outer edge and forced into the top of the stringer when the rail is laid, to hold it against working off laterally and in case the bolts work loose; also, to act in conjunction with the bolts for holding them on the stringers. A strong flat plate is let into the top of the stringers flush with the surface where the rails meet to prevent the ends from being forced into the wood as they would otherwise be.

Improved Machine for Turning Bags.

Joseph Martin, New York city.—This invention has for its object to furnish an improved machine for turning bags after they have been sewn, and which shall be so constructed as to take the bag after it has been turned and deliver it in a pile upon the platform or table of the machine. To the forward part of the table and platform of the machine are attached two uprights, in the inner sides of which, near their forward edges, are formed grooves to serve as a way for a frame to move up and down in. To the platform between the uprights are attached two other uprights to receive the bags to be turned. To the upper ends of the arms are pivoted friction wheels to diminish the friction as the bags are drawn over said arms in being turned. The receiving arms are adjustably attached to the platform, so that they may be moved toward or from each other, as may be desired, to adjust them according to the width of the bag to be turned. Upon the outer edges of the upper parts of the arms are formed inclines which, as the bag is turned and the lower parts of the arms pass below the offset of the receiving arms, force apart or spread the lower ends of the said arms spreading out the bag. The tapes pass around the guide rollers and deliver the bag upon the fly, the fingers of which enter the spaces between the tapes as they pass from roller to roller. The fly is operated to deposit the bag upon the platform by a coiled spring.

Improved Wheel for Vehicles.

Michael McNalley, Houston, Texas.—The invention consists in a one piece attachment for wooden hubs. The wooden hub being turned larger in the middle, and the grooves for the bars being cut, a double band is driven on the center of the hub, so that flanges inclose the spoke mortises and support the spokes as they are driven, likewise preventing the wood from checking. Thus, while the spoke tenons will be in contact with the wood, the latter will be supported and strengthened by bars, so that rigidity of the spokes and durability of their sockets or mortises will be attained. The shoulders of the spokes rest both on the wood and metal bars, thereby insuring a firm and enduring yet measurably elastic support.

Improved Lubricating Compound.

Ethan A. Tonner, St. Louis, Mo.—The object of this invention is to furnish a lubricant for car axles and other purposes, which consists of tallow, oil, Tripoli, and lamp black. These ingredients are thoroughly mixed together after the tallow is reduced to a liquid state by the application of heat. The Tripoli and lamp black polish the journal, while the tallow and oil lubricate it.

Improved Furnace Block Press.

Alfred Hall, Perth Amboy, N. J.—The object in this invention is to vary the form of the block by means of a single pair of adjustable plungers in a single mold, and to so arrange the machine or press that the labor will be greatly diminished and the blocks be pressed in a more complete and workmanlike manner. The invention consists in adjustable plungers and changeable bearing presser knobs. The movement of the presser bars is slight, but powerful. The pressure is given at each edge of the block, and, while the thickness is governed by the depth of the mold, the edges are made to conform to the position of the plungers. After the block is pressed it is shoved from the mold by moving up a plunger, and is taken from the platform by hand, when another block is placed upon the platform, and the operation is repeated. The press is operated by two men—one to each pair of levers—who put on and take off the blocks.

Improved Bee Hive.

Amos Deweese, Oak Mills, Kansas.—This invention is an improvement in the class of devices or apparatus for closing the entrances of a series of hives simultaneously. The improvement, consists, first, in arranging the sliding bar, which connects the entrance gates of the several hives, so as to stand in the place of the usual alighting board; and, second, in a peculiar manner of providing the gates with wire gauze ventilators, whereby, when the bee entrances are closed, air may be admitted.

Improved Harvester.

Richard A. Roberts, Salisbury, Mo.—This invention has for its object to improve the construction of an improved harvester dropper for which letters patent No. 128,564 were granted to the same inventor July 2, 1872. The finger bar which is hinged or jointed is secured to the grain divider, and the bar is supported at or near its hinge by a shoe. The inner end of the bar is connected with the frame of the machine. The platform upon which the grain falls is formed of a number of pairs of parallel slats. The outer ends of the slats are secured to the grain divider, and their inner ends are connected with and supported by bars or a framework attached to the framework of the harvester. To belts are attached teeth, prongs, or fingers of such a length as to pass through the slots between the slats and rise above said slats sufficiently to take hold of the cut grain and carry it across the platform and up the inclined part of said platform to the dropper. Curved arms, when lowered, receive the grain and detain it while the dropper is being operated to drop the gavel to the ground.

Improved Washing Machine.

William E. Millegan, McKinney, Texas.—This invention has for its object to furnish an improved washing machine which shall wash the clothes quickly and thoroughly, and without injuring them. In using this machine a lever is raised to bring the rubber block to the upper part of the wash board; a part of the clothes which have been previously soaped and placed in the water in the box is drawn up and spread over the lower part of the washboard. The lever is then moved up and down, which moves the rubber up and down upon the washboard until the said portion of the clothes is washed clean, a bucket, each time the lever is raised, bringing up water from the lower part of the box to wet the clothes while being operated upon.

Improved Wardrobe Bedstead.

Richard W. Frost, New York city.—The invention consists in the improvement of wardrobe bedsteads. The case for inclosing the bed is constructed in the form of a bureau, and has a drawer in the upper part, and a detachable front below, which closes the entrance to the space for inclosing the bed. The mattress is hinged to the bottom of the case and is divided at the middle longitudinally in two sections in order to fold short. The sections are hinged together. The legs may be hinged to the mattress frame to fold down flat on the bottom when the bed is folded up, and have appliances for bracing them when supporting the bed. When folded up, the parts will be secured by hooks and eyes.

Improved Scarf Ring.

John Haack, Hoboken, N. J., and Saintemme Diolot, New York city.—The object of this invention is to supply a scarf ring which, in a neat and efficient manner, attaches and closes securely to the scarf or other object. The invention consists of a broad band, round, oval, or otherwise, with a buckle hinged to it, which supports a hook-like pin entering, through a perforation, to the interior of the ring, and piercing the article to which it is applied, adhering securely thereto.

Improved Blacking Brush.

Charles W. Maguire, Brooklyn, N. Y.—The object of this invention is to strengthen and render more durable the brush used for blacking boots and shoes, and it consists in a blacking brush having the supply brush, polisher, and handle jointed together by dovetail tongue and groove, instead of being attached by screws as ordinarily.

Improved Horse Hay Rake.

Richard B. Sheldon, Canastota, N. Y.—This invention has for its object to furnish an improved sulky or riding horse hay rake, which shall be so constructed that it may be readily controlled by the operator. The invention consists in the pivoted pawls, in combination with the ratchet wheels attached to the hubs of the drive wheels, and with the axle of a horse hay rake; in the hinged form of the semicircular T grooved piece, and in a semicircular T flanged piece, in combination with the axle and thills of a horse hay rake, in order that the weight will always be directly over the axis of the axle, whatever may be the position of the operating parts of the machine; in arrangements to throw said pawls into gear with the ratchet wheels; and also devices to throw said pawls out of gear with the ratchet wheels of the drive wheels automatically. The former pawl mechanism projects the pawls into contact with the ratchet wheels, so that the revolution of the wheels may raise the rake teeth to dump the load. The latter, withdrawing the pawls from the ratchet wheels, allows the teeth to drop to the ground from their own weight. By suitable arrangements, by pressing downward and forward upon the upper end of a lever, the rake teeth will be held down firmly to their work. By moving the upper end of the lever to the rearward and pressing it downward, the teeth will be raised from the ground for convenience in passing over any obstruction. A button may be turned to hold the teeth away from the ground for convenience in passing from place to place.

Improvement in the Manufacture of Traveling Bag Frames.

James B. Blakslee and Charles F. Blakslee, St. Petersburg, Pa.—For making the sheet metal angle bars comprising the frames for the top and ends of traveling bags, the inventors propose to take a flat strip of metal of the length required and wide enough for the two bars of a bag, and first punch the holes for sewing the cloth or leather portions of the bags to them, and shape the ends for the blanks of the hinges, to be subsequently completed for jointing the ends of the frames together. The strips are then bent into proper form by dies which are male and female, in the form of right angled blocks with beveled sides, each succeeding set used being more acute in the angles of the beveled sides than the preceding set.

Improved Rotary Printing Press.

Calvert B. Cottrell, Westerly, R. I.—In continuously revolving cylinder printing presses, there is considerable inaccuracy in the registering of the sheets on the cylinder. The difficulty is owing to the high speed of the gripers when they close upon the paper, which is at rest, the gripers being on the cylinder and revolving with it, and the paper lying on the table, which causes the gripers to slip a little on the paper while closing upon it and before seizing it with sufficient force to overcome the *vis inertia* and set it in motion. This slippage varies with every variation of the speed of the cylinder; also, with different conditions of the paper and by other causes. It is proposed to overcome the difficulty by having the gripers cease to revolve with the cylinder at or before the taking of the paper and be at rest, or nearly so, relatively to the cylinder while closing upon the paper, and also be gaged relatively to the paper at the same time by the instrumentality of a device independent of the cylinder, but in such relation to the table whereon the sheets of paper are presented to the gripers that the latter will always come to the paper exactly the same, irrespective of the speed of the cylinder. To this end, the gripers swing or slide or otherwise move forward on the cylinder just before coming to the place for taking the paper—say at the time of discharging or releasing the printed sheet—so as to gain time for a slight period of rest, and then fly back against the aforesaid gage or stop, and rest while closing upon the paper, thereby enabling them to gripe it firmly and securely, and always in the same relation to the table before being set in motion with the cylinder again.

Improved Combined Bureau, Wash Stand, and Wardrobe.

Thomas W. Moore, New York city, assignor to Fannie N. Moore, of same place.—This invention consists of an upright wood case, divided vertically in two principal compartments, one of which is devoted to the purposes of a wash stand in the lower part and a bureau in the upper part, and the other is, by preference, devoted to the purposes of a wardrobe, but may have drawers instead. The wash stand part is provided with supports for the wash bowl and the soap dish, which swing out from under the drawers above when a door which incloses the front is opened; also, with special places for the other articles of crockery ware appertaining to a dressing room. A door is also provided for the wardrobe when used as such. The object is to combine either two or three of the principal articles of the furniture of a room in one, so as to economize space and expense.

Improved Rock Drilling Machine.

Ferdinand Johnson, Toledo, Ohio.—The object of this invention is to construct a drill for boring for water or oil, which, by a rapid succession of strokes and turns, accomplishes quick and effective work, and which may be easily raised and lowered as the exigencies of the work require it. The invention consists, mainly, in a spring lever connection of the drill, which imparts a strong force to the same in connection with grooved rollers with a slide arrangement for the purpose of lifting and guiding the drill.

Improved Gun Lock.

Walter J. Morris, New York city.—This invention consists of improvements in pistols and other small arms which have or are intended to have the hammer working behind the breech of the barrel or recoil block and between the sides of the lock or sides of the feed arms. The invention comprises a cover, over the lock and the opening in the breech block through which the firing point enters, to intercept any object that might fall into the lock or into the opening in the breech block, and a device on the hammer for throwing off any objects lodging on the cover. To stop the hammer after it has penetrated the priming at the right point, and to protect the firing point from wedging in or striking against the walls of the opening through the recoil block, the hammer is made inside of the lock, so that when it has moved forward as far as it is intended to go it will be stopped by a point or points which are provided in it or on the lower, middle, and rear parts of the recoil block.

Improved Feeder and Filter for Boilers.

John G. Fulton, Toledo, Ohio.—The object of this invention is to exclude from steam boilers all those impurities that are usually contained in the feed water supplied to them. The invention consists, more particularly, in the arrangement, within tanks that contain the feed water, of a flexible piece of pipe which is connected with floats that hold the end of said pipe in the upper and therefore purer part of the water contained within said tanks, so that the water flowing through such flexible pipes into the boiler will be comparatively pure, inasmuch as the sediment settled within such tanks will not be allowed to enter the pipes. The invention also consists in the arrangement of stirring devices within such tanks, for agitating and stirring the sediment that will settle on the bottom of the tanks, so that such sediment will run out when the necessary cock is opened to discharge the accumulated impurities.

Improved Thill Coupling.

John Martin, Henry city, Ill.—The invention consists in a thill coupling which is a simple countersunk jaw coupling with the horizontal bolt passing through, so that when it wears loose the slightest turn of the bolt nut makes the coupling tight and firm.

Improved Oiler.

Cyrus E. Grandy and Ziba B. Grandy, Stafford Springs, Conn., assignors to themselves and William D. Heald, of same place.—This invention consists of an oil vessel into which extends a tube. Within the tube is a second tube, the lower end of which is closed. The first tube has orifices made in it, near the point of its junction with and inside the vessel. The inner tube sliding within is arranged in connection with a lever and spring so that it may be operated from without to open and close said orifices and so to allow or prevent the escape of oil from the spout.

Improved Strap for Street Cars.

Mahlon Warne, Philadelphia, Pa.—The object of this invention is to furnish an improved form of hand support for passengers who are compelled to stand in street or other railway cars or omnibuses, so constructed that it shall also serve as an advertising medium; and it consists in a metallic frame (incidentally adapted for containing advertisements) suspended from the hand rail by a swivel connection, and in a hand strap attached thereto. The frame is so constructed that the cards or advertisements can be readily changed from time to time, as may be found necessary.

Business and Personal.

The Charge for Insertion under this head is **$1** *a Line.*

Wanted—The address of parties who can make first class small iron castings and do Galvanizing. Address C. L. T., P. O. Box 773, New York.

Abbe's Bolt Headering Machines, latest and best. For cuts, prices and terms, address S. C. Forsaith & Co., Manchester, N. H.

The Ellis Vapor Engines, with late improvements, manufactured by Haskins Machine Company, Fitchburg, Mass.

Patent for Sale—Folding, Extension, and all other Tables. Address J. Quevedo, 1553 Dean Street, Brooklyn, N. Y.

Gear, Boston, Mass., sells Improved Mechanical Contrivances.

Among the matters now stirring the minds of the people is the new method of Curing Rupture. The Elastic Truss retains the rupture absolutely, in spite of the most violent exercise; is worn with ease and comfort night and day, and not taken off at all till a cure is reached. Sent by mail everywhere by The Elastic Truss Co., No. 683 Broadway, New York City, who send Circulars free on application.—N. Y. Independent, April 17th, 1873.

Wanted—Engagement as Foreman or Superintendent in Machine Works by a thorough practical engineer and draughtsman: large experience home and West Indies in designing and erecting general machinery, Incline Railways, aut'ic cut off and pumping engines, Sugar Mills and Boilers. Address Orosco C. Woolson, Mount Vernon, Ohio.

For the best and cheapest small portable Engine in market, address Peter Walrath, Chittenango, N.Y.

For Circular Saw Mills, with friction feed works, and Stationary Engines, address Wm. P. Duncan, Bellefonte, Pa.

Shortt's Patent Couplings, Pulleys, Hangers and Shafting a Specialty. Orders promptly filled. Circulars free. Address Shortt Mf'g Co., Cortlandt, N.Y.

Machine Shop for Sale—For particulars, address The Abbott M'f'g Co., Seneca Falls, N. Y.

New England Band Saw Machines, cheapest and best, only $187. For descriptive cuts, address S. C. Forsaith & Co., Manchester, N. H.

Buy Gear's Improved Balanced Jig Saw, Boston, Mass.

Children can bind grain—Sheaf binder and bag-tie rights for sale. Address Patent, P.O. Box 4998, N.Y.

A young man of extended business experience, who has been manager of a manufacturing business for years, would like an engagement where energy and strict attention would be appreciated. Is familiar with management of men and care of horses. Has had experience with machinery, and, when necessary, can run an engine, make a stone boat or keep a set of books. Can furnish very highest testimonials as to character and ability. Please address Walter Waring, Brooklyn, N.Y.

Grain, Paint, Ink, Spice and Drug Mills. Ross Bro's, 85 First Street, Williamsburgh, N. Y.

For Sale—A complete set of Blanchard's Pat. Plow Handle Machinery, in perfect order. G. D. Clute, Waterloo, N.Y.

Drawings, Models, Machines—All kinds made to order. Towle & Unger Mf'g Co., 20 Cortlandt St., N.Y.

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Key Seat Cutting Machine. T.R. Bailey & Vail.

Hydrofluoric Acid, for Etching Glass and many other purposes. We are the largest makers in this country. Quality guaranteed. by L. & J. W. Feuchtwanger, 55 Cedar Street, New York.

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Wood workmen—Ask your Bookseller for Richards' Operator's Hand Book of Wood Machinery. 65 cts. Only $1.50.

Standard Spring Steel Machinist's Rules, manufactured by The Star Tool Co., Middletown, Conn., the only company that can graduate on spring steel. Every Rule warranted. C. W. Sweetland, Selling Agent, 84 Washington Street, Boston, Mass.

Agents' names wanted. Wendell & Francis, 436 Walnut Street, Philadelphia, Pa.

Wanted—The address of parties who will contract to cut gas retort carbon into blocks 5 ins. long, 2 ins. wide, and ¼ of an in. thick. Address, stating price per thousand, Leclanché Battery Co., No. 40 West 18th Street, New York.

Shaw's Planer Bar—For Shop, County, and State Rights, apply to T. Shaw, 913 Ridge Av., Phila., Pa.

Hammer Dies and Heads, strong and durable, cast to order by Pittsburgh Steel Casting Co. All work warranted.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

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3 Winn's Pat. Improved Portable Steam Brick Machines. Averages 40 m per day. Fully guaranteed. For sale cheap. John Cooper Engine Manufacturing Company, Mount Vernon, Ohio.

Oxide of Manganese, best quality, for Steel and Glass Makers, Patent Dryers, etc. We are first hands for this article. Supply any quantity at lowest rates. L. & J. W. Feuchtwanger, 55 Cedar Street, New York.

Water Glass, Soluble Glass and Silicates Soda and Potash—for Artificial Stone and Cements—fire, water, damp and mildew proof. Manufactured by L. & J. W. Feuchtwanger, 55 Cedar Street, New York.

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Diamond Carbon, of all sizes and shapes, furnished for prilling rock, sawing stone, and turning emery wheels or other hard substances, also Glazier's Diamonds, by John Dickinson, 64 Nassau St., New York.

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The Best Smutter and Separator Combined in America. Address M. Deal & Co., Bucyrus, Ohio.

Boring Machine for Pulleys—no limit to capacity. T. R. Bailey & Vail, Lockport, N. Y.

Damper Regulators and Gage Cocks—For the best, address Murrill & Ketzer, Baltimore, Md.

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Gauge Lathe for Cabinet and all kinds of handles. Shaping Machine for Woodworking. T. R. Bailey & Vail.

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

The Berryman Manuf. Co. make a specialty of the economy and safety in working Steam Boilers. I. B. Davis & Co., Hartford, Conn.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

Machinists—Price List of small Tools free; Gear Wheels for Models, Price List free; Chucks and Drills, Price List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

The Berryman Steam Trap excels all others. The best is always the cheapest. Address I. B. Davis & Co., Hartford, Conn.

Absolutely the best protection against Fire—Babcock Extinguisher. F. W. Farwell, Secretary, 407 Broadway, New York.

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

A Superior Printing Telegraph Instrument (the Selden Patent), for private and short lines—awarded the First Premium (a Silver Medal) at Cincinnati Exposition, 1872, for "Best Telegraph Instrument for private use"—is offered for sale by the Merchi's M'f'g and Construction Co., 50 Broad St., New York. P. O. Box 6865.

Williamson's Road Steamer and Steam Plow, with rubber Tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1809.

Parties desiring Steam Machinery for quarrying stone, address Steam Stone Cutter Co., Rutland, Vt.

Nickel Salts and Ammonia, especially manufactured for Nickel Plating, also "Anodes," by L. & J. W. Feuchtwanger, 55 Cedar Street, New York.

Notes & Queries

S. asks for the best mode of preparing caustic lye, for soap making, from soda ash.

F. E. H. asks for the best means of cleaning light kid gloves.

A. R. asks: What can be mixed with clay that will harden it, without using fire?

F. D. H. asks: How can I make good liquid stains to imitate black walnut and oak?

A. H. G. asks: How can I stereotype from wood cuts? What is used for molds and how is the metal poured so that all the lines will be perfect?

W. H. H. asks: How can I make a waterproof tarpaulin cover to throw over a wagon in case of an unexpected shower?

H. D. T. asks what kind of varnish is best for transferring prints on to wood? Can colored prints with their various colors be transferred to hard wood?

S. asks: Why will a piece of cold iron covered with grease remain at the bottom of a kettle full of melted iron, while a piece that is not greased will rise to the top?

A. A. asks: Is it safe to carry a pressure of 20 lbs. to the square inch in a boiler well made of 1-16 inch copper, the dimensions of the boiler being 12 inches long x 6 inches diameter?

E. H. R. says: I have just finished building a brick kiln, and I would like to know what degree of heat it will require to dry lumber, such as flooring, etc., in the shortest possible time without injuring it?

R. B. says: I want to paint an engine. There is a good deal of grease on it, and I want to know: 1. How I can get it off best? 2. What kind of paint is best to stay on where it is hot? What kind of paint is used to make new engines look glossy?

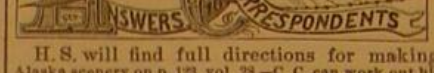
J. P. H. asks for a practical plan for boring or scraping out the cylinder of a portable engine, without detaching it from the boiler. "Cannot scrapers be set in a wooden shaft and on paper backing to raise them to their work, the shaft being turned to fit the cylinder, which is of 6½ inches diameter?

J. M. asks: What is the cause that we cannot keep the wings on a blower which we use for cleaning grain? It is a suction blower, 1 foot diameter x 8 inches high, and it runs at 1,600 revolutions per minute. It is made thus: A ⅝ inch iron shaft with a block of wood 3 inches square. The wings are of heavy sheet iron, nailed on to the block; and they tear off the nail heads. If we put them on with screws, the screws break off close to the wood.

G. W. K. says: I have a number of heavy muslin or canvas coverings which are made waterproof by being saturated with boiled linseed oil. The trouble is that when they are folded and packed away, they stick together so tightly that it requires the strength of several men to pull them apart. What can be put on and mixed with the oil to prevent sticking and yet keep them soft enough to bear folding without injury? Is there anything that is cheaper and better than the oil?

W. & Co. ask: Can any of your correspondents give us a recipe by which we can make a shingle roof fireproof? The roof is felt, composition, and sand; it has been on for 5 years and is so much bother to keep tight that we have to put on a new roof, and would much prefer shingles provided we can make them so that the danger from fire is not increased. We propose painting or dipping the shingles before they are laid.

C. J. H. asks: What is the best thing to do to work an oil deposit most advantageously? The following are the circumstances: The bore shows about 10 feet of soil, then from 7 to 15 feet of sand saturated with petroleum, then various strata of gravel, sand, clay, each with more or less petroleum, going down to a depth of 120 feet. From this, down to 980 feet, the gravel, sand, and clay continue. The sand yields on distillation about 30 gallons, and, from the bore, a barrel or so of oil is pumped daily. Should the bore be continued? Would it be practicable to mine the chalk where there is so much gas? The chalk samples yield from 30 to 35 gallons superior oil. The chalk oil at 60° Fah. showed 923, but contains very little tarry matter. After once running, the gravity was 905, and the analysis showed: Burning oil at 60°, gravity 822, 23·3 per cent. Heavy (blue) oil, gravity 918, 63·2 per cent. Solid paraffin, a trace. Loss on refining, 2·5; by acids and alkalies, 8·5; by distillation, 2·5.



H. S. will find full directions for making Alaska scenery on p. 123, vol. 28.—C. C. can work out his problem by following the instruction on p. 257, vol. 29.

THE BOUNDARY LINE BETWEEN ARITHMETIC AND ALGEBRA.—There are many problems which can be solved as well by the arithmetical as by the algebraic method; but there are others which, although they appear to consist of conditions belonging simply to the field of arithmetic, require for their solution the algebraic mode of calling the unknown quantity by some sign, say x, and treating the resulting expression after the regular rules taught by algebra; then the solution, which otherwise is highly intricate, becomes a work of mere manipulation of signs. A problem of this kind was recently sent us by a correspondent of Cambria, Wis., who states that some persons claim that it is utterly insoluble, while others think that there is a solution, if only they could find it; he says further that the Normal School at Oshkosh cannot solve it, meaning, we presume, that some of the students were unable to do so. The question is this: "A merchant has two grades of wheat with 25 cents difference in their value; a customer buys one dollar's worth of each grade, mixes them, and finds that he has exactly two bushels of the mixtures. At what rate per bushel did he pay for each grade?" The following is the solution: Call the price per bushel of the cheapest wheat x cents, then that of the better quality is $x+25$ cents, which, when expressed in dollars is $\frac{x}{100}$ and $\frac{x+25}{100}$ of a dollar. As now the quantities obtained for the same amount of money are in an inverse ratio of the price, the relative quantities of wheat which the customer buys for one dollar each will be $\frac{100}{x}$ and $\frac{100}{x+25}$, and as the two quantities are stated to be 2 bushels, we have the equation $\frac{100}{x}+\frac{100}{x+25}=2$. Bringing these two fractions under the same denominator, by multiplying numerator and denominator of the first by $x+25$ and of the second by x, we obtain $\frac{100x+2500}{x^2+25x}+\frac{100x}{x^2+25x}=2$

$\frac{200x+2500}{x^2+25x}=2$. Multiplying each term of this equation by x^2+25x, we obtain: $200x+2500=2x^2+50x$; divide by 2, $100x+1250=x^2+25x$, or $x^2-75x=1250$. This reduces the whole problem simply to the solution of this equation of the second degree, which we do by adding to each number the square of the half of 75, or $37{\cdot}5^2=1406{\cdot}25$, which gives $x^2-75x+37{\cdot}5^2=1250+1406{\cdot}25=2656{\cdot}25$. The square root of this equation is $x-37{\cdot}5=\sqrt{2656{\cdot}25}=51{\cdot}54$, and $x=51{\cdot}54+37{\cdot}5=89{\cdot}04$ cents, which is the price of the inferior wheat per bushel; while the better quality costs $89{\cdot}04+25$ or $114{\cdot}04$ cents. We have given the operation here with much more detail than is customary in such solutions, but this is for the benefit of those not very familiar with such algebraic operations; for the satisfaction of the same we will now test the solution: The amount of wheat worth 89·04 cents per bushel, which can be had for one dollar or 100 cents, is evidently equal to $\frac{100}{89{\cdot}04}$ bushel, and for the same reason, that of 114·04 cents is equal to $\frac{100}{114{\cdot}04}$ bushel. If now we bring these two fractions under the same denomination we obtain $\frac{10000}{8904}$ and $\frac{10000}{11404}$; and adding them together, we have $\frac{210308}{101502}$ bushels, which is exactly 2 bushels.

J. asks: Will heat affect the attractive power of a permanent magnet? 2. Are oxygen and nitrogen gases combustible? Answers: 1. Heat diminishes the attractive power of magnets. 2. Oxygen supports combustion. Nitrogen does not.

C. J. C. asks for a process for tempering trap springs. "I want full directions for hardening and drawing the temper, and the best method of heating. Will a common blacksmith's forge answer, or will a Lehigh fire do?" Answer: Heat to a bright cherry red, either in a furnace, so constructed that they will not come in contact with the coal or flame, which are liable to contain sulphur or other base minerals, or they may be heated over a charcoal or coke fire. Harden by plunging, when hot, into a bath of pure whale oil (be very careful that it is not adulterated). To every gallon of oil, add 6 lbs. of rosin, 1 lb. beeswax, and 2 lbs. mutton tallow, and you may add 1 lb. pine pitch. Melt the rosin first, then add other ingredients, and melt together, and stir into the oil when hot. The vessel containing the hardening bath should be surrounded with cold water to prevent overheating. Be sure that the springs always harden to a silver white, so that a file will not cut them. After hardening, clean off the loose oil with fine saw dust, brushing off that which remains loose. Then draw the temper slowly until the oil is all burned off and stops smoking. This may be done best in an open wire cylinder over a charcoal fire in a sheet iron furnace, similar to that used for roasting peanuts or browning coffee, or it may be done in a well constructed hot blast oven, or even over a charcoal or coke blaze. Let them cool off in the atmosphere. The mixture for hardening can be kept up by occasionally adding rosin, beeswax and tallow. The principle of always getting a good spring temper is to first get the steel hardened thoroughly, without overheating or fire cracking it; then, by drawing it down to a dead blue, or until the oil is burned off. Four years experience in tempering cavalry sabers and swords taught me this.—J. E. E.

M. P. The idea of propelling canal boats by wheels running on the bottom is very old.

J. G. asks if there is any machine invented for felling large timber trees, which will save the great loss consequent upon felling with the common axe, or that will perform the work in a shorter time. If so, what is it? Answer: Several devices for this purpose have been published in the SCIENTIFIC AMERICAN, and some of them illustrated.

S. B. E. asks: When did James Watt complete his first engine, and when and to whom was the first patent given for a steam boiler? Answer: James Watt completed and patented his first engine in the year 1769-9. Papin used a steam pressure boiler in 1695, and Savory patented a steam engine with a pressure boiler in 1698.

H. A. B. asks: What proportion of burnt clay should be mixed with quick lime after the lime is slaked, to make good water lime cement? Answer: Our correspondent should read page 411 of Miller's "Elements of Inorganic Chemistry." The subject is too large to be discussed in our columns.

L. R. asks for further instructions on tempering steel, asking us to select a recipe suited to his case. This we are unable to do, as we have no knowledge of his requirements. We have lately given much space to this subject; and on page 283 of our current volume the matter is discussed at full length.

W. A. S. says: 1. I enclose a piece of scale from our boiler. Will you please tell me of what it is composed, and what I had better use to prevent it? 2. How long ought a stationary boiler to last with careful use? We blow off twice a week and clean out twice a year. 3. Can you give me a rule for finding the strength of any section of malleable castings or for cast iron? Which is the stronger? 4. What is the cheapest and most convenient article for making cloth or rope fireproof? 5. I have also a little invention on hand. Is there any place in Boston where I can get access to the Patent Records, that I may see if I have got anything new? Answers: 1. The scale is composed of sulphate of lime principally, with some magnesia, sand, clay, and iron oxide, and a little salt. If the incrustation does not collect with considerable rapidity, chloride of barium is a good preventive of its depesition in this dense and hard form. The scaling hammer, properly used, where the deposit is accessible, takes it off most effectually and inexpensively. 2. We have known steam boilers of the plain cylindrical class to last thirty years. Marine tubular boilers are expected to last 6 or 8 years, but sometimes are kept running more than twice that length of time. 3. The best cast iron, such as is used for ordnance, bears a tensile pull of 30,000 pounds per square inch, or more. Ordinary metal has about two thirds that strength. Malleableized cast iron has a strength of from 25,000 up to 45,000 pounds per square inch according to quality. 4. Tungstate of soda. 5. The Public Library.

M. H. B. says: I have a little engine with a cylinder 3 inches in diameter and 6 inch stroke; ought it to take about 20 lbs. of steam to run it? When I take hold of the fly wheel, it is about as much as I can do to turn it with both hands. The boiler is an upright, 6 feet high and 26 inches in diameter, with 22 two inch flues. How many horse power would that be? Is it a good idea to have nothing but a thin place in the eccentric rod to overcome the up and down motion? How long ought a boiler and the engine, made as above stated, to last? Answer: The engine is decidedly in need of attention. It ought to run, without load, with four or five pounds of steam. The eccentric rod is often so made and answers very well on very small engines. A plain boiler, well taken care of, should last many years, and the engine much longer than the boiler. Some of James Watt's engines are still at work.

G. T. R. says: A friend states that an ordinary wooden pump, placed in a well with a tight oaken platform, over which a layer of three feet of yellow clay has been tightly tamped, will work perfectly and permanently. I do not believe it will, as the water is elevated by atmospheric pressure, which in this case would be partly or wholly removed. Which is right? Answer: If the well were made absolutely air tight, the pump would not work. We think it probable that, even where arranged as described, sufficient air would enter the well through the surrounding soil or the top to allow of its operation.

C. M. D. asks: Is corn a profitable fuel at 20 cents a bushel, when wood is $5 per cord, say for a 10 horse power engine? Answer: It requires about 50 bushels of corn to weigh as much as a cord of wood; 40 will weigh as much as a cord of soft pine. The chemical constitution of wood and grain is about the same, and they therefore should be of about equal heating power, pound for pound. We can therefore conclude that, if wood is worth $5 per cord, a corresponding weight of grain at 20 cents per bushel would cost $8 or $10. Burn your wood and sell your grain.

I. W. F. asks: Can you inform me how they grind old razors, and what the machinery used is? Answer: By means of fine stones, the same as other cutlery.

C. W. O. says: In your issue of April 19, A. M. says: "I am running a saw mill making 500 revolutions per minute;" and after giving size of mandrel, kind of box, etc., he goes on to say that "the box next to the saw runs hot in spite of all efforts"; in answer to which you give a method of lining a box to prevent said heating, namely, by putting oiled paper around the journal while pouring off the Babbitt metal. Now as we are running quite a number of saws, large and small, I should like further light on this subject. We have at present a 50 inch saw on a 3 inch mandrel, making 825 revolutions per minute, in boxes lined precisely as you advise, in which it has been running for several months, during which time the box next to the saw has not run cool for a single day, though the box on the other end of the mandrel, made in the same way, runs very nearly cold. The power for driving the saw is obtained by a 12 inch belt on a 24 inch pulley at the side of the last named box. Now why does the journal at the end next the saw heat, and the one on which the weight, caused by the tension of the belt, rests run cool? The boxes have been relined three or four times in two years, and always with the same result. The motion is steady for 11 hours per day, stopping one hour at noon; and the best of oils are used. Answer: Saws unevenly ground or filed out of shape are out of balance; this will cause the box at the saw end of the mandrel to heat. When the saw is in the cut, there is little or no weight on the lower part of the box, unless the belt draws downward; or, in other words, when the saw teeth are in the cut, the tendency is to lift the mandrel and throw the pressure against the cap or upper part of the box; and the pressure of the timber against the teeth forces the arbor back against the side of the box, so that the pressure of the journal is con

stantly changing from one position to another, which tends to heat the box more than if the pressure were in one direction.—J. E. E.

W. W. B. says: I use small malleable iron castings, and would like to make them bright by rolling them in what I call a tumbler. I see that others in the same business make them very bright; but I am unable to get the same "shine" on them. Can you tell me how to manage it? Answer: Castings are polished by rolling them in barrels with plumbago.

J. J. B. asks us to inform him as to the best method of rendering solid a liquid stove polish. Answer: Let it stand in an open vessel until the liquid evaporates.

A. W. G. says: I have a large pile of cinder, or scale, such as is usually found in rolling mills. It comes from under the rolls, and is quite full of small particles of iron. Would not a magnet be the best way to get the iron from the cinder? Where can I obtain a cheap magnet? It should be quite broad. Answer: You can obtain magnets at toy stores. As to treatment of cinder, to separate iron therefrom, read the description of the Henderson iron process, heretofore published in the SCIENTIFIC AMERICAN.

A. J. D. says: When a very heavy charge of powder is fired in an ordinary shot gun (very nearly all the gun will stand without exploding), will all the charge burn, or will part of it be dropped at the muzzle of the piece without igniting? Answer: If the charge is excessive, a part of the powder will be burned after leaving the gun. Where the gun is short and the charge heavy, a part may even escape unburnt; and, on firing the gun over a smooth or, particularly, a snowy surface, the grains may sometimes be seen. The best charge for a gun should always be found by trial, and will sometimes be found to be apparently very small. Excess of powder increases greatly the strain in a gun and its recoil, without any gain.

F. A. U. asks: How can a shingle roof be kept from leaking around the chimneys and flues, where they are on the side of roof, that is, not at the comb? Answer: If the chimney is yet to be built, make a projection of the brickwork, put on a cant board and cant the shingles up under the brick projection. But to repair a present chimney, use step flashing of painted tin or zinc, a piece of the metal under every course of the shingles, turned up against the brick and worked into the joints of the brick work. Put them in as you would a flexible shingle, letting the bottom of the upper one cover the top of the lower one, with the wooden shingle continued over it to the chimney; but drive no nails through the metal except at the top of each piece. Fill in the joints of the brick with paint skins or putty, where the metal enters them. They will enter on the horizontal joints, only, and break down at every piece like a flight of steps. This method applies to the sides of a chimney, where the roof crosses it at an angle equal to the pitch; but where, as at the top and bottom, the roof meets and leaves the chimney on a level line, ordinary flashing will do, running under the shingles and turned up and into the brickwork. If the shingles are canted up against the chimney well on every side, a cap flashing will sometimes do, worked into the joints of the brickwork, and lying down on the top of the shingles. The step flashing is also very good for the valleys of a roof.

R. H. asks: What is the difference between hydraulic and steam pressure? If there is any, what makes it? Answer: There is no difference, *so far as* simple pressure is concerned. The effect of testing a boiler, with cold water in one case and hot in another, may be quite different, however. Hot water, by expanding the metal, may close up seams and prevent leaks, under tests, where cold water might reveal an unclosed lap. Hot water will also produce strains due to expansion which might not exist where a cold water test was adopted. A cold water test we regard, therefore, as the best test of the tightness of a boiler, while hot water gives us the severest test of its strength to resist the the usual strains of a boiler in use.

W. & S. say: We intend building a wood working manufactory, 50x70 feet, this summer, and put in a new boiler, engine, etc. We are at loss to know just what to build and buy, and not waste our money. 1. The shop will stand on the bank of a river, and all of the foundations will rest on solid rock. We have from 25 to 27 feet of water in the spring freshet. We want to put the lower floor 27 feet above the bed of the river, and wish to know how thick the wall ought to be from the bottom to the first floor (27 feet high) to stand against the high water. We can let the water in or keep it out, if we knew what strength to build in both cases. The building will be 3 stories and a half above the first floor. 2. In a wall 50 feet long, 27 feet high, which would stand the most pressure from water, a certain number of perch of stone laid regularly, or put in the form of buttresses every 8 feet or so, making the rest of the wall proportionately thinner? 3. We put in steam two years ago for power and heating; we think that we use more fuel under our boiler to heat our building than we formerly did in the air tight coal burning stoves, all the time, even when we are not running our engine at all, and use live steam. Yet we are told that we can heat by steam cheaper than by good stoves and furnaces. We want to see it in that light also. Can you put us in the way of some satisfactory experience? 4. Does not the additional back pressure cost all the difference between using exhaust steam for heating instead of live steam? We have 3 inch pipes in our shop. 5. Three weeks ago we read in your paper that steam at 120 was economical. One of our boiler makers here thinks that 60 lbs. gives more satisfactory results than when used higher, and it will not cost as much to keep the steam up; which is the nearest right for a common factory? Our boiler and engine are large enough to do the work at 60 lbs. easily. Answers: We should build the wall, if in stone, of selected material, paying particular attention to the quality of the cement, which should be quite strongly hydraulic, and should not attempt to carry such a head of water. To do so, would necessitate building walls of similar proportions to those of any other dam walls. The thickness of base would be about 13 feet. Allowing the water to flow inside at high water, the walls need be but little thicker than ordinarily, if the cement be good: say 30 inches. 2. The buttressed wall. But do not reduce the thickness to less than the figure just given. In such a case as the one under consideration, too great care cannot possibly be taken, if the pressure of the water is to be carried, to get a perfectly sound wall through which or under which, the water cannot find a crack which will allow its entrance. A stream once started through the wall may do serious injury when not suspected. 3. Equally efficient and thorough warming of large buildings should cost less by steam than by stoves. Is not the building more completely and more highly heated than before? 4. Yes, if the pipe is not made large. We should generally anticipate that, unless the area of heating pipe were made very great, live steam would be most economical in a cold climate. 5. The higher the steam pressure, the greater is the amount of expansion allowable. An engine too large for its work is wasteful, but, even in that case, high steam throttled down is more economical than low, if the boiler, steam pipes and engines are all carefully protected against losses of heat by radiation and conduction.

M. F. asks: How much larger will each of our four hydraulic pumps have to be bored in order to give us the capacity of two more (six instead of four) pumps? The outside diameter of pump is 4¾ inches, diameter of plunger, 1⅝ inches, diameter (or bore) of pump, 1⅛ inches, length of stroke, 8½ inches. Answer: A pump 4¾ inches diameter has a cross area of plunger of 13¾ square inches. Six such plungers would have a combined area of 80 inches, and this, divided among four plungers, again would require each to have an area of 20 inches, or a diameter of about 5⅛.

K. solves E. C. M.'s problem as follows: Question: A body weighing 5 lbs. descends vertically, and draws a weight of 6 lbs. up a plane whose inclination is 45°. How far will the first body descend in 10 seconds? In this problem, the motive force is 5 lbs. and the retarding force is 6 lbs. × ·7071067812=4·2426406872. Hence the motive force or power, P, is to the retarding force or weight, W, as 5 lbs. is to 4·2426406872 lbs. Now if a body weighing 4 lbs. were acted on by a motive force of 40 lbs., the accelerating force would be ¼ of 40, or 10 lbs.; or, were the retarding force 5 lbs. and the motive force 100 lbs., then the accelerating force would be 100÷5=20 lbs.; and so in all cases the accelerating force may be found by dividing the motive force by the retarding force, it being expressed by P over W. In this problem, the retarding force would be the greater, and would drag the other down the plane, were it not that a portion of its force is expended on the plane, whilst the entire force of the motive power is exerted in pulling W up the incline. Now the law of mechanics relating to the inclined plane is this: The power is to the weight as the hight of the plane to its length. Consequently the retarding force diminishes as the angle of elevation diminishes, and, in the same proportion, the accelerating force increases. Now in this case, the hight of the plane is to its length as 1 is to the square root of 2. And in this and in all cases, the hight is to the length as the sine of the angle of elevation is to 1. The sine of 45°—the square root of ½=·7071067812; hence on this plane, P, 5 lbs., is to W, 6 lbs., as ·7071067812 is to 1. If, in this proportion, we multiply together the extremes and means, we get 5 lbs. for the motive force, and 4·2426406872 for the retarding force. Hence the accelerating force will be found by dividing 5 by 4·2426406872, which gives 1·1785113. Had this quotient been unity, or 1, it would have shown that the motive and retarding forces were in equilibrium, and that they would consequently remain at rest. But as the motive force exceeds the retarding by the decimal ·1785113, this decimal will express the relative rate of motion of the motive force, compared with what it would be were it left to fall freely. Now if the power, P, were to fall freely without obstruction of any kind, it would descend 16·083 feet the first second, and its total descent in any given number of seconds would be found by multiplying 16·083 by the square of the time expressed in seconds. Hence in 10 seconds it would descend 100 times 16·083 feet, or 1608·3 feet. But the accelerating force is only ·1785113, and consequently it will fall only ·1785113 of 16·083 feet in the first second, that is 16·083 × ·1785113=2·8709972 feet. But as gravity acts similarly on the excess of the motive over the retarding force, the law of increase in the acceleration of the descending motive power will be the same as though it fell freely: and hence the distance fallen *through the first* second, 2·8709972×100 (the square of the time) gives us the required answer, namely, 287·1 feet, nearly.

O. A. B. says, in reply to E. M. C's question on the velocity of a body descending vertically, being acted on by a weight on an inclined plane: Cosine 45°=·7071—force or resistance of any weight on the inclined plane. ·7071×6=4·2426 lbs.—the static resistance of 6 lbs. weight, or the amount of 5 lbs. weight required to to balance the same. 5—4·2426=0·7574 lbs.=excess of 5 lbs. weight, which, if it had nothing but its own inertia to overcome, would fall 1608·5 feet in ten seconds: but it has to move a mass of 11 lbs. Hence 1608·5 × 5/11 ths=110·75 feet=the answer.

W. R. S. sends a solution of E. C. M.'s problem: A weight of 5 lbs. draws a weight of 6 lbs. up an incline of 45°; required the distance the 5 lbs. would fall in 10 seconds. Answer: Six pounds on an incline of 45° would be balanced by 4·28 lbs. hanging vertically, according to well known laws of inclined planes. Therefore the weights 5 lbs.+6 lbs.=11 lbs., are acted on by a force of only 5—4·28=·72 lbs. Or ·72 lbs. has to move a weight 15·28 times heavier than itself, and consequently its rate of movement and total fall made in 10 seconds would be only 1/15.28 of its own fall by itself, provided the directions were both vertical. A body would fall in 10 seconds 10²×16.1 feet=1608½ feet, and under above circumstances only 1608½÷15·28=105·25 feet in the same time. But the 6 lbs. moves up an incline of 45°, and, according to the laws of inclined planes in mechanics, would again diminish the fall of the 5 lbs. in the proportion of 5 to 7, nearly; therefore the 5 lbs. would only fall ⅝ of 105·25 feet, or nearly 73·18 feet in 10 seconds. No allowance is made for friction.

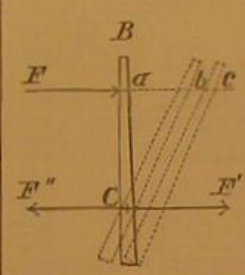
V. J. S. says, in reply to E. C. M., who asked for a solution of a problem on the acceleration due to a force: I give below the formula required: The acceleration due to a force is equal to the moving force, divided by the mass moved. In the case given, the moving force is equal to ½ sin. 45° and the mass moved is equal to 5+6; hence, denoting the acceleration by g', we have the equation g'=(5+6 sin. 45°)÷(5+6)=1.1/11=·968818. The equation for the space passed over by a falling body is s=½gt², in which s=space, g=gravity, and t=time. Applying this formula, and substituting, for g=gravity, g'=acceleration, we have s=½g't²=·968818×10²=48·4409 feet.

J. B. H. says, in answer to A. W. T., who asked how to polish walnut wood: Walnut, well sandpapered and then varnished with furniture varnish (to be bought at any furniture store), has a very elegant appearance; it dries in from 15 to 24 hours.

A. says, in reply to F. A. S., who asked how to drill a hole in a pane of glass without a diamond: I have done it with a common drill, moistened constantly with spirits of turpentine.

J. E. E. says: On page 406 of your volume XVI., there is an article under the head of electrical light, which gives an outline of Professor Wheatstone's electric machine. I do not understand how the horse-shoe-shaped soft iron is arranged with the revolving helix. The regular electro-magnetic machine is made by arranging a permanent magnet in a box with an electro-magnet or helix, revolving at the poles. This new machine by Professor Wheatstone dispenses with the permanent magnet, which is a great thing when expense is an object. Can some one give me information on the subject? Answer: See our editorial pages of this issue.

H. B. says, in answer to E. W. H.'s problem: A rigid body, A, B, is supposed to be without weight and in a state of rest in space, uninfluenced by any external forces. Required the motion imparted by a given force, P, applied at any point, as A, supposing there be no resistance of the air. 1. If a rigid body at rest in space is acted upon by a force, directed towards its center of mass, it will attain a progressive motion in the direction of the force, which, after the *impulse ceases to act*, will continue in the same direction and with uniform velocity, but so that the body will remain parallel to its primary position. 2. If a couple of forces act upon a body, which before was in a state of equilibrium in space, they will tend to impart a rotary motion upon it, the axis of rotation going through the center of mass. This axis will at the same time be right angular to the plane of the couple, if the body should happen to be in a running balance on *this axis*. *In every* other case, the resulting rotation will be of a double character, as is that of our earth, which revolves on its axis between the two poles, while this very axis does not remain parallel, but again revolves on an axis, inclined to the former, thus causing the polar mutation of the stars. (Being unacquainted with astronomical terms, I am not sure whether this last phrase expresses my meaning, which is, the motion of the polar point in the system of stars in a large circle, in a period of many centuries). In this latter case, the calculation of the rotary velocity, attained by the action of a given couple in a given time, is of a most difficult nature, while in the first case it is very easy, if the momentum of inertia of the body on the axis of rotation is known. 3. If the force, F, acts upon the body, B, (see engraving) one can imagine two forces F' and F'' acting upon the center, C, of the body in opposite directions, both being equal and parallel to F. This measure can evidently not affect the result. The forces, F and F'', form a couple, which impart to the body a rotary motion, while the remaining force, F', in the center, produces a progressive one. Hence the one force, F, having the same effect as the three considered forces together, produces a progressive and a rotating motion, the latter of either a single or double character. If, in *the two cases* considered under 1 and 3, equal forces act for the same length of time, the progressive motion will be the same in either case; but the entire inertia imparted upon the body will be greater in the latter case, because the force acts through the space, a c; but in case 1, it acted only through the space b c. This difference is taken up by the momentum of rotation. If, however, in these same cases, the forces act through equal spaces before they cease, the progressive motion in the second case will be smaller than in the first one, in the same ratio as b c is to a c. The comparative results will be similar if the forces act till the points of application have a given velocity. A specific calculation in any one given case requires knowledge of the dynamics of forces in relation to the momentum of inertia.



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

R. D. M.—It is tin. We should be glad to see a specimen of the ore which yields it.

S. E.—The rock is limestone, and the minute "golden" particles are iron pyrites.

S. L.—It is a very pure galena, or lead ore.

W. A. L.—Iron pyrites.

J. H. P.—It is pure galena, (lead ore) and probably came from the veins once worked at Martinsburgh.

G. C. W.—It is of no value; it consists of minute crystals of pyrites.

H. P. L.—It is plastic clay—ferruginous and blue. We are not aware that it is put to any special use in this country. It is unusually rich in iron.

F. C. H.—They are specimens of chalcedonic quartz not hard enough for watch jewels.

S. B. D.—It is galena, the rich ore of lead, in a vein of calcite.

J. S. G.—The specimen is too minute for determination, but it resembles zinc blende.

T. P. Y.—The specimen contains galena, but not to any workable amount.

J. I. J.—The specimens are brown and yellow ocher, or oxide of iron, frequently used for rough painting.

J. A. H.—The brilliant "metal" in the clay is iron pyrites, and valueless.

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 Million Dollar Telescope. By D., by J. E. E., by B. F., and by S. H. M., Jr.

On Exhibiting the Carbon Poles. By T. W. D.

On the Wreck of the Atlantic. By E.W. F.

On the SCIENTIFIC AMERICAN. By J. B. C.

On the Spanish Inquisition. By H. G.

On Searching for Metals. By C. G.

On Transportation of Produce. By S. S.

On Worm Eggs in Apple Trees. By J.J.W.

On a Cure for Girdled Trees. By A. D.

On Power Transmitted by Belts. By A.M.S.

On Tannate of Soda. By J. G. R.

On Turning Leaves of Books. By J.W. K.

Also enquiries from the following:

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

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

April 15, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Wrench, railroad track, P. L. Gibbs	137,910

APPLICATIONS FOR EXTENSIONS.

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

24,858.—PUMPING ENGINE.—H. R. Worthington. July 2.
24,866.—SEWING MACHINE.—E. A. Goodes *et al*. July 9.
24,947.—JOURNAL BOX.—J. A. Montgomery. July 16.
24,963.—FLOUR PACKER.—S. Taggart. July 16.

EXTENSIONS GRANTED.

23,690.—BOILER FURNACE.—J. Amory.
23,693.—COOKING RANGE.—B. W. Dunklee.
23,703.—MAKING DRAIN PIPES.—B. S. & M. R. Pierce.
23,707.—HARVESTER.—S. Ray & M. R. Shalters. (A)
23,707.—HARVESTER.—S. Ray & M. R. Shalters. (C)
23,716.—STOVE.—S. B. Sexton.
23,716.—HEATING STOVE.—S. B. Sexton.
23,735.—SEAMING MACHINE.—J. Wilson, *et al*.
23,736.—CORRUGATING METAL.—J. Wilson, *et al*.

DISCLAIMERS.

23,716.—STOVE.—S. B. Sexton, Baltimore, Md.
23,716.—STOVE.—S. B. Sexton, Baltimore, Md.

DESIGNS PATENTED.

6,586.—PARLOR STOVE.—W. Doyle, Albany, N. Y.
6,587.—GLASS DISHES, ETC.—J. Hobbs, Bellaire, Ohio.
6,588.—CARPET.—A. Heald, Philadelphia, Pa.
6,589.—BADGE.—H. A. Oesterle, Philadelphia, Pa.
6,590 & 6,591.—CARPETS.—J. Powell, Kidderminster, Eng.
6,592.—COFFIN HANDLE.—J. S. Ray, East Haddam, Conn.
6,593.—CARRIAGE MOUNTINGS.—A. Searls, Newark, N. J.

TRADE MARKS REGISTERED.

1,211.—FRILLINGS, ETC.—F. Browett & Co., Coventry, Eng.
1,212.—LUBRICATOR.—Gerdom, Cook & Co., N. Y. city.
1,213.—CORN MEAL.—Kipe & Townsend, Chadd's Ford, Pa.
1,214 & 1,215.—LINIMENTS.—Merchant's Gargling Oil Co., Lockport, N. Y.
1,216.—PILE REMEDY.—J. P. Miller, Baltimore, Md.
1,217.—PRINTS.—J. R. Osgood & Co., Boston, Mass.

SCHEDULE OF PATENT FEES:

On each Caveat	$10
On each Trade-Mark	$25
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On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
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VALUE OF PATENTS

And How to Obtain Them.

Practical Hints to Inventors

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

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

HOW TO OBTAIN *Patents*.

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

How Can I Best Secure My Invention?

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

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

Preliminary Examination.

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

Reissues.

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

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, New York, for full particulars.

Value of Extended Patents.

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

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

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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.

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

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

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

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

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

Foreign Patents.

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

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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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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.

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FOURTH
CINCINNATI
Industrial Exposition,
1873.
OPENS SEPT. 3, CLOSES OCT. 4, 1873.

PROPOSALS for ENGINES and BOILERS.

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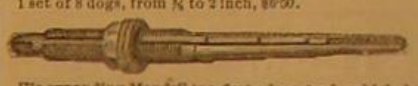
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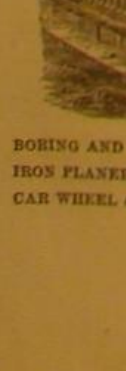
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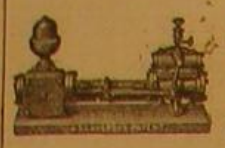
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