SCIENTIFIC AMERICAN

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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.

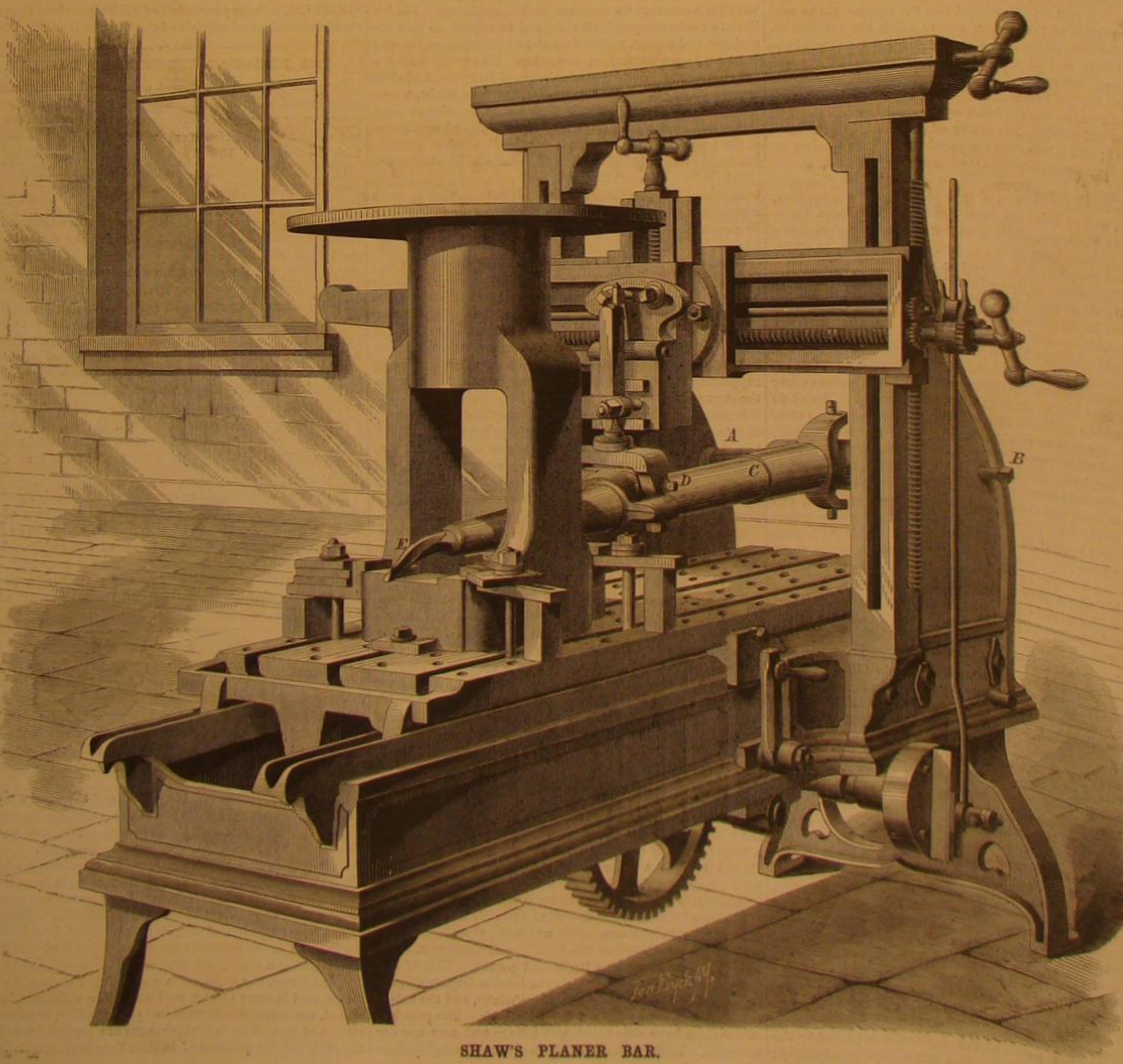
In brief, the device is a planer bar; its object, to reach through work on planing machines, and thus serve to perform a large proportion of the labor of slotting and shaping apparatus, at, of course, a materially decreased expense. It consists of a heavy shaft, A, at the rear of the planer, which rides 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.

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

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Contents.

(Illustrated articles are marked with an asterisk.)

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 litmus, 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 equai 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 diluted 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.

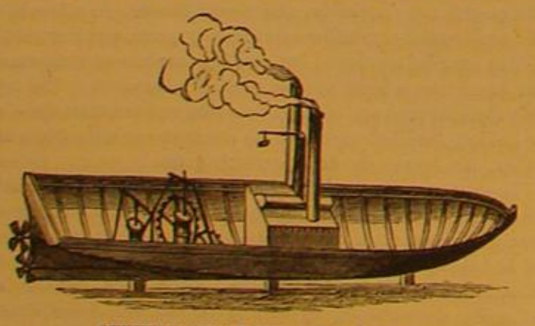
The *Chronique de l'Industrie* says that "a series of experiments have lately been made between St. Petersburg and Lausanne with an American Baldwin locomotive, burning anthracite. With a train of ten carriages, the engine ascended the heaviest grades at a speed of 40 miles per hour, and consumed during a run of 82 miles about a ton 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.

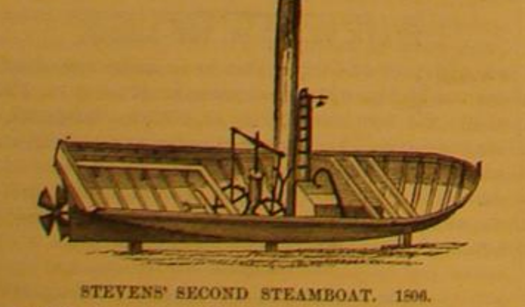
A late number of the *Journal de St. Petersbourg*, recently received, says that since the completion of the line of Voronege—Rostow, to the province of the Don, there has been considerable activity manifested in altering the locomotives so as to make them suitable for the consumption of anthracite. The 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.

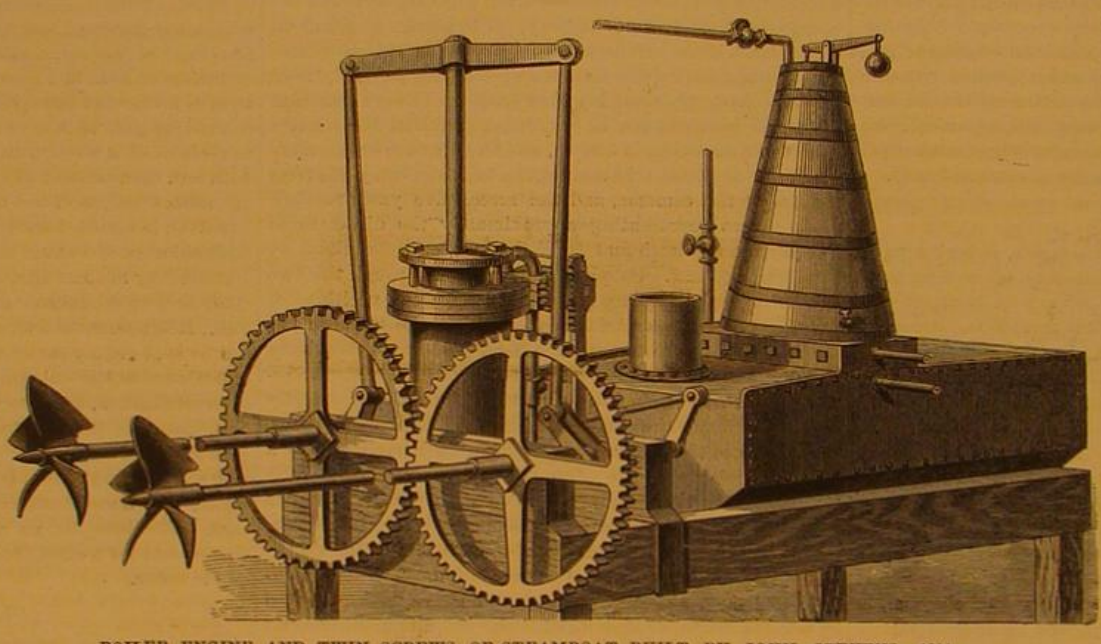

STEVENS' SECOND STEAMBOAT. 1806.

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

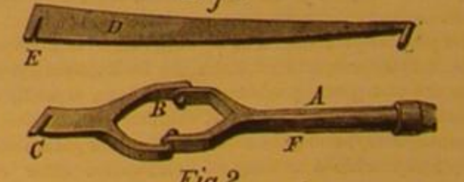
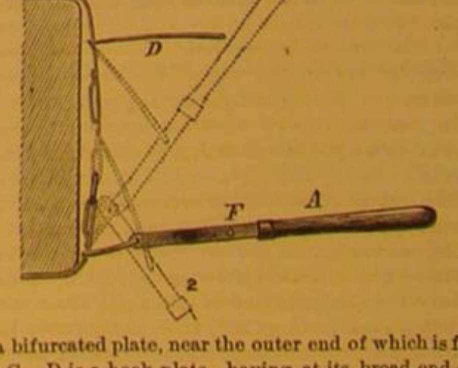


Fig. 2



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

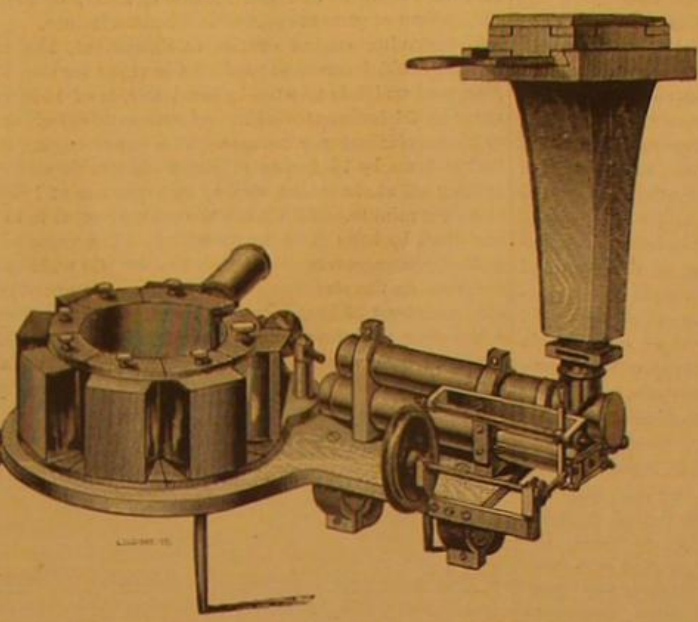


FIG. 1.—DR DRAPER'S APPARATUS

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

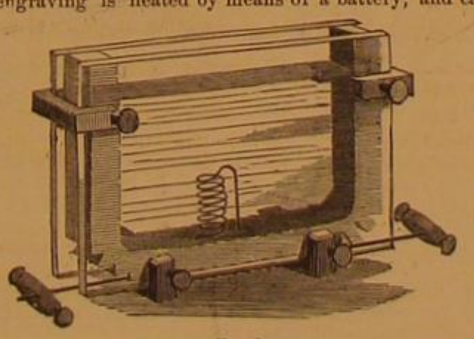


FIG. 3.

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.

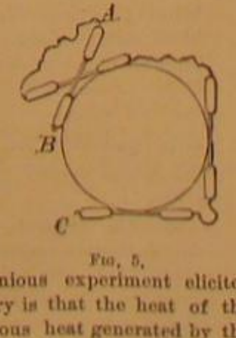


FIG. 5.

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.

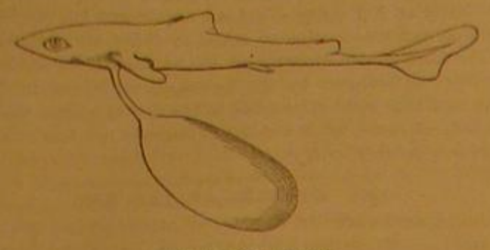
Before showing you the structure of the egg proper, as it exists in all animals before it takes upon itself any individual character, I will say a word on other modes of reproduction, in order that you may have before you the whole subject, and that I may not be limited in my comparison to the ovarian 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, supplied 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.

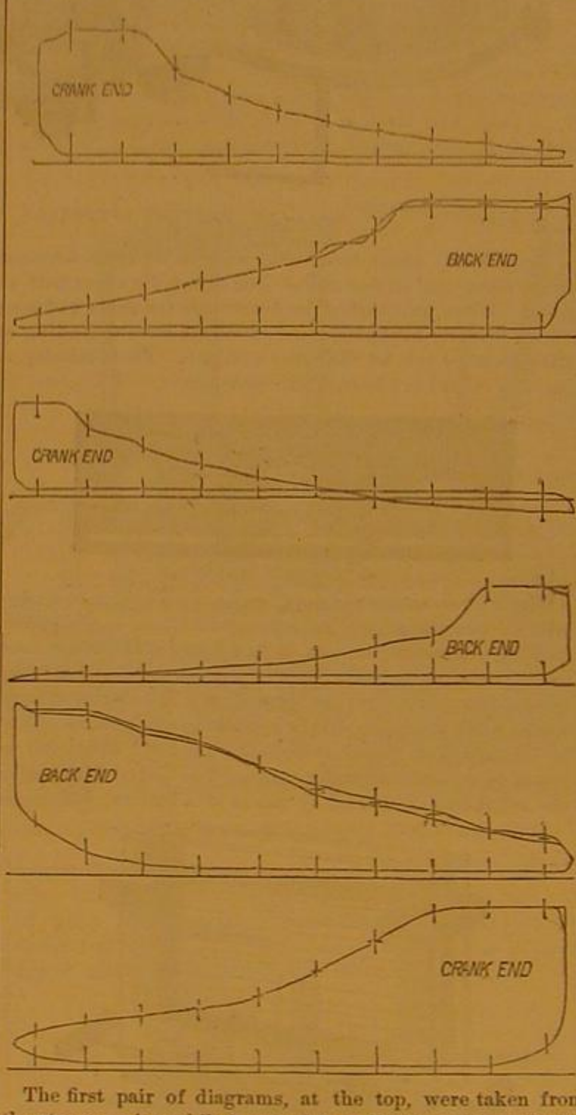
The irregularity of number is another astonishing feature of this problem of reproduction. It would seem that some kinds of animals require a far greater number of individuals for the maintenance of the type than others. Some animals multiply by hundreds of thousands—nay, by millions. Others bring forth 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	$\frac{1}{40}$

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	$\frac{1}{40}$

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	$\frac{1}{30}$

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.

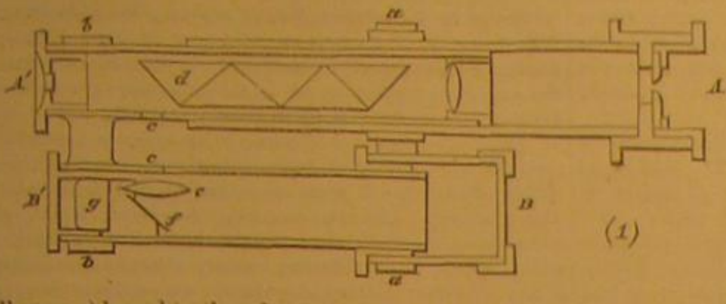
G. L. K. calls attention to the small proportional number of the light houses, beacons and buoys on the coasts of British North America, and suggests the use of the calcium light on shore for this purpose, as well as the employment by ships of some explosive (giving a pyrotechnic light, of some prearranged 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.

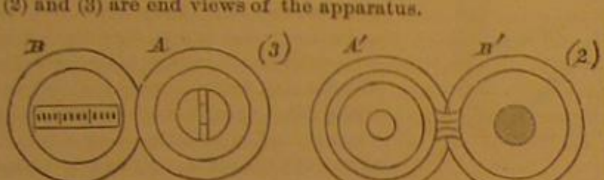
Professor Partridge, Professor of Anatomy of the British Royal Academy, is dead. Three men—body snatchers—once brought the body of a boy to him for sale. The professor suspected from the appearance of the corpse that a murder had been committed for the purpose of selling the body. He caused their arrest. 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 chloride 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 done in 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 $\frac{1}{4}$ inch shell, with $\frac{3}{8}$ 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 appeared 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.

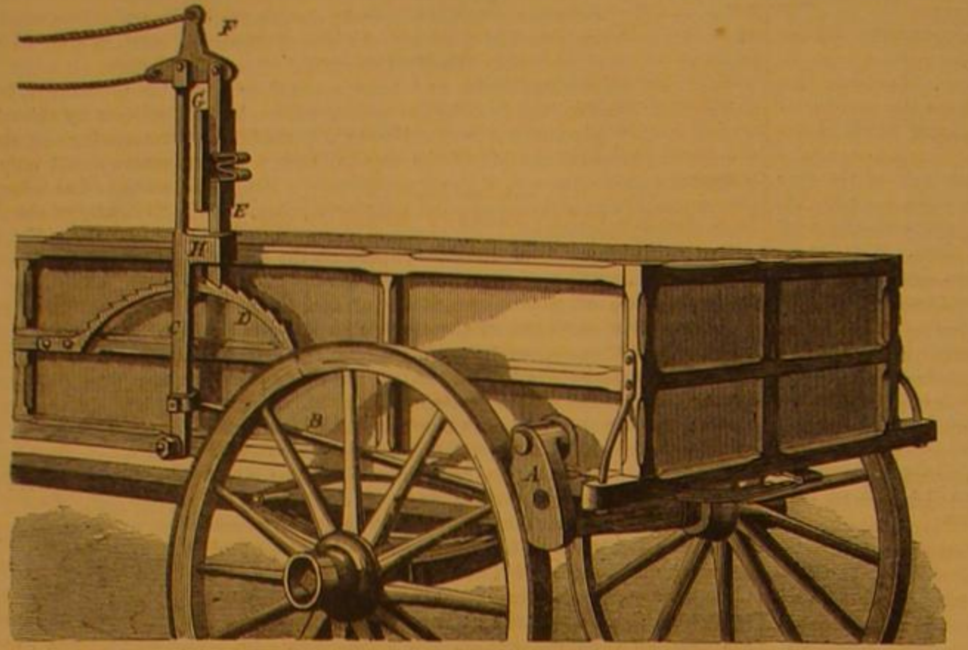
ONE HUNDRED AND THIRTY first class steamers are now employed on the various lines, plying between New York and European ports. During the last thirty-two years—or since ocean steam navigation was fairly begun—forty-four steamers have been wrecked.

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

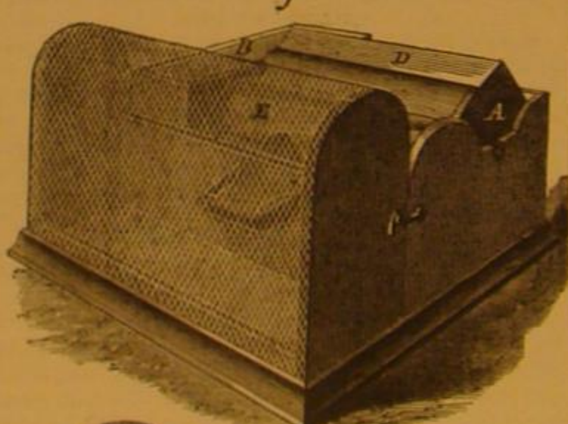
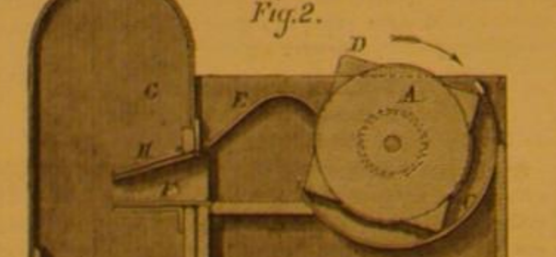


Fig. 2.



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 Chiacgo, 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.

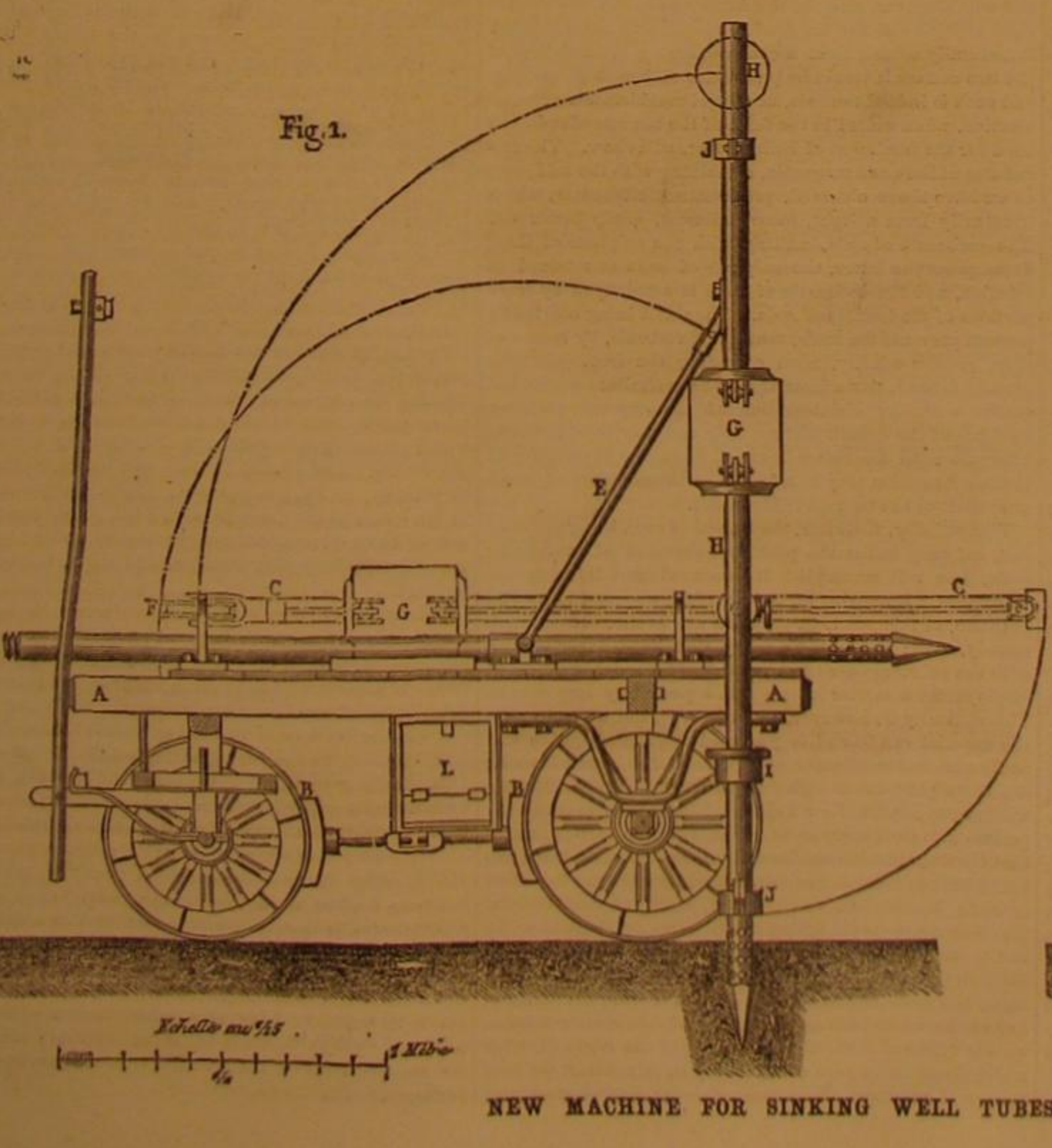
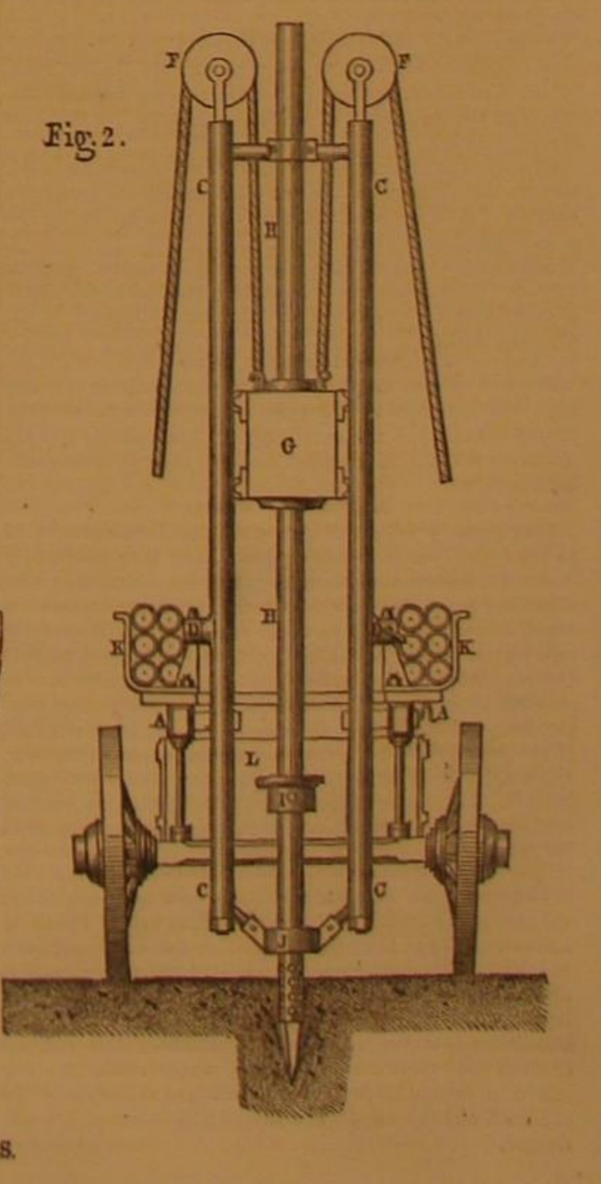


Fig. 2.



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 account 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 balance 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 3, 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 so 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 grind stone, 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. 121,829 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.

Business and Personal.

BEST MODE OF INTRODUCING NEW INVENTIONS.

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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?

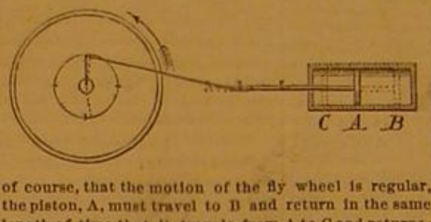
J. P. H. says: Take a piece of card board, bend up the sides, and fill the inside with tin foil. Hold the card board and tin foil over an alcohol flame and the foil will melt and the card board not burn. What is it that prevents the card board from burning?

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,

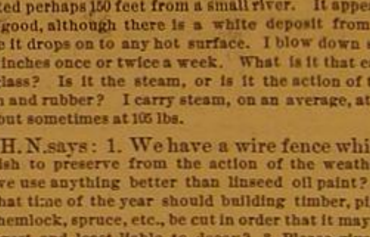


of course, that the motion of the fly wheel is regular, the piston, A, must travel to B and return in the same length of time that it travels from A to C and returns; or, in other words, when the stroke is half made, the fly wheel has not made one quarter of its revolution. Is not this so?

W. P. W. says: On my boilers I use glass water gages of the common construction; the glasses are 16 inches x ⅝ diameter. They are packed in the usual way with a soft rubber ring or gasket about ⅛ 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 candles 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 perpen-



diculars 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.

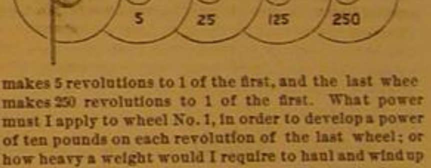
J. D. says: 1. Suppose a ball of cast or wrought iron suspended by a cord, say, 5 feet long, approach a ball magnet held in the hand, will the latter draw the ball to itself before touching it? 2. If it will, how near must it approach to cause the ball to swing? 3. Please tell me what is meant by "it 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 whee 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 $\frac{1}{5}\times\frac{1}{5}\times\frac{1}{5}\times\frac{1}{5}\times\frac{1}{2}=\frac{1}{1250}$: 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, 1½ 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 ⅞ of the stroke; I wish to have it cut off at ⅝ 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 20 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 weight 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 25 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 50 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 50 lbs. and the length of stroke, 1⅔ feet — 9416, divided by 45 times diameter fly wheel, say 9 feet — 405 — 23¼ cwt. the same as above multiplied by 25 gives 235,400 lbs.; now if the 25 was 2·5/10 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 25, 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 4⅛x 3⅜ inches, and the weight, 3,300 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 crystallization 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 hack 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.

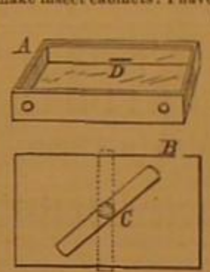
E. H. replies to G. W. H., who asked how to color butter: The juice of carrots expressed and mixed with the cream before churning, is best, as it does not injure the butter in any way.

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 ¾ 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.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

April 1, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Alloy, H. Aiken	137,279
Axle turning machine, A. F. Moore	137,316
Bag frame, J. B. and C. F. Blakslee	137,339
Bale tie, cotton, A. J. Going	137,301
Barrel, tumbling, F. N. Bixby	137,409
Basket, W. C. Higgins	137,368
Bed bottom, A. Turnbull	137,511
Bed bottom, A. S. Wells	137,399
Bed bottom, spring, Spencer & Parker	137,498
Bed spring, O. C. Campbell	137,287
Bedstead, sofa, C. Streit	137,505
Bedstead, wardrobe, R. W. Frost	137,396
Bee hive, A. Dewees	137,348
Bee hive, E. Gerry	137,433
Bit, adjustable, F. Jonas	137,373
Boats, detaching, T. Shaw	137,526
Boiler attachment, wash, T. Shuman	137,492
Boiler feeder, A., Jr., and T. C. Spencer	137,497
Boiler feeder, etc., J. G. Fulton	137,357
Boiler stand, etc., C. F. Hitchings	137,448
Bolt, expansion, D. L. Bartlett	137,398
Boot heel trimmer, L. Coté	137,292
Boots, inserting pegs in, A. Cavalli	137,298
Boot heel finisher, L. P. Hawkins	137,304
Box, E. C. Patterson	137,385
Brick machine, S. Martin	137,460
Bridge, wooden truss, T. W. Pratt	137,482
Bromine, making, D. C. Turner	137,512
Brush, blacking, C. W. Maguire	137,376
Brush machine, E. F. Bradley	137,411
Brush socket, P. Wagner	137,315
Buckle attachment, J. B. Welpton	137,519
Buffing machine, W. W. Messer, Jr.	137,465
Bureau, etc., T. W. Moore	137,380
Burial casket handle, A. G. Chapman	137,289
Burglar-proof door, etc., G. Little	137,436
Bushing, anti-frictional, F. S. Burr	137,415
Cam grooves, cutting, George & Houghtaling	137,338
Can, nitro-glycerin, A. Hamar	137,439
Cane crusher, C. H. Dickinson	137,349
Capsule, plaited, J. J. Baranowski	137,408
Car coupling, C. H. Knowlton	137,455
Car coupling, H. Mulhollen	137,470
Car spring, D. G. Daniels	137,295
Car spring G. F. Godley	137,300
Car strap, street, M. Warne	137,307
Carbureter, J. F. G. Kromschroeder	137,307
Carpet stretcher, D. White	137,522
Carriage axle lubricator, H. F. Philips	137,479
Carriage axle box, W. J. Parmalee	137,475
Carriage clips, forming, W. S. Ward	137,517
Carriage dash rail, M. Hine	137,446
Case for laces, etc., M. Deitzler	137,297
Cattle, supplying salt to, F. Stamberger	137,286
Chain machine, G. W. Binnix	137,408
Chair, etc., revolving, D. E. Teal (r)	5,345
Channeling tool, etc., L. Bauer	137,534
Chimney, J. Browell	137,412
Churn, H. A. Hincheer	137,369
Claw bar, W. S. Terhune	137,333
Clutch, friction, S. B. Alger	137,335
Collar, A. Flatley	137,353
Combing machine, Smith & Bradley	137,326
Cord, covering, Gillespie & Kohn	137,360
Cultivator, H. H. Perkins	137,478
Curtain fixture, G. W. Beers	137,405
Curtain fixture, A. D. & E. M. Judd	137,450
Curtain fixture, P. W. Phillips	137,480
Curtain fixture rack, J. Pusey	137,320
Dental diamond drill, J. P. Gillespie	137,434
Ditching machine, etc., L. D. Noble	137,318
Door knob guard, H. Ahrend	137,40
Door plate, etc, T. M. & W. F. Tobin	137,508
Door spring, L. J. Higgens	137,367
Dovetailing machine, W. F. Moody	137,315
Drawer lock, C. A. Stock	137,391
Drill jar, R. McMullen	137,378
Drill operating machine, J. W. Stockwell	137,504
Drill ratchet, B. Gallagher	137,432
Drilling machine, rock, F. Johnson	137,372
Earth closet, portable, A. Panyard	137,319
Elevator, P. W. Mellen	137,461
Elevator indicator, J. H. Corey	137,422
Engine, dummy, J. Comly	137,421
Eraser, rubber, E. W. Frost	137,299
Evener, draft, R. Bunker	137,286
Exercising machine, L. D. Tice	137,294
Fabric, dress protector, J. McMullen	137,311
Fabrics, piling textile, A. Warth	137,518
Fan, G. Brueck	137,413
Fire escape, H. A. Richards	137,483
Fire extinguisher, J. C. Meehan	137,379
Fire extinguisher, W. K. Platt	137,481
Fireproof floor, N. Cheney	137,343
Flask, powder, T. L. Sturtevant	137,332
Flour, manufacturing middlings, G. T. Smith	137,495
Flour, etc., bolt for, Foreman & Speck	137,430
Fruit jar, J. L. Mason	137,461
Fruit jar cover, J. L. Mason	137,462
Fruit knife, G. W. Stevens	137,501
Fruit, tray for drying, G. W. Stevens	137,502
Furnace, blast, D. W. Hendrickson	137,366
Furnace, smelting, B. M. Smith	137,493
Gage, pressure, J. W. Stiles	137,331
Gas burner, G. W. Hatch	137,303
Gas burner attachment, J. O. Belknap	137,406
Gas generator, J. W. Stanton	137,337
Gas regulator, P. Keller	137,454
Gas, illuminating, Whipple & Blunt	137,521
Gas retort charger, T. F. Rowland	137,457
Gas retorts, charging, T. F. Rowland	137,465
Gas retorts, raking, T. F. Rowland	137,456
Gas pipes, sealing, H. H. Edgerton	137,425
Gold and silver, separating, E. Lundquist	137,375
Grindstones, cutting, J. P. Gillespie	137,435
Gun lock, W. J. Morris	137,381
Gun, machine, W. B. Farwell	137,428
Gun, magazine, A. Swingle	137,392
Hammer, steam drop, F. B. Miles	137,313
Harness saddles, J. B. Welpton	137,519
Harrow, H. Wendover	137,520
Harvester, J. F. Seiberling	137,49
Harvester, E. Taylor	137,50

Harvester, bean, J. Hinds 137,370
Harvester, track-clearer, O. DuBois 137,331
Hinge, W. I. Ludlow 137,458
Hoops, cutting, A. G. Parkhurst 137,304
Horse power, E. Crockett 137,394
Hub, vehicle wheel, J. Monk 137,314
Hydrant, F. J. Paul 137,476
Ice, making, G. Willard 137,323
Insect destroyer, D. G. Mosher 137,469
Iron tender, etc., J. W. Goff 137,436
Jack, lifting, J. S. Haldeman 137,363
Lathe carrier, F. Ferrin 137,398
Levers, adjusting, G. W. Jordan 137,374
Lime, treatment of, J. L. Rowland 137,323
Locomotive sanding device, M. V. Nobles 137,472
Medical compound, W. A. Ruth 137,488
Metallic wheel case, A. Myers 137,471
Middlings receiver, etc., Hunter & Whitmore 137,449
Mill, grinding, H. B. Stevens 137,303
Mill hopper, etc., J. M. Finch 137,429
Millstone bush, etc., R. S. Cathcart 137,418
Millstone dress, J. B. Harris 137,361
Mirror, window, A. & A. Olander 137,383
Nitro-glycerin, A. Hamar 137,440
Nut, W. Van Anden 137,395
Nut lock, M. L. Ballard 137,401
Nut lock, Eichenberger & Binkly 137,426
Nut lock, G. W. Keen 137,453
Nut lock, I. E. Nagle 137,382
Nut lock, E. Turner 137,312
Oil still, W. B. Snow 137,496
Oiler, C. E. & Z. B. Grandy 137,361
Organ, reed, A. Dreher 137,350
Packing, piston, J. F. Hermance 137,444
Painter's pot, T. E. Costello 137,423
Pants presser block, Cohen & Waller 137,346
Paper from walls, removing, C. F. Ware 137,396
Paper stock, fiber, T. Routledge 137,481
Pi no action, upright, G. C. Manner 137,377
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Pile driver, explosive, H. Vogler 137,514
Planter and plow, J. T. McElhiney 137,309
Printing press, C. B. Cottrell 137,347
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Pulley, dynamometer, I. P. Tice 137,393
Pulley, expanding, J. E. Fales 137,352
Punching machine feed, W. B. Bement 137,407
Purifier, middlings, E. P. Welch (r) 5,346
Rack, dry goods, C. N. Cadwallader 137,416
Railroad rail, H. G. Angle 137,337
Railroad rail, M. F. McIntyre 137,463
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Rake, harvester, J. S. Truxell 137,510
Rake, horse hay, R. B. Sheldon 137,380
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Sash holder, C. C. Algeo 137,280
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Saw handle, M. L. Ballard 137,402
Saw set, A. & W. Boynton 137,410
Sawing machine, E. Benjamin 137,284
Scarf ring, Haack & Diolot 137,302
Scraper, road, J. Steffensen 137,499
Scraper, wood, H. D. Spickler 137,329
Screw propeller, J. Hartman, Jr. 137,365
Screw cutting die, Bates & Murray 137,283
Screw, wood, S. P. Burdick 137,414
Sewers, cleaning, W. H. Chase 137,290
Sewing machine, D. H. Rogan 137,321
Sewing machine shuttle, Edwards & Schleder, (r) 5,342
Sewing machine plaiter, O. M. Chamberlain 137,342
Sewing machine box plaiter, O. M. Chamberlain 137,343
Shade holder, M. W. House 137,306
Shaft eccentric, crank, J. F. Haskins 137,441
Shell, explosive, J. T. Senn 137,491
Shingling bracket, L. W. Merriam 137,312
Silk winders, guide for, J. H. Campbell 137,417
Spark arrester, W. F. Grassler 137,438
Spike making machine, D. Eynon 137,427
Spindle step, J. J. Henry 137,443
Spinning jack, A. Paul 137,386
Spinning mule, G. O. Wickers 137,331
Spool holder, etc., A. P. Ayers 137,282
Stalk cutter, J. G. Armstrong 137,281
Stencil plate, F. L. Morrison 137,317
Stone, artificial, J. L. Rowland 137,322
Stone, cutting and dressing, W. A. Forman 137,354
Stove door frame, S. Smith 137,328
Stove, heating, G. R. Moore 137,467
Stove, reservoir cook, S. W. France 137,355
Stove, reservoir cooking, H. Stephens 137,500
Stove pipe cover, T. M. Losie 137,457
Stove support, W. M. Conger 137,291
Stove support, W. M. Conger 137,292
Stud, lacing, D. Heaton 137,305
Stump extractor, E. Colyar 137,420
Sugar drier, A. Mackey 137,459
Table, extension, S. E. Wales 137,516
Telegraph, duplex, J. B. Stearns, (r) 5,344
Tomatoes, drying, M. P. Smith 137,327
Trap, ant, T. G. Ames 137,336
Trap sewer inlet, J. Hitchcock 137,447
Trap, steam, J. H. Blessing 137,285
Trimming, O. M. Chamberlain 137,344
Truss, D. Pomeroy 137,387
Type setting machine, C. T. Moore 137,466
Velocipede, W. Gaffey 137,431
Veneer cutter, J. N. Seib 137,489
Vessels, propelling, S. Gerhard 137,359
Vise, D. Green 137,302
Wagon, road, C. W. Saladee 137,324
Wagon seat, E. C. Cole 137,419
Wagons, trough for, A. Iske 137,371
Wall washer, etc., E. N. Bradley 137,340
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Watch spring attachment, R. Gove 137,437
Waterproof material, X. Karcheski 137,451
Waterproofing, X. Karcheski 137,452
Water main stop, W. Young 137,399
Water tank, railroad, J. L. Shaw 137,388
Whip lash, H. J. Bush 137,341
Wood, rubber-coating, Holmes & Albright, (r) 5,343
Wrench, P. E. McIntosh 137,310

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:

24,605.—SHEET METAL COFFIN.—I. C. Shuler. June 18.
24,660.—LOOM PICKER MOTION.—W. Stearns. June 18.
24,680.—CORRUGATING SHEET METAL.—W. E. Worthen, H. B. Renwick. June 18.
24,735.—OPERATING WINDLASS.—P. Philip. June 25.

EXTENSIONS GRANTED.

23,557.—SEWING MACHINE.—W. C. Hicks.

DISCLAIMERS.

24,523.—BEDSTEAD FASTENING.—L. W. Buxton.
23,448.—PAPER FOLDING MACHINE.—C. Chambers.
133,976.—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.
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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.

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

How Can I Best Secure My Invention?

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

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & CO., 37 Park Row, 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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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 obtaine . to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & CO., 37 Park Row, New York.

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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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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.

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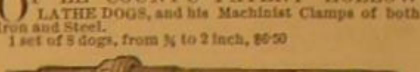

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