SCIENTIFIC AMERICAN

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

Vol. XXXIX.—No. 25. [NEW SERIES.] NEW YORK, DECEMBER 21, 1878. [$3.20 per Annum. [POSTAGE PREPAID.]

A NEW WATER ELEVATOR.

Some time since Mr. Foucault suggested the utilization of the pressure exerted by ammoniacal gas at a temperature of 100° C. in raising water economically to considerable height. Mr. H. Seyforth has constructed a machine embracing this principle, which is said to be very economical and effective. Before describing the construction and operation of this machine, it will be well perhaps to state, that while 100° C. are required to create the pressure, a reduction of temperature to 60° C. effects a reabsorption of the gas and produces a vacuum.

In the accompanying engraving the apparatus is shown partly in section, for the sake of clearness There are four generators, A, mounted on a circular base, each being provided with a filling spout, B, through which the ammonia solution is poured into the cylinder, *a*, which resembles a small vertical boiler. In the top of each generator there is a water chamber, which communicates with the cylinder, *a*, through three vertical pipes, which open above the water just under the head of the generator. The water chambers communicate with a central air chamber, G, through openings near the bottom of the chambers. A pipe, which projects from the bottom of the air chamber, G, supports a valve, E, from which radiate four pipes, each supporting at its outer end a sprinkler, F, between the cylinder, *a*, and the water chamber in the top of the generator. The stem of the valve, E, is prolonged downward, supporting near the middle a smoke drum, D, and at the lower end a four-armed spider, which carries three water pans and one fire grate. The valves, the water pans, and the grate, are arranged in such relation to each other that while the fire is under one of the generators, A, a water pan is under each of the others, and water is showered down through the sprinklers, F, upon and through the cylinders, *a*, and is received by the pans and delivered to the conduits seen below the circular base. The water chamber of each generator is provided with a suction pipe, as seen at the right, and it communicates with a rotary valve, H, which is connected by a short pipe with a cylinder, I, whose piston actuates the valves, H E, and the spider which supports the water pans and fire grate beneath the generators. The water in the chambers in the upper part of the generators is covered with a stratum of petroleum to prevent the absorption by the water of the ammonia gas, and the piston in the cylinder, I, is covered with a layer of petroleum to prevent the leakage of gas.

The operation of the apparatus is as follows: The fire being under one of the generators, A, the ammonia gas is driven from the solution in the cylinder, *a*, through the three pipes into the water chamber, where the pressure exerted on the surface of the water, which reaches 7½ atmospheres, forces the water into the air chamber, G, whence it flows through the pipe at the top of air chamber to the place of use or storage. The water thus forced into the chamber, G, is retained by check valves. Simultaneously with the discharge of water from the generator, the piston in the cylinder, I, is acted upon by the gas pressure, and in its descent moves the gearing shown below the cylinder, I, by means of the rack and pinion, J. This actuates the weighted lever, K, which, by its oscillations, imparts through the belt an intermittent rotary motion to a shaft below the floor. This shaft periodically rotates the spider carrying the water pans and fire grate and the valves, E H. So that after the water is forced out of the water chamber of one of the generators, the fire is moved to the next, and communication between the cylinder, I, and the empty water chamber is closed, and as the water is poured down upon the cylinder, *a*, the absorption of the ammonia gas is effected and a vacuum is formed, which draws through the suction pipe to again fill the water chamber. At the same time the valve, H, is again opened, permitting the absorption of the gas contained by it, thus producing a vacuum that draws the piston to the top of the cylinder preparatory to another descent, which takes place as the cylinder is placed in communication with the next generator in order. The fire is carried under the generators one after another in regular rotation, and while it rests momentarily under one of the generators, the others are being cooled by the shower of water from the air chamber, G. The smoke and steam pass into the drum, D, thence downward into the chimney flue shown at the bottom of the cut.

It is stated that, taking everything into consideration, this water elevator compares favorably as to efficiency and economy with the best pumping apparatus now in use, while its simplicity and manageableness are strong points in its favor.

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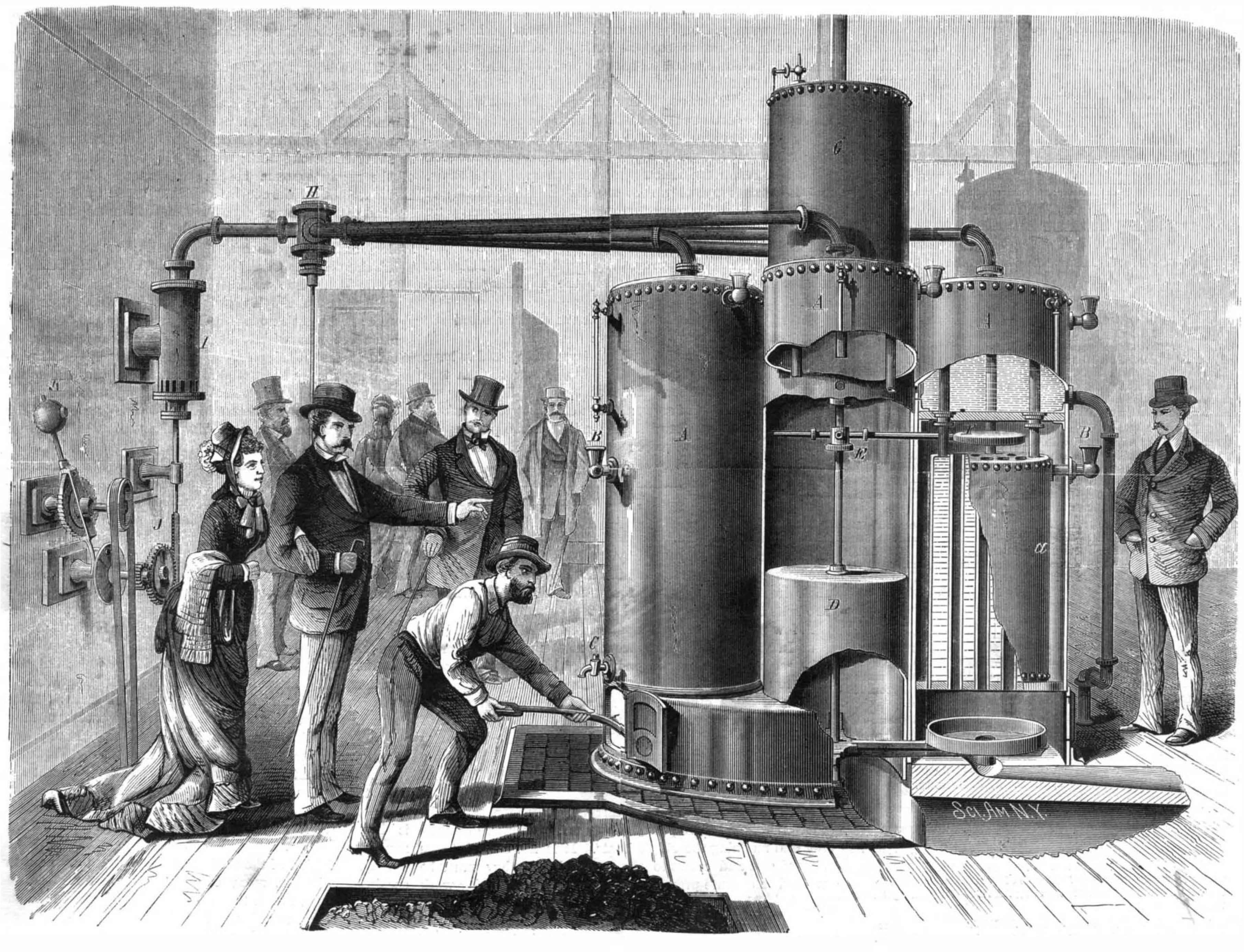
A CLOCK is being exhibited at Paris which fires a shot every hour. Somebody says that its great practical utility is "to kill time."



WATER ELEVATOR OPERATED BY AMMONIA

Scientific American.

ESTABLISHED 1845.

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VOL. XXXIX., No. 25. [NEW SERIES.] *Thirty-third Year.*

NEW YORK, SATURDAY, DECEMBER 21, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT No. 155,

For the Week ending December 21, 1878.

Price 10 cents. For sale by all newsdealers.

THE INTERNATIONAL DAIRY FAIR.

The dairy fair held in this city the week ending December 7, proved to be as popular and successful as the importance of dairy industry demanded. Dairymen who had attended all the prominent butter and cheese fairs hitherto held in the country freely accorded the palm to this, as not only the most extensive but decidedly the best the country has seen. Upwards of ten thousand packages of butter, cheese, and dairy appliances were entered, representing a dozen or more different States of the Union, besides Canada and several European countries.

In the foreign exhibit of butter were casks and tubs of Danish butter exhibited at the London Dairy Show of 1878; a sample of first quality cured Normandy butter; butter made in Friesland, Holland; a sample of ordinary cured Cork butter made in Ireland last October; a cask of Leinster cream butter, from Ireland, prepared on the Dorset system of packing; samples of extra mild cured Cork butter; some first quality Kiel butter, exhibited at the London Dairy Show of this year; and a tub of cured Welsh butter that took the first prize at the recent London Dairy Show.

Almost every variety of domestic and foreign cheese was represented. The show of cattle was not large, but it included some of the most valuable cows in the country. The exhibition of dairy implements and machinery was full and interesting. The most popular feature, however, was probably the practical illustration of the processes of making creamery butter and factory cheese. Each day some 500 gallons of milk and 30 gallons of cream were converted into butter and cheese by approved processes, from the reception and weighing of the milk to the end. In no industry has greater progress been made of late years, thanks to invention and co-operative effort, than in dairy management; and already the dairy interest begins to overshadow all the other agricultural industries. The product of butter and cheese last year in this country was valued at $350,000,000, surpassing the wheat crop by one seventh, and the cotton crop by a third. The export of these products has doubled in six years. Last year we exported 21,000,000 lbs. of butter, and 107,000,000 lbs. of cheese. This year the exports promise to reach 25,000,000 lbs. of butter and 130,000,000 lbs. of cheese. Add the value of the milk consumed to the aggregate yield of butter and cheese, the beef, leather, and other products which we owe to the cow, and some idea will be formed of the vast importance of this useful animal in domestic, industrial, and commercial affairs. Yet the dairy business of the country is comparatively in its infancy.

THE POMERANIA DISASTER.

The Hamburg-American steamship Pomerania, which left New York November 14, was sunk by collision with an iron bark, in the English channel, at midnight, November 25. The night was dark and foggy, and the ship sank within twenty minutes. Many passengers and several of the crew were drowned; and had it not been for the timely appearance of another steamer the loss of life would have been much greater. The reports of what occurred between the collision and the sinking are confused and conflicting, and, in some respects no doubt, much exaggerated. It seems to be clear, however, that two of the ship's boats were crushed in the collision, one was capsized by a rush of sailors, and the rest were seized chiefly by an unmanageable portion of the crew, who were more careful in many instances to save their luggage than to help the drowning passengers.

Several points in connection with the disaster stand out prominently. Among them, these:

1. The ship sank with fatal rapidity, though said to have had seven water tight compartments, not more than two of which could have been breached by the collision.

2. The undisciplined crew, as has so often happened before, were a source of peril rather than a help to the passengers.

3. Though the sea was not rough the life boats were sadly inefficient for the saving of the passengers, owing to unskillful handling and the misconduct of the crew.

4. The life buoys, though not generally resorted to, preserved the lives of those who used them properly; among them the captain, who went down with the ship, and was afterwards picked up, saved by his life belt. To several of the passengers, however, the life buoys served only to insure their drowning; they were found floating head down, the life belts having been fastened too low or too loosely.

A few practical observations suggest themselves.

a. In view of the ignorance of most men and women, with regard to the nature and use of life buoys, it would seem to be advisable to make it the business of the surgeon, purser, or some other of the ship's officers, to give at the beginning of each voyage an exhibition of the proper use of the life saving apparatus provided; to be followed up by such special instruction as might be called for. The trouble would not be great, and the advantage in case of accident would be enormous.

b. The crew of every vessel carrying passengers should be thoroughly drilled, in port and out, in the exercise of lowering and manning the ship's boats. It is not enough to assign officers and crews to the several boats; they must be trained to execute promptly and surely the particular work required; they must be made practically familiar with the launching and handling of the particular boat they are to take charge of in an emergency, and this in all sorts of weather. In view of the wretched and shifting material of the crews of most ocean steamers, the need of repeated drills of this sort at the outset of every voyage would seem to be imperative.

Still more: the safety of the passengers in case of collision, storm, or fire, will be augmented by every reduction possible in the number of coalheavers and others of the baser portion of the ship's crew. Accordingly the work now done by such men should be turned over to machinery, as fast and as far as invention can provide acceptable substitutes.

c. Life rafts should be more generally carried by ocean steamers. Sailors have a contempt for them; yet in cases like that of the Pomerania disaster, rafts have been proved to be better than boats. By means of them vastly greater floating capacity can be carried in the space allowed for boats; they cannot be swamped in launching; they will float in any sea; and, for sudden emergencies, they are much more serviceable. It is safe to say that with a few such appliances every soul on the Pomerania might have been saved.

d. So long as it is possible to leave open ways between them, water tight compartments in ships are a delusion and a snare; they are never closed when they ought to be. To be secure, and a sure protection against fire and water, each compartment should have unbroken walls. Openings from one to another should be prohibited, the inconvenience of their entire separation from each other being amply compensated for by the superior security afforded. It might be well also to insist on the periodical testing of these compartments, if need be, by filling successively with water those not furnished for the accommodation of passengers.

Ultimately, we believe, passenger ships will be so constructed as to be unsinkable. Until then the safety of passengers in cases of accident must be provided for by the perfection and multiplication of life saving appliances and means for preventing destruction by fire, collision, and other mishaps.

In one direction very little has yet been done, and that is in lighting ships so as to make them visible through fogs and darkness, and to prevent the confusion and danger which usually attend, if they do not directly result from, darkness in case of accidents at night. With the multiplication of shipping on every sea the need of more penetrating lights for ships needs no argument. There seems to be a wide field of usefulness here for the electric light, and an opening for invention at once profitable and beneficent.

SHORT HAND.

Scarcely a week passes in which we do not receive one or more letters asking which is the best system of short hand, and how long it would take a youth of ordinary capacity to learn to report verbatim, with say one hour's practice a day. Seeing that there are a dozen or more stenographic systems in use by reporters and professional stenographers, each of which is claimed to be the best by its users, while there has never been to our knowledge any competitive test of the comparative speed and legibility of the different systems, it is manifestly impossible to answer judicially the first question. Some of the most successful stenographers have used an abbreviated long hand; the majority now use one or other of the many systems based on Pitman's phonography. There are, besides, the cursive system invented by Mr. Lindsley and called tachygraphy; a somewhat similar scheme invented by Mr. John Brown Smith, styled the chirographic system, and much praised by its disciples; Waring and Schofield's short hand; Cross' eclectic short hand (not phonetic); Melville Bell's line writing; Manseau's adaptation of the French system of Duployé; the German, or "Gabelsberger" system; and there's no telling how many others.

For those who wish to be professional stenographers, we should advise the adoption of some form of Pitman's phonography, simply because it is the most in use, and so far appears to be best worked out for reporting purposes.

The second question is even harder to answer; everything depending on the manual capacity of the learner, his sense of form, quickness, and retentiveness of memory, patience, and other personal qualities. Probably not more than one out of every hundred young men that have undertaken phonography or other short hand methods, has ever been able to report any considerable portion of an ordinary sermon or public address. It is something like learning Chinese; a few hundred words are learned quickly, but after that the tax upon the memory is, to the majority, unsurmountable. In all forms of stenography words and phrases are hinted at, never written, and that system is the best which enables the writer to suggest the most with the fewest motions. Very skillful stenographers may "take down" perhaps two hundred words a minute for brief periods; but that does not imply the writing of so many words, or even the tenth part of them. By skillful omissions enough is set down to suggest what was spoken; and the success of some reporters in this line is really marvelous. It requires, moreover, a combination of mental and manual dexterity that not one in ten thousand has or can acquire. But this cannot fairly be called writing, since it is legible only to the one who does it, and even he cannot make out what is hinted at after the subject matter has passed from memory.

The acquisition of the skill required to report even a slow speaker involves so many conditions which cannot be determined without trial, that it is obviously impossible to answer the question put by so many correspondents. In any case, however, it will do no hurt to try the system nearest at hand. Success will bring no great reward; and failure will not be without advantage.

AMALGAM FOR TOOTH FILLING.

So long as the filling of teeth with gold remains a tedious and painful operation, the public generally, since they have to bear the pain, will naturally prefer the employment of plastic fillings, if such fillings can be made to do reasonable service. Can they?

On this point the professional world is sharply divided, one school of dentists holding that nothing but gold should be used in any case, the other that cheaper and more easily inserted fillings are in many instances, if not always, better than gold. So marked a difference in professional opinion on a point of such vital importance would be a professional disgrace, were it not for the circumstance that the human mouth presents conditions so variable and uncertain that it is impossible to decide in many cases whether the success or failure of an operation is due to the skill of the dentist or his lack of it, to the nature of the filling, to the organic life and condition of the patient's teeth, to the character of the local secretions to which the work is subjected, or to other complications impossible of detection or control. Some salivas seem capable of dissolving anything; other mouths will hospitably receive fillings that could not be trusted at all under the conditions usually prevailing; and even in the same mouth variations in the patient's general health may cause the sudden failure both of filled teeth and of previously sound teeth, that have successfully stood the test of years of usefulness.

Such being the case it is not surprising that dentists of equal intelligence and skill should be found in opposition. Probably the question of gold *versus* amalgam will remain in professional chancery until some lucky inventor hits upon a composition approximating dentine and enamel in physical properties, with the ability of pure gold to withstand the action of every possible food or drink or buccal secretion. Meantime it is interesting to watch the shifting aspect of the professional battle—provided one is not called upon to decide upon a filling for his own failing teeth.

A forceful argument in favor of the use of amalgam under many conditions appears in our excellent contemporary, the *Dental Cosmos* for December, from the pen of D. Van Denburgh, of San Francisco. The writer was educated in the Parmly, Harris, and Westcott school of opinion that amalgam was unfit for tooth filling. His use of it began in little faith or hope that it would prove serviceable; and the fact that amalgam had won a place of usefulness in his practice is accounted evidence of its merits. He says: "Many of my own teeth were filled by C. A. Harris, of Baltimore, thirty years ago. A few more in the half dozen succeeding years were filled by Amos Westcott, of Syracuse, N. Y. One alone of these fillings failed, and that repeatedly within the first half dozen years. I would not have the tooth extracted, as advised; and, after having the decay excavated, I prepared a putty of tin, silver, and quicksilver, and myself placed it in the cavity of the unfortunate lower molar tooth. For more than twenty years it has done me as good service as its brighter neighbors. But the point of interest is, that it has done this where gold skillfully used had failed. After a year or two of good conduct by this amalgam filling, I began to feel some interest in it, and in various ways in my laboratory to test some amalgam mixtures.

"I occasionally filled in some mouths (where I might have opportunities afterwards to watch it) some dilapidated tooth that would otherwise have been extracted, some soft or poorly cared for teeth that fillings of any kind were least likely to preserve, and some difficult cavities that were hard to fill satisfactorily with gold. With such a beginning I went on experimenting, testing, and comparing, and now, after twenty years, I still use it, and nearly as often as I use gold."

The mixture used by Mr. Van Denburgh is composed of coin silver, 4 parts; tin, 5 parts; and mercury, *q. s.* The tin is added to prevent the shrinkage experienced with an amalgam of silver, and to form a mass sufficiently hard to resist mastication. The amalgamation is a matter requiring great care and skill, and thorough washing with alcohol is essential.

In the earlier years of his use of amalgam, Mr. Van Denburgh thought he occasionally observed so much superficial oxidation, as, after a considerable time, to injure the edges of certain fillings, and produce a crevice that favored the renewal of decay; but longer experience has taught him that the fault was his own in unskillful preparation and use of the material. He believes now that amalgam will resist all destructive agents in the mouth as well as any dentine or enamel can do; but a caution may be necessary to the inexperienced, not to use so much or so little quicksilver as to make it crumble under mastication; or to attempt to use the mixture in any case after it may be perceived that the hardening process has begun. If this process be once interfered with, though it will be renewed in a degree, no reliance can be placed upon the mixture. A good amalgam filling will not stain any tooth. That anything hurtful to the most delicate or diseased organization can be found in it, or produced from it in the mouth, seems to him the most fanciful nonsense. Any quantity of the metal that might be placed in the mouth would not probably lose by trituration or chemical action a perceptible amount of any or all of its ingredients in a lifetime; and even if such loss were to occur in any way or form, he knows of no reason to suppose that it would be hurtful if taken into the stomach.

As regards durability, Mr. Van Denburgh believes that properly prepared amalgam, skillfully inserted, provides as lasting a filling as can be made with gold, and its advantages in saving time and pain are very great. He says: "Five minutes are sufficient to insert any amalgam filling, and nothing more is required to keep the work dry than a napkin or a roll of paper. But not only am I convinced that amalgam, in respect to usefulness and durability, may in any case be as good as gold; I am equally certain that in some cases it is superior, and for the reason I have mentioned, of its more kindly contact and healing qualities in connection with soft dentine. As a mechanical stopping, where a tooth is much weakened by the loss of substance, amalgam brings no strain as gold does; on the contrary, it becomes a binding and supporting protection. Much of the solid substance of teeth is often cut away to secure the better insertion of gold that would be unnecessary for amalgam. Any one with strong masticating organs can 'chew up' a gold coin; so, the most perfect gold filling, when made a projecting portion of a tooth, and subjected to severe mastication, will spread and finally break away. Amalgam has a greater power of resistance, and in many such cases will prove the most serviceable grinder."

It is but fair to note that in the same number of the *Dental Cosmos*, Dr. William H. Truman, of Philadelphia, critically reviews the question of amalgam fillings, and arrives at conclusions much less favorable to their use, though he is far from condemning their use under all conditions. The materials proposed in place of gold will no doubt amply repay by increased durability any extra care in their preparation and insertion; but they all, he thinks, have inherent defects which will have to be overcome before they can be called reliable. They have their place, and probably have not been used as much as they might. Nevertheless, "gold has been used too long, and with too much success, to be abandoned before a better method is at hand. We would ask every professional brother before accepting the teaching and adopting the practice of this new departure, to reflect a moment on the past, and see how often these tidal waves have swept over the profession. At one time it is arsenic, at another amalgam; twice sponge gold has rolled over us, leaving many an aching void; and no doubt the indiscriminate use of the mallet and cohesive gold, the reckless building up of teeth without regard to their position or character, has done much to secure this idea the warm reception it has met."

Accordingly, Dr. Truman advises caution before cutting loose from so faithful and well-tried a friend and risking professional reputation on "the uncertain ground of plastic fillings." The fault *may* lie with the operator, and not with the material used.

AN ACTIVE VOLCANO IN THE MOON.

For many years the opinion prevailed that the moon had long since arrived at the stage of physical quiescence: that it was, in short, a dead planet. Neison, in his admirable work on the Moon, takes strong ground against this opinion; and the drift of later observation has been to indicate

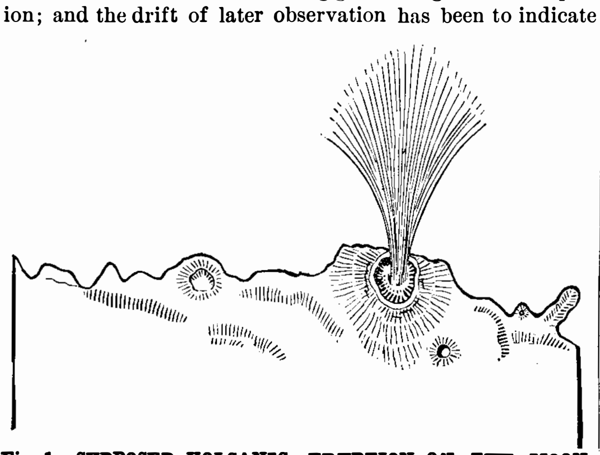


Fig. 1.—SUPPOSED VOLCANIC ERUPTION ON THE MOON.
(Seen by Mr. John Hammes, at Oskaloosa, Iowa, November 12, 1878, 8:30 P.M., civil time.)

at least the probability of the progress of active volcanic changes during recent years. In one instance, at least, a large crater has disappeared, apparently by filling from within; but hitherto no astronomer has been fortunate enough to witness anything like an eruption.

The correspondence below puts this question in a novel and most interesting light. The observation of Mr. Hammes seems to confirm the growing opinion of the best of our living selenographers that the moon is far from dead; and from the nature of his occupation the probability of his being misled by any error in the adjustment of his instrument, accidental reflection, or the like, would seem to be very slight. The fact that the supposed eruption lasted, or was watched, for half an hour, by at least two different observers, still more reduces the likelihood of error.

U. S. NAVAL OBSERVATORY,
Washington, December 4, 1878.

To the Editors of the Scientific American:

I inclose a correspondence in relation to a volcano in the moon.

Mr. Hammes writes to me that he travels around the country with his telescope, showing the moon and planets to colleges and schools, and that he is perfectly familiar with the appearance of the moon, and with the use of his instrument.

The crater seen by Mr. Hammes seems to be, from his drawing, in the vicinity of Baco, Barocius, and Nicolai, as these names are given on Beer and Mädler's Map of the Moon.

Very respectfully, yours,
JOHN RODGERS,
Rear-Admiral, Superintendent.

KEOKUK, Iowa, November 20, 1878.

ADMIRAL JOHN RODGERS:

I take the liberty to offer you a sketch of an observation on the moon, taken November 12, hour 8:30 evening, seen by me, my son, and several gents who were present, at the town of Oskaloosa, Iowa, about latitude 41° 30′—what I supposed to be an eruption of a volcano. It was only seen for one half hour through my 6½ inch telescope, as plain as any other mountain scenery in the moon is seen, and of the same color. I would like to hear what you think of it.

I remain, respectfully, your obed't servant,
JOHN HAMMES.

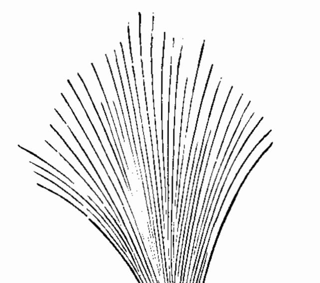


Fig. 2.—APPEARANCE OF THE ERUPTIVE STREAKS.
(As described by Mr. Hammes.)

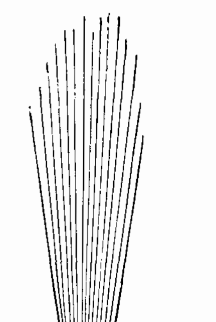


Fig. 3.—APPEARANCE OF THE ERUPTIVE STREAKS.
(As described by Mr. Hammes' son.)

[Reply.]

U. S. NAVAL OBSERVATORY,
Washington, November 23, 1878.

DEAR SIR: Your report of what you saw on the 12th of this month in the moon is very interesting, so interesting that the fact will not be received by the astronomical world without the closest scrutiny. Your observation will be attributed to some chance dust on the glass, or to some error in adjustment, or to an accidental light reflected from some neighbor's window, or to some other source of error. Therefore please send your observation in full, with the signatures of the gentlemen who saw it with you; and also the certificate of some well known person, governor, mayor, U. S. senator, or other, stating something about the gentlemen who sign.

I presume you, as a man of the world, will understand this: that new facts are received in astronomy with extreme caution, and that in publishing such things, one must take care to give all his grounds for so doing, and leave no means of verification untried. Very truly yours,

JOHN RODGERS, R. Admiral, Superintendent.

Mr. John Hammes, Keokuk, Iowa.

[Testimonials.]

CITY OF KEOKUK, Mayor's Office, December, 2, 1878.

John Hammes is well known in this city, and bears the reputation of an honest and reliable man.

JOHN N. IRWIN, Mayor.
J. C. PARROTT, P. M.
R. ROOT, Dept. U. S. M.
W. T. RANKIN, Ass't U. S. Attorney.

EXPIRING SUBSCRIPTIONS.

The next number will terminate the present volume, and with it will expire several thousand subscriptions. We never force our journal upon any one who does not wish it, or who does not feel it to be money well laid out; hence we apply, in all cases, the strict business rule of discontinuing the paper when the term paid for runs out. This we think is the best plan.

We believe that the SCIENTIFIC AMERICAN has been worth during the past year more than it has cost any one of its subscribers—indeed, it is almost a wonder to ourselves as we glance over the pages and see the number of expensive original illustrations it contains, how we have been able to give a weekly journal of the size and quality at so low a price. We are anxious to increase our circulation, and we know that thousands more would be glad to take it, if some one would but invite their attention to it. No other journal has had better friends in this respect than the SCIENTIFIC AMERICAN. We feel grateful for all the solid interest which has been shown to us in this respect, and we honestly believe that those new subscribers who become patrons of the paper through the solicitation of some of our old friends and subscribers will receive the thanks of the new patrons for directing their attention to the paper. The publishers certainly will be grateful to all such friends.

QUICKLIME AS A SUBSTITUTE FOR BLASTING POWDER.

Unslaked lime compressed into cartridges, or used loosely and well tamped down in the hole, using water or other liquid to saturate and expand it, is now proposed for use in fiery coal mines. It is claimed that the advantages to be derived from its use are economy in the production of coal; making less slack than by using ordinary blasting powder; lives of colliers are in less danger; the breaking or shattering of coal back of the charge—which is especially characteristic of the use of gunpowder—is avoided; and the quality of the atmosphere is rather improved by its use than otherwise.

THE NEW OTTO SILENT GAS ENGINE.

This engine is the latest and most complete of thermodynamic motors. In it a sustained pressure is utilized on the piston by a quick combustion—a feature which was the lacking element in the previous forms of explosive engines. The following explanation will suffice to make clear the essential features of this new contrivance.

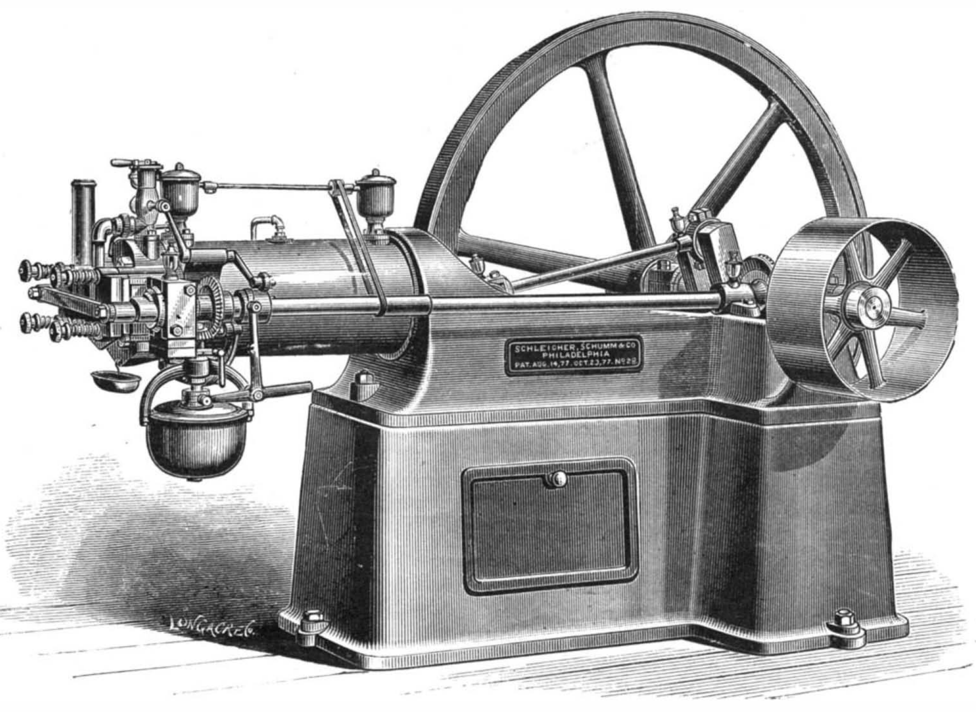
Instead of the usual explosive mixture of gas and air, used up to the present time in explosive engines, a diluted mixture containing more air than the complete combustion of the gas should require, is introduced in the cylinder by the first outstroke of the piston; in the following instroke this charge is compressed to a certain degree, and at the end of the stroke is ignited by slide lights. By this manner of compressing a diluted mixture, which, at ordinary atmospheric pressure would enter into combustion too slowly to produce any useful effect, the particles of the gases having been brought more within the range of chemical attraction, will produce a combustion quick enough to develop the maximum pressure at the beginning of the stroke. Such a compressed weak or diluted mixture will burn more slowly than one containing a higher percentage of gas, while the heat resulting from the combustion is imparted to the non-combustible portion of the mixture, expanding it and giving that sustained pressure, before alluded to as a desirable feature, to be transformed without jars or shocks into useful work. The mechanism may be more fully comprehended by reference to the accompanying engraving.

The gearing of the engine is operated by a shaft running longitudinally with respect to the cylinder. Motion is imparted thereto by conical wheels from the crank shaft in such manner that the latter makes two revolutions while the former makes one. The shaft actuates the slide by one crank and one connecting rod, and by means of this slide, the functions of giving inlet to gas and air, and of igniting the charges each at the proper instant, are performed. This slide works with its inner side against the cylinder head, and with its outer side against the face of the slide cover or cap, which is pressed by springs against it, and furnishes an equilibrium against the pressure.

An arrangement that acts as an automatic regulator of the amount of fuel consumption in relation to the amount of work thrown on the engine is the combination of the governor and the valve-actuating mechanism, which maintains a constant speed whether the engine is working full power or with no load, while the number of effective strokes, or of combustible charges taken in per minute, will vary; so that when the engine runs idle, it will have one revolution only for four revolutions of the gearing shaft, while a charge of gas and air is introduced; but while doing the full work, gas will be admitted by the governor on each revolution of this shaft. Besides the advantage derived therefrom, with respect to economy, that of not having the speed slacked down when work is thrown on, or having the engine running away when some is taken off, will often be of importance when the work requires a varied and constantly changing amount of power, as in the case of hoisting, etc.

The exhaust of the engine is operated by a lever and a cam moving the escape valve. Two automatic oil cups on top of the cylinder, moved by a small shaft and pulley, as soon as the engine is running, deliver a certain number of drops of oil to the slide valve and the cylinder and piston, and thereby the only attendance left for lubricating has been almost entirely confided to the engine itself. An automatic arrangement is furthermore provided to stop the inlet of the gas, in case the engine should stop accidentally and thereby waste the gas that might escape should the engine stop in the position where the gas valve would be open.

The total cost of running may be said to be represented by the expense of the gas, and as the quantity of gas required for the "Otto" has been reduced materially, as compared with former gas engines, the expense has been made very low as a total. From a correspondence in the London *Engineering* the consumption appears to be 21·5 cubic feet per hour per indicated horse power, which would give, at our prices for gas of $2 to $2.50, a cost of 4·3 to 5·4 cents, and where special rates are given for gas consumed as fuel, the cost would be less. By reason of the cut-off arrangement, the above gas consumption is, however, seldom reached in practice, the average cost being often only 0·25 or 0·5 of the above maximum rate. The safety of gas engines, which leave insurance policies unaffected, the saving of time in their handling, from their general convenience, and their complete cleanliness, do away at once with a great number of small expenses and items of trouble, and will therefore leave the balance of all expenses very much in favor of gas engines. Their peculiar advantages make gas engines highly suitable for use in printing offices, where generally from 2 to 7 horse power are required. For hoisting in stores and warehouses on account of their constant readiness, complete safety, and little attendance, engines up to fifteen indicated horse power have already been largely and successfully applied, as well as for other similar intermittent work, as the running of electro-magnetic machines, ventilating of public halls, theaters, etc. Even in large industrial establishments gas engines have been used to run single machines at night, for which the principal engine could not be kept running, and as a reserve engine that can be started at once in case any accident or breaking should occur in the regular power, and require an expensive stoppage, might be found very valuable help.



THE OTTO SILENT GAS ENGINE.

To gas companies the Otto silent gas engine opens a new field for the use of gas, so threatened by the last advances of the electric light and Mr. Edison's promises, as to become the cause of anxiety to gas stock holders. By the moderate quantity of gas that the new gas engine requires, gas companies have a means of bringing the question of gaseous fuel, in course of a little time, to a practical solution; and when the electric light shall be turned on and off in private houses, as the gas is now, the gas companies will supply their product in larger quantities, during a longer time, and at a much cheaper rate for fuel and power.

The engine, as shown in the illustration, is designed by Messrs. Schleicher, Schumm & Co., engineers and machinists, 3045 Chestnut street, Philadelphia, which firm controls the sale of the Otto gas engine in this country.

A Humane Dog.

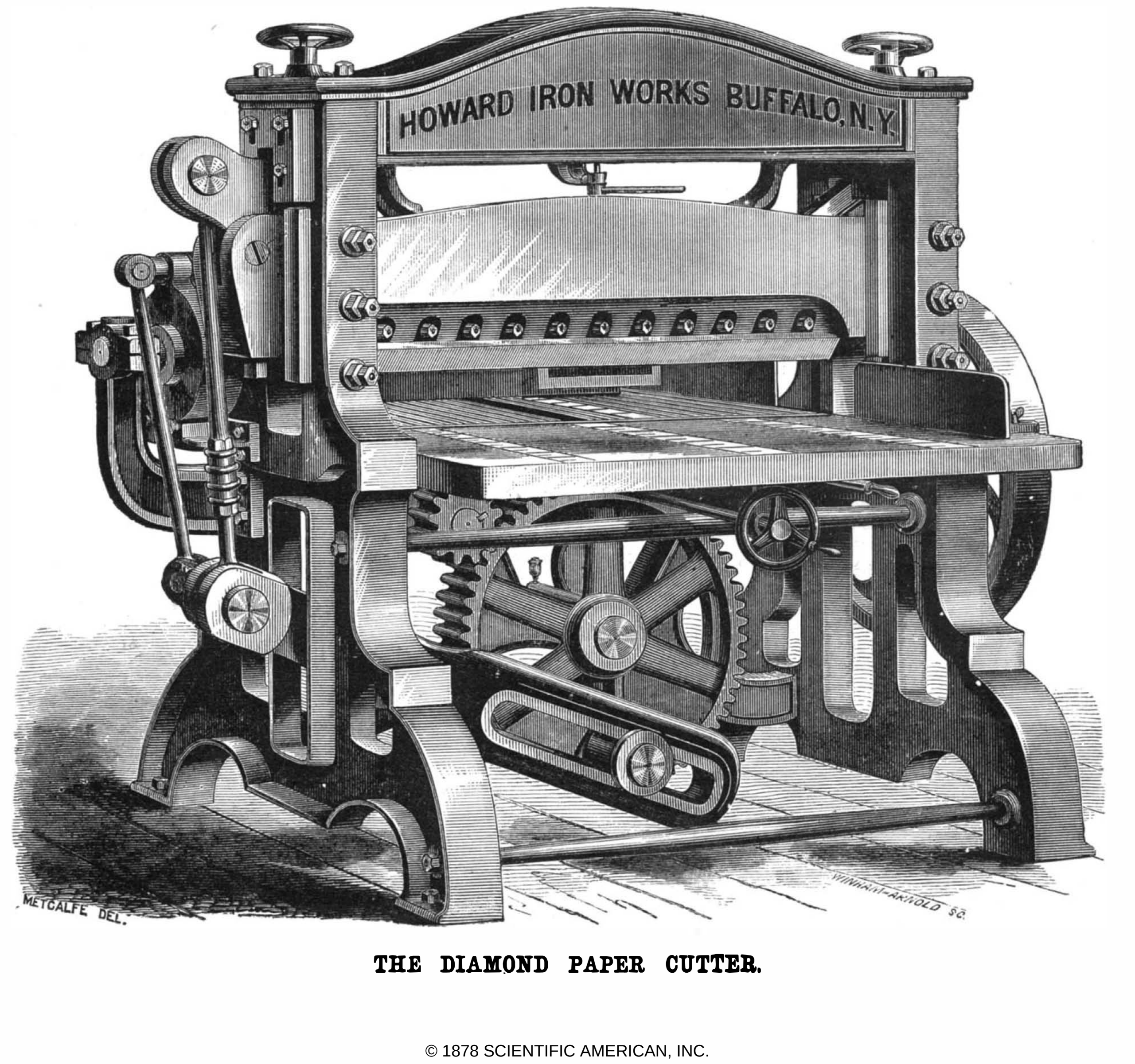
Two gentlemen who were passing a house in Worcester, Mass., recently, were attracted by a large Newfoundland dog, which kept running toward them and then returning in the direction of a pond in the grove, where something was evidently wrong. They followed the dog to the pond, where they found another dog in the water and unable to get out. His front paws were on the curbstone, but he could not get sufficient hold to draw himself up. He was nearly exhausted, and would probably have been drowned had not the gentlemen assisted him. The dogs showed their gratitude in unmistakable signs.

IT is the intention of the publishers to make the SCIENTIFIC AMERICAN, during the coming year, better, handsomer, more useful, and more interesting than it has ever been before. In the way of illustrations, we have in progress of execution some choice original subjects for the new volume.

THE DIAMOND SELF-CLAMP PAPER CUTTER.

The accompanying engraving shows a new paper cutter manufactured by the Howard Iron Works, of Buffalo, N. Y., under E. Schlenker's patent. These machines are made in various sizes ranging from 32 inches to 62 inches. They are well designed and strongly built, as will be seen from the engraving. The machine cuts any size of paper or card rapidly and smoothly, and is provided with an automatic clamp for holding the paper, which is applicable to all thicknesses without adjustment, and its pressure on the paper may be varied from 50 to 5,000 lbs. The clamp is provided with an indicator that marks the cutting line on the paper. This improvement, it is stated, is possessed exclusively by this machine. The knife has a positive motion and quick return. The table is provided with wooden cutting sticks, and is divided into lines, squares, and inches.

This machine took the first premium at the Centennial Exhibition, and is used by many of the first printers and stationers in this country.



THE DIAMOND PAPER CUTTER.

AMATEUR MECHANICS.—DRILLS AND DRILLING.

An ordinary flat drill for most purposes will answer nearly, if not quite, as well as a twist drill. It is not a difficult matter to make them, since we have such reliable material as Stubs' steel wire of every size. The best form of flat drill for general purposes is shown in Figs. 1, 3, and 4. It is made by milling or filing the opposite sides of the wire, so as to form a bit or blade having a thickness equal to about one fourth of the diameter of the wire. The angle of the point should be 90°, and the angle of its cutting edge about 45°, for most uses. For a drill for very hard substances, these angles may be more obtuse.

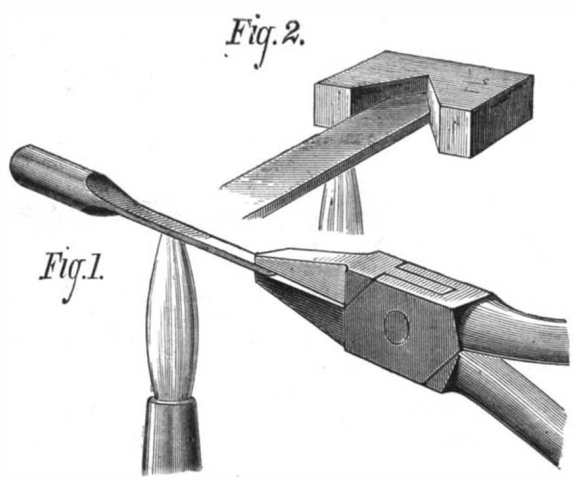
Having formed the drill, it should be hardened by heating it to a low red and plunging it straight down into cool (not cold) water. In case of a very small drill, it may be held in the flame of a gas burner or lamp in a pair of spring nippers over a vessel of water. When it attains the required degree of heat it may be dropped into the water.

To temper for most cases the drill, after being brightened on an emery wheel or piece of emery paper, is heated; if it is a small one, in an alcohol or gas flame, until its color at the point runs down to a brownish yellow verging on a purple. If the drill is very large it may be heated over a forge fire, or over a heavy piece of red-hot iron. If the drill is a very small one, it may be hardened and tempered at one operation by heating to a low red heat and plunging it immediately into a piece of beeswax.

If it is desired to have the point of the drill very hard, without being liable to breakage, its temper may be drawn by holding its point in pliers, as shown in Fig. 1, while the main portion is held over a gas flame. The cool jaws of the pliers prevent the point from becoming heated.

Another method, applicable to larger drills, is to employ a notched block of lead, as shown in Fig. 2. The drill in this case is driven a short distance into the lead before it is hardened; then, as it is tempered, it is replaced in the lead to preserve the hardness of the cutting edges while the temper is drawn in the other portions.

When a drill is hardened by immersing its point in mer-



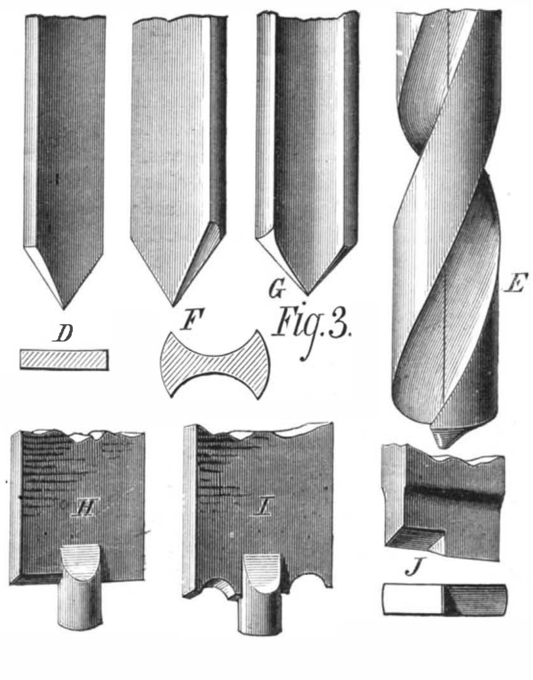
TEMPERING.

cury instead of water, it acquires a diamond-like hardness. The point of the drill just described is shown in perspective and in section at D in Fig. 3. The drill, F, is similar to the drill, D, the point of difference being a half round groove along each face adjacent to the cutting edge. This device gives the cutting edge a more acute angle, which is desirable for some kinds of work. G is a straight drill having concave or fluted sides, and E is the well known twist drill. The drills, G E, are shown in cross section in the central figure. Twist drills of recent manufacture have a central longitudinal line, which locates the point in grinding.

The best rule for grinding twist drills is to preserve, as nearly as possible, the original form. The ordinary pin drill, H, is used for counterboring, a hole being first drilled to receive the pin. The drill, I, is employed to give an ornamental appearance to plates in which pivots or small shafts are journaled, as in clock work. The bottoming drill, J, has three cutting edges, one upon each side, and a central transverse one connecting the other two. This drill, as its name indicates, is designed to make a flat bottom in a drill hole.

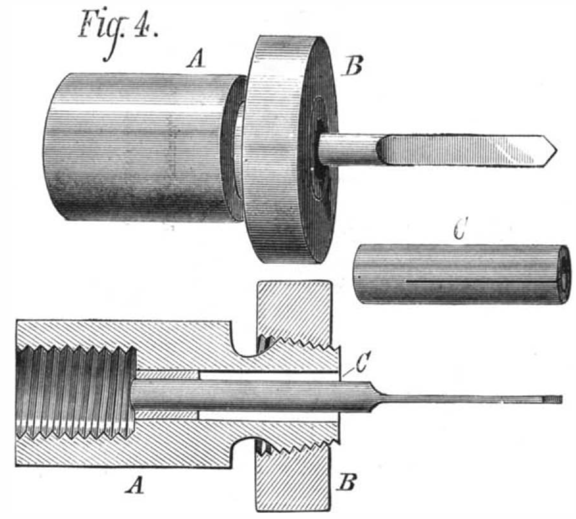
The pin drill, K, which is shown in side and end views in Fig. 6, is first carefully turned and afterward milled with the rose bit, L, producing the cutting points or lips, which are afterward beveled with a file. This drill is used for boring large holes in sheet metal, a small hole being drilled first to receive the pin. M is an expansion drill for the same purpose; its construction will be readily understood from the engraving. The spindle is mortised to receive the tool carrying arm, which is secured in the mortise by a key. The lower end of the spindle is bored to receive the drill, which also forms the pin for guiding the cutter.

While universal chucks are recommended for holding drills, another form of chuck, shown in Fig. 4, may be used with equal advantage. It consists of a main portion, A, which screws on the lathe spindle, and has a tapering



FORMS OF DRILLS.

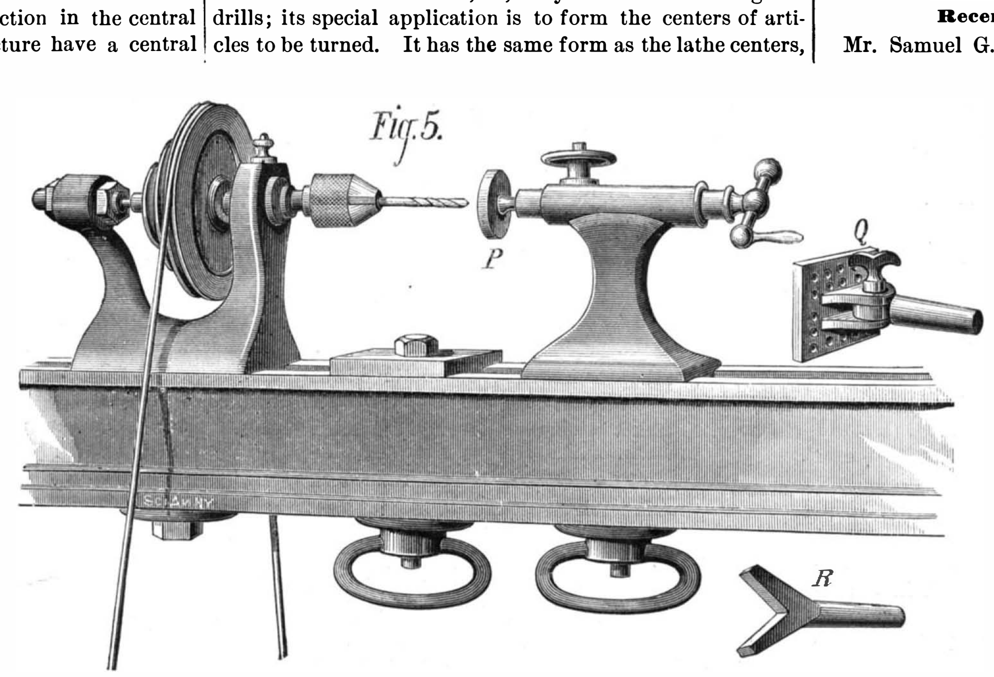
threaded end for receiving the milled nut, B. The threaded end is split to admit of its contraction as the nut, B, is screwed on. The part, A, is bored longitudinally to receive sections, C, of iron or steel rod. To prepare this chuck for



DRILL CHUCK.

holding drills, the pieces, C, are inserted in the chuck, centered with a pointed tool, and are drilled with the drill with which they are intended to be used. They are then split longitudinally with a saw for about three fourths their length. The pieces, C, when once prepared, will always answer for the same sized drill; they may also be used with an ordinary chuck having a set screw.

The fluted countersink, O, may be classed among the drills; its special application is to form the centers of articles to be turned. It has the same form as the lathe centers,



LATHE, WITH WORK SUPPORT.

and makes a truly circular conical hole, providing the number of flutes or cutting edges is odd.

Every lathe should be provided with a plate, or drill rest, P, fitted to the tail spindle, for supporting plain work while drilling it. The lathe should also have a hinged or pivoted rest, Q, which may be clamped at any desired angle for drilling irregular work. This plate should have several perforations for receiving pins, for preventing the work from slipping. For supporting cylindrical objects to be drilled transversely, a fork, R, is inserted in the tail spindle.

As to the matter of drilling, little need be said, as nearly everything must be learned by experience; however, a few points may be mentioned. The work should be carried forward with a regular and not too heavy pressure. The speed of the drill will vary with the material being worked. For steel, wrought iron, and copper, the speed should be slow; for brass and cast iron, it may be quite rapid. In drilling steel or wrought iron, oil is the best lubricant for the drill; in drilling glass, the drill should be wet with turpentine, to which gum camphor has been added; the drill may be used dry in drilling brass and cast iron. M.

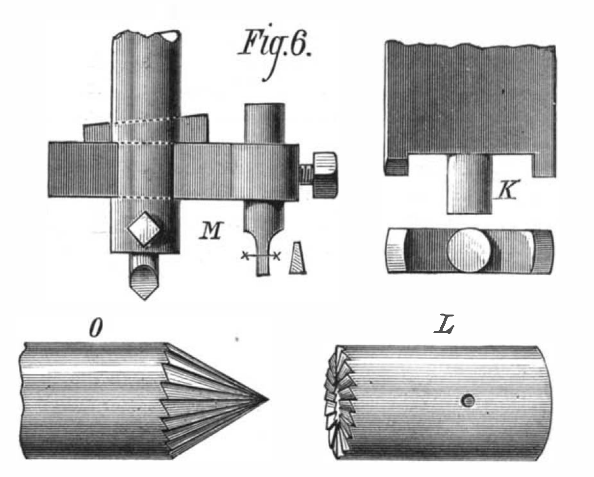
Novelty in Cleaning Iron Scraps.

An English inventor proposes to utilize tin plate and terne plate scrap by employing a centrifugal apparatus, so arranged as to permit of the scrap being readily placed therein and withdrawn therefrom, and of receiving a central fire for heating the scrap. The rotating cylinder or drum of this apparatus is fitted with a cage, which is packed with the scrap intended to be utilized, and in the center of the cylinder and of the inserted cage is a chamber for the fuel.

When the cylinder is charged and the fuel ignited, a rapid rotary motion is applied to the cylinder and its contents, and an indraught of air to the ignited fuel is thus produced and maintained. The heat thereby generated is caused to impinge upon the scrap and raise the temperature of the mass to a sufficient height to fuse the coating metal.

The effect of the centrifugal action is to discharge the fused metal in the form of spray into the casing of the apparatus, and to leave the iron in a clean state.

The cage containing the scrap is then to be removed and replaced by another charged with fresh scrap, and the operation may then be repeated. Instead of using a central fire the heat may be supplied from an adjacent stove. This



DRILLS AND ROSE BIT.

will permit of the temperature being nicely adjusted to suit the work in hand, and thereby prevent the volatilization of the metal, as, for example, when zinc is required to be recovered, or otherwise injuring the substance under treatment. The scrap iron thus cleaned is in a fit state for working up again into plates, or to be used for bottoms for puddling furnaces.

Recent Engineering Inventions.

Mr. Samuel G. Martin, of South Amboy, N. J., has devised an improved Steam Steering Apparatus, in which a steam steering mechanism and the ordinary hand steering mechanism are combined in such a manner as to enable either to be used alone whenever desired, without interfering with the action of the other.

Mr. James Manes, of New Haven, Conn., has patented an improved Process and Apparatus for Manufacturing Sulphuric and other Acids, and for extracting volatile matters from ores and other substances. It consists in a revolving roasting chamber and a partitioned condensing chamber of novel design.

An improved Ore Washer has been patented by Mr. Theophilus T. Allen, of Denver, Col. The object of this invention is to provide a simple and effective gold washer, which will operate automatically and may be easily cleaned. It consists in an arrangement of gratings, sluices, riffles, and spiral jets, the construction and operation of which cannot well be described without an engraving.

Mr. Louis Leypoldt, of New York city, has devised a Railroad Rail composed of outer steel plates, inner iron plates, and central strip of lead, the metallic strips being separated by layers of leather or similar material.

The International Dairy Fair.

Cheese factories and creameries in practical operation constitute a special feature of the Dairy Fair in this city, beginning December 2, and continuing through the week. Three hundred gallons of milk and twenty-five gallons of cream are required for these operations. The entries of butter and cheese, each over 200 lbs. in weight, exceed 1,000, and the single packages will reach 10,000. One exhibit is a cheese weighing 1,500 lbs. A large display of blooded dairy cattle and dairy implements and machinery add to the interest of the fair.

The secretary has given the following statistics with regard to the importance and rapid growth of the butter and cheese trade:

The production of butter and cheese as specialties began in the eastern part of this State scarcely thirty years ago; thence it extended northward and westward, until it has become the leading industry of the State. In Pennsylvania, the best counties are devoted to dairying; the northern part of Ohio makes it a specialty, several counties of Michigan, all of northern Illinois, the best sections of Wisconsin, and portions of Iowa, give almost exclusive attention to making butter and cheese. Colorado has established several cheese factories, and California within ten years has changed from an importing to an exporting State in these articles. Fifteen years ago, Chicago merchants obtained their supplies of cheese from the East; while at the present time one hundred millions of pounds pass through that city for New York annually. Canada within a brief period has become our competitor in the English markets to the extent of 80,000,000 lbs. yearly; while she formerly bought of us. With the exception of the States mentioned and a few counties in Vermont and New Jersey, the remainder of the United States buy more than they produce. The entire South is supplied from this city and the West.

The value of the land and cows in the United States employed in furnishing milk, butter and cheese is not less than $1,300,000,000, or the sum of nearly half the national debt, at its highest point. Over three thousand factories are engaged in the manufacture of these articles and tens of thousands of private dairies besides; more than one quarter of each are in this State. One manufacturer in Western New York State has over forty factories; others in different sections have from five to thirty each. Different firms in this city handle from $2,000,000 to $3,000,000 worth of cheese and butter annually.

The production of cheese is estimated at 350,000,000 lbs. per annum, and of butter about 1,500,000,000 lbs.; of the former 130,000,000 lbs. will be exported this year and about 25,000,000 lbs. of the latter. The value of the two is about $350,000,000, or $50,000,000 more than the wheat crop of the country; three times more than the oats crop; four times more than the potato crop; one seventh more than the hay crop; one third more than the cotton crop, and but one fifth less than the corn crop. The number of cows in the United States is over 13,000,000; which is six times the number in Great Britain, over twice the number in France, two and a half times more than in Prussia, and more than in the countries of England, Ireland, Scotland, Wales, Denmark, Norway, Sweden, Russia, Finland, Austria, Hungary, and Switzerland combined, although these countries together contain four times the population of the United States. The proportion of cows to the inhabitants here is twenty-three to each one hundred persons.

The productions of cheese and butter have increased thirty-three per cent this year, and the exports have been in like proportion.

The cheese and butter exported this year have paid freight to the amount of over $1,000,000 to the ocean commerce of this port, or a sum almost sufficient to support a line of weekly steamers. These articles pay to the railroad companies over $5,000,000 annually for transportation, and the article of milk pays nearly as much more. Loaded on railway cars, ten tons to each car, the butter and cheese produced in this country in one year would fill 22,000 cars, and make a compact line 135 miles long.

Corrections of Errors in Patents.

The following rules have just been promulgated by Gen. Paine, the Commissioner of Patents, which, having received the approval of the Secretary of the Interior, will hereafter govern the action of the Patent Office in such cases as come under their provisions:

Where a mistake incurred through the fault of the Office is clearly disclosed by the records or files of the Office, and does not constitute a legal ground for reissue, a certificate showing the fact and nature of such, signed by the Secretary of the Interior, countersigned by the Commissioner of Patents, and sealed with the seal of the Patent Office, will, at the request of the patentee or his assignee, be indorsed without charge upon the letters patent and recorded in the records of patents.

Where a mistake incurred through the fault of the Office constitutes a sufficient legal ground for reissue, such reissue will be made by the correction of such mistakes only, without charge of office fees, at the request of the patentee.

Mistakes not incurred through the fault of the Office, and not affording legal grounds for reissues, will not be corrected after the delivery of the letters patent to the patentee or his agent.

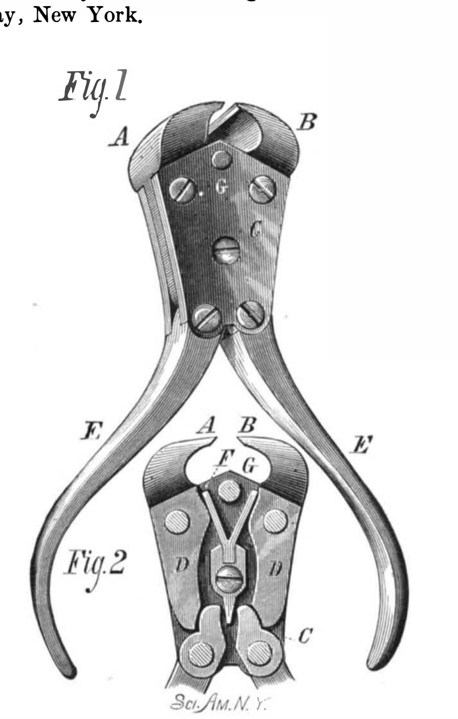
No changes or corrections will be made after their delivery to the patentee or the agent, except as above provided.

THE FAIRBANKS PRIZES.

Messrs. Fairbanks & Co., the scale makers, are used to winning prizes; yet their experience at the Paris Exhibition must have been a surprise even to them. Seven medals, in as many different classes, constitute a victory as unique as it was honorable. Their honors embrace three gold medals, two of silver, and two of bronze. One gold medal was received for their general exhibit; their scales received one gold, two silver, and one bronze medal; the improved type writer won a gold medal; and the oscillating pumps, for which the company are world agents, received a bronze medal. It is through the skill and integrity of houses like Fairbanks & Co., that the high rank of American manufactures has been achieved; for such products not only compel admiration abroad but rivalry at home. Every article of sterling merit, like the Fairbanks scales, raises a standard in its department of manufacture which all other makers must strive to equal or their success is impossible. The whole country is benefited, both directly and indirectly, by such victories in industrial competition.

NEW CUTTING NIPPERS.

Cutting wire by means of the ordinary cutting pliers is an operation often requiring the entire strength of both hands, making it a difficult matter under some circumstances to use a tool of this description. Any one who has used cutting nippers has seen the necessity of an easier means of doing this kind of work. The accompanying engraving represents a new form of cutting nippers which seem to fulfill the requirements. It was recently patented in this country and in Europe by Mr. Thomas G. Hall, of New York city, and is manufactured by the Interchangeable Tool Company, 71 Broadway, New York.



HALL'S CUTTING NIPPERS.

In the engraving Fig. 1 is a perspective view, and Fig. 2 has the side removed to show the internal arrangement. The jaws, A B, having cutting edges of the usual form, are pivoted between plates, C, and their arms, D, are engaged by the shorter arms of the handle levers, E; these levers being also pivoted between the plates, C.

A spring, F, engages the two cutting jaws and throws them apart. The screws, which serve as pivots for the jaws and handles, also serve to hold the plates, C, together. A pin, G, acts as a stop on the jaws. By means of the double leverage obtained by this construction, wire cutting is made a very easy operation.

In addition to the great power attained, it possesses the further advantage of not becoming entirely useless from the fracture of jaw or handle. In this nipper a broken jaw or handle can be easily replaced, as all of the parts are perfectly interchangeable, and a new piece may be obtained from the manufacturers at the cost of a few cents. This advantage will be apparent, as all users of such tools well know that other nippers broken in the handle or jaw are useless, and must be replaced by a new tool.

REMEMBER that the information contained in the SCIENTIFIC AMERICAN, on mechanical subjects, new inventions and discoveries, cannot be obtained through any other source.

ANOTHER TRADE MARK DECISION.

The first trade mark case under the recent treaty between the governments of Great Britain and the United States was decided at the Patent Office, December 2.

English trade marks have been registered at Washington for many years under a section of the Revised Statutes, authorizing reciprocal privileges to citizens of countries wherein American citizens were granted the right of registration.

In 1876, Secretary Chandler, at the suggestion of Commissioner Duell, and with the advice of the head of the Department of State, decided that the treaty of 1794 between the United States and Great Britain, under the provisions of which the American patent officials had been registering British trade marks, did not warrant such registry, even before its abrogation, which took place long ago, and that no further privileges of that character could be granted British subjects until a treaty was entered into authorizing it. Thus for more than two years these privileges have been withheld, or, if not, they were granted in violation of the ruling of the head of the department.

Meantime a convention was entered into to meet the exigency, and the resulting treaty, which was framed by Minister Pierrepont and Lord Derby, was promulgated by the President last July. A question immediately arose as to the validity of the British trade symbols registered previous to Mr. Chandler's decision, and that question has remained undecided to this time, when a registration of the mark of George Westenholm & Son, the well known Sheffield cutlery firm, was allowed, thereby recognizing the former insufficiency of all others of its class. The Patent Office officials have determined to make the best of a bad job by registering all such marks without further fees under the heading of office errors.

This decision is thought to affect the interests of some three hundred British subjects whose goods are sold in our markets, though no large interests will be sacrificed if the parties concerned take proper steps to protect themselves.

A Warning to Amateur Chemists.

A recent fatal explosion of an oxygen retort in London calls out the fact that two other accidents of the same nature have occurred within a few years. In both these cases binoxide of manganese was used as the source of the gas, and it was afterwards discovered that the oxide was adulterated, in one instance with soot, in the other with antimony sulphide, making mixtures as dangerous as gunpowder under the conditions required in the manufacture of oxygen. As this compound of manganese is very frequently used in the production of oxygen for experimental purposes, in the class room and elsewhere, it should always be tested beforehand for such adulterations.

Correspondence.

C. E. Andrews & Co.'s Baking Powders.

To the Editors of the Scientific American:

In your issue of the 16th ult., was a communication by Henry A. Mott, Jr., in which our name is used in a manner calculated to mislead the public, by saying that *the* baking powder manufactured by C. E. Andrews & Co., of Milwaukee, Wis., contained ingredients unhealthy and injurious. If the analysis given meant our oldest baking powder, known under the brand of Pearl, and that *it* contained no cream tartar, we now propose: If any chemist in New York, or elsewhere, will select with *us*, wherever sold, a number of one-pound, full-weight cans of *our* Pearl Baking Powder, that we may be confident that the labels have not been broken and the powder tampered with, then we will select a chemist, and the two to select a third, and then upon analysis, if they declare that the analysis then given corresponds with that given in your issue of the 16th ult., under the ambiguous title of "The Baking Powder," and that the Pearl does not contain cream tartar, that biscuits made from it would be injurious, then we are ready to pay upon demand any amount previously agreed upon.

If the result of the analysis made by the chemists so chosen does *not* correspond to the analysis given of "*The* Baking Powder" in yours of the 16th ult., but that the principal ingredient in our Pearl is cream tartar, then the opposite party is to pay us the amount previously agreed upon.

We DO make and sell a baking powder containing exsiccated alum, and if that is *the* baking powder meant in yours of the 16th ult., why was not the name "Regal," which is the only printing matter on the front part of the label, given, as the names of the other powders alleged to have been analyzed were stated? Our alum baking powder we take as much interest in, as in our oldest, the Pearl. When sold it was always stated to be an alum powder, and no misrepresentations made. WE were satisfied that biscuits made from it were in no way injurious. We shall continue to sell it, with the name of the powder, Regal, and our firm name upon the labels, especially after the clear, concise, and intelligent exposition of the harmless effect of exsiccated alum in baking powders, given by Mr. Henry Pemberton, Jr., in your issue of December 7th, and corroborated in same issue by the opinion of such an eminent chemist as R. Ogden Doremus, M. D., LL.D., Bellevue Hospital Medical College, New York.

We take the liberty to quote you, Messrs. Editors, from your issue of December 7th: "Finding alum in the baking powders named, Dr. Mott leads the reader to infer that there must be alum in the biscuits made therewith. This inference, as Mr. Pemberton shows beyond a doubt, is altogether wrong; the chemical process of baking causing the total disappearance of the alum as such, the resulting compounds being either wholesome or inert. . . . . . The whole matter, indeed, seems on examination to resolve itself into a rivalry between different *methods* of producing baking powders; and in lauding one form at the expense of another equally wholesome."

In conclusion, if Henry A. Mott, Jr., is actuated solely for the public good, and is republican in his wishes, and not ROYAL in his proclivities, he will admit the truth of your editorial from which we have quoted.

Respectfully,
C. E. ANDREWS & Co.,
Manufacturers of Pure Spices, Pearl and Regal Baking Powders, Milwaukee, Wisconsin.

PERSONS living in cities and large towns can obtain the SCIENTIFIC AMERICAN at the counter of any enterprising newsdealer in their place. It is commendable to patronize your local news agents by subscribing through them.

THE PURITY OF REFINED SUGAR.

BY HENRY A. MOTT, JR., PH.D., E.M.

Having had occasion during the past five years to constantly examine the refined sugars of the market, I can say that in the whole course of my experience I have never examined a sample of sugar to which any intentional foreign substance had been added It is true that in some refined sugars a trace of tin has been detected by acute chemical tests, but the amount present was so infinitesimal that no harm could accrue from the use of such sugars. Professor Chandler, speaking on this point, says, "The quantities of tin employed are too small to give any cause for alarm." The fact that some sugars when used in tea produce a dark color has led some people to believe that the change in the color of the tea was due to some substance used to adulterate the sugar, which, however, is not the case. In preparing the raw sugars from the cane juice it sometimes happens that the juice being acid (not being thoroughly neutralized) takes up a small percentage of iron from the evaporating pans, and strange as it may seem, this small per cent or trace of iron follows the sugar all through the refining process; and it is this small trace of iron which, when brought in contact with the tannin in tea, produces a dark color, which is objectionable for green teas, but in no way injurious; this, however, is only present by the merest chance, not once in a thousand times.

With respect to the addition of glucose to refined sugar—as considerable has been written on this subject—I think it well to say a few words. With the exception of cut-loaf, granulated, and extra powdered sugar all refined sugar contains a small percentage of a sugar known as inverted sugar. This inverted sugar has been falsely represented to be glucose. The truth of the matter is that very few persons appreciate what the word glucose is understood to represent in commerce, hence arises the misstatements regarding it. The word glucose applies to the sugar in commerce known as common starch sugar. In chemistry it still has another name, dextrose. The cause of the importation and increased home production of glucose arises from the fact that most of the lager beer brewers in the country and the manufacturers of other malt liquors are using a large percentage of glucose as a substitute for malt. Glucose also has a large use in the manufacture of candy and honey.

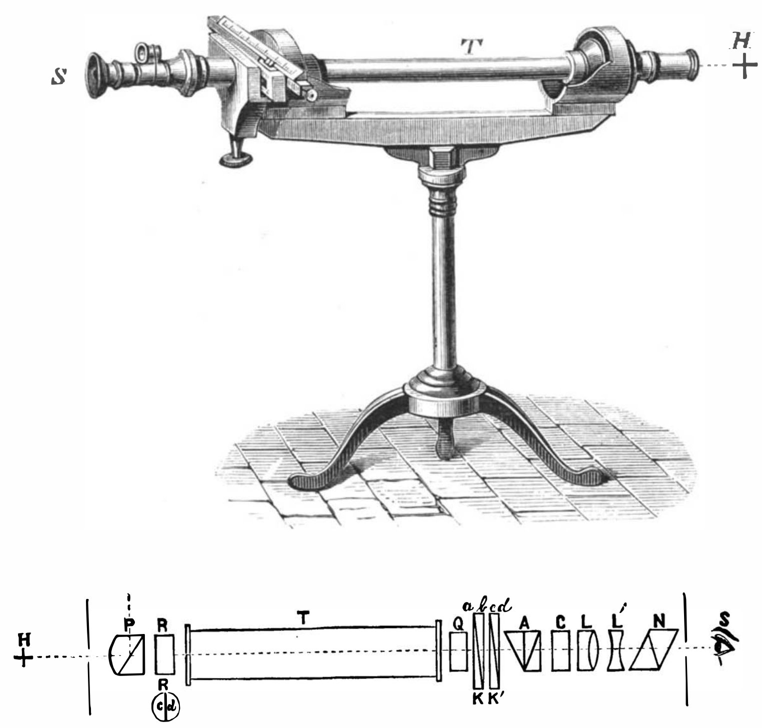
I think the following explanation will clearly demonstrate the impractibility of adding glucose (starch sugar) to cane sugar and still have the latter sugar test less than 100 per cent. Several instruments known as saccharometers are used for determining the per cent of sugar in a given sample. The annexed engraving represents the one known as the Duboscq Saccharometer.

For this instrument it is necessary to weigh 16·035 grammes of the sugar to be tested, to dissolve the same in 100 cubic centimeters of water, decolorizing if necessary, and examine a portion of the solution in the instrument.

With pure granulated cane sugar, taking 16·035 grammes, 100 per cent will be indicated. With pure dry powdered glucose, 194 per cent will be indicated—for convenience, we will say 200 per cent. Therefore one grain of glucose affects light as powerfully as two grains of cane sugar. Now let us apply this fact to an analysis. Given a sugar which has the following composition Cane sugar, 90 per cent; water, 3 per cent; gums, inverted sugar, and mineral matter, 7 per cent; total, 100 per cent.

If the 7 per cent of the above sugar were glucose (which it is not) then, the per cent of cane sugar is too high. For 7 per cent of glucose is equal to about 14 per cent of cane sugar in its effect on light, as shown above. Therefore from 90 per cent we must subtract 14 per cent, leaving only (90 — 14) 76 per cent as the amount of cane sugar present in the sample. This is known to be false, as 90 per cent of sugar can be obtained from a sugar testing 90 per cent. Therefore 7 per cent of glucose cannot be present in the sugar. If, in another case, 7 per cent of glucose were added to the above sample of cane sugar, it would test over 100; but no such reports have been made even from the Custom House chemist; therefore to say that any profitable amount of glucose has been added to any of the samples, the analysis of which has been published as testing under 100 per cent, is simply nonsense. The question may be asked, What is inverted sugar? The answer is simple. If cane sugar be heated in any part of the operation of its production or refining process for a considerable length of time, or in a slightly acid solution, some of the sugar will be converted into inverted sugar; this sugar is present in the unripe cane, which in the ripe cane is transformed into cane sugar, and then in the decay of the sugar cane appears again, as also in the renewed growth of the cane. Inverted sugar is largely present in molasses; not crystallizing itself, it prevents the cane sugar from crystallizing also. Inverted sugar is a compound made up of dextroglucose and lævulose. Dextro-glucose is the same sugar chemically as dextrose, and effects the light to the right the same as cane sugar. Lævulose is a left handed sugar and effects the light in the opposite direction. The mixture of these two sugars, known as inverted sugar, is also left handed from the fact that the per cent of lævulose which enters its composition is more than sufficient to neutralize the effect of the dextro-glucose on light.

If the 7 per cent in the above analysis were all inverted sugar, then the 90 per cent of cane sugar would be too small, for the 7 per cent would prevent some of the cane sugar manifesting itself to the right, or, in other words, some of the cane sugar would be neutralized; the test of the instrument would in such a case fluctuate with the quantity of inverted sugar present. It may be well to state that inverted sugar does not act as powerfully to the left by two thirds as cane sugar does to the right, therefore the effect would be considerably less. The 7 per cent in the above analysis, as stated, is composed of gums, inverted sugar, and mineral constituents (present in most all foods). The gums act on light, some to the right and some to the left, but sufficiently to the right to neutralize those to the left, as also to neutralize the inverted sugar. Therefore the test of the instrument for cane sugar is correct. From the above it will be clearly seen that if glucose (starch sugar), which acts to the right, were added to cane sugar alone, the sample would in every case test over 100 per cent, but as no such sample has as yet been reported, we must deny that glucose is used to adulterate sugar. Inverted sugar (which, I have stated, contains dextrose), cannot be added as the crystallization of the cane sugar would be prevented. Let us look for a minute at raw sugars, analyses of which I have made by the thousands, and of which I can state (with the exception of sand) I have never met with any adulterated samples. The impurities present in raw sugar, which it is the duty of the refiner to remove, are treacle, caramel, fragments of sugar cane, spores of a fungus, live animalcula or acari, and albuminous matter, which decomposes and promotes fermentation. It is for these impurities that raw sugars are unfit to use before being refined. The acarus sacchari can be seen by the eye, being itself of sufficient dimensions, and when taken into the system produces a series of disturbances. From the following analysis of raw sugar it will be seen that it contains inverted sugar, which some ignorant writers have tried to pass off as glucose (starch sugar). If raw sugar contains inverted sugar, we certainly would expect in the low grade refined sugars to find it present also, which is the case; thus demonstrating that inverted sugar is naturally present in refined (soft) sugars, and not that it is added.



DUBOSCQ'S SACCHAROMETER.

ANALYSIS OF A RAW SUGAR.

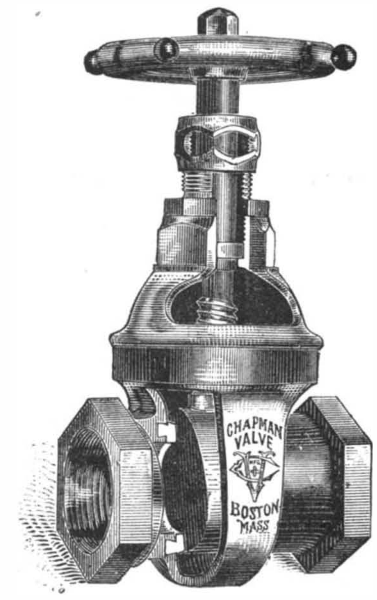
Cane sugar	82·50 per cent.
Water	6·20 " "
Inverted sugar	6·30 " "
Extractive matter, gums, etc.	3.52 " "
Mineral matter	1·48 " "
	100·00 per cent.

There is another point connected with the analyses of refined sugar which have been published, which is very apt to mislead the public, and that is to use the word impurities for all that is neither water nor cane sugar. To a scientific man this word explains itself, but to the public it means everything impure and injurious, such as arsenic, antimony, tin, etc., while it really means inverted sugar, gums, and mineral matter. Until, then, a refined sugar is found that tests over 100 per cent and contains a large amount of tin, the public may indulge in this important article of food with perfect safety.

POUGHKEEPSIE, N. Y., according to the Chicago *Railway Review*, is to have no more locomotive whistling. A bell, worked by electricity, is set up at the depot, and when the trains come within a mile of the station, it will ring until they arrive. The danger signal is thus given, and the waste of steam is avoided, to say nothing of the racket. Any engineer who whistles hereafter when in Poughkeepsie loses his situation on the Hudson River Railroad.

CHAPMAN'S VALVES AND HYDRANTS.

At the recent Massachusetts Mechanics' Exposition in Boston, the Chapman Valve Manufacturing Company had a fine exhibit of their valves and hydrants, to which allusion was made in our notices of the exhibition. The highest award given in their class (a silver medal and diploma) has been awarded this exhibit, coupled with a report from the Board of Managers indorsing the claims made by this company for superiority of their manufactures.



The company construct fire hydrants and direct passage valves of all sizes from one half inch to thirty inches in diameter, for all the various uses to which valves are applied. They are constructed on principles that differ from other valves and hydrants.

The accompanying cut is a sectional representation of one of their steam valves. To all who have been troubled with leaky valves a brief description showing the advantages claimed for the Chapman valves may be interesting. The introduction of a ring or packing of Babbitt metal, or other similar alloy, around the inlet and outlet openings of the valve, forms a seat for the gate when the valve is closed that insures tightness between them. This material will outwear any other known substance used for seats of valves, and will resist the cutting action of steam. Hot or cold water has no injurious action upon it; for gas and ammonia it possesses qualities not found in any metal; while for acids, various alloys may be used adapted to the different kinds of acids that are to pass through the valves. Thus each class of valve has for its seat an alloy which has been found by experience best fitted for the service the valve is to perform. It is stated that all of the seats are non-corrosive, and that as the alloy forming the seats is dissimilar from the metal forming the gate, no cohesion can take place. The alloy is cast into dovetailed recesses in the body of the valve when the gate is in position, and forms a perfect joint with the face of the gate. The body of the valve and seats are made tapering to conform to the taper of the gate. In case of wear or accident to the seats, they may be refaced, a recess being left in the bottom of the valve for the tapering gate to conform to its new seat. In case of destruction of the seats, they may be recast into the valve with slight trouble and expense. The use of alloys of metal for valve seats is secured to this company by letters patent. The gate is made in one piece in the form of a hollow tapering plug, guided upon its sides to prevent it from coming in contact with its seats until the passage is closed, thus avoiding wear of both seats and plug. It is probably well known that the form of gate in direct passage valves in general use is two disks, hanging loosely upon the spindle, variously joined at their backs, and having some expanding form to force the disks in closing to their bearings, when opposite their seats. These valves are called adjustable disk valves, and are fitted with seats of hard metal. The early make of gate valves were constructed with a plug gate, but owing to the cohesion which took place between the gate and its seats of hard metal, it was found impossible to operate them with satisfaction, hence the invention and introduction of adjustable disk valves. The advantages of a plug gate over disks is, that there are no parts, joints, or wedges to get out of order, and that the action of the plug gate in closing is positive in a vertical line, and not by expanding to the seats. It has been reserved for this company to combine the advantages of a plug gate with seats to which the gate would not cohere under any circumstances, irrespective of the length of time they may remain in contact. All valves are tested by hydraulic pressure far above what they will be required to withstand. Special valves of large size are made for oil pipe lines that are tested to a pressure of 2,000 lbs. per square inch. The largest valves open and close easily, the seats and all the working parts being fitted to insure ease of operation.

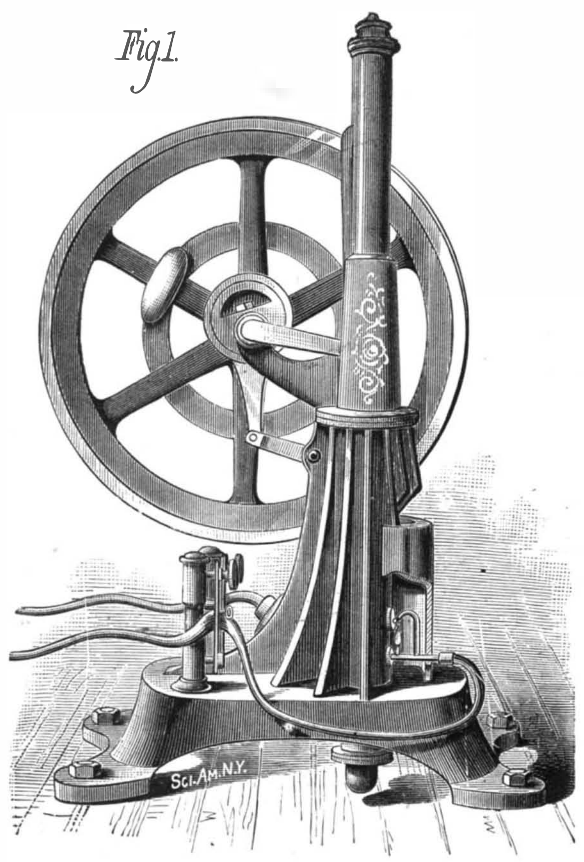
The fire hydrants manufactured by this company are known as gate hydrants, having a gate valve at their base which opens and closes vertically, gradually cutting off the flow of water and preventing any water hammer or strain upon the pipes and joints in closing. The gate valve is constructed on the same principle as the water gates, and possesses all the merits claimed for them.

Further information may be obtained from the Chapman Valve Manufacturing Co., 77 Kilby street, Boston, Mass.

A NEW GAS ENGINE.

A workman who has a lathe or two to keep going in his own house, or any other such small machines, commonly worked by hand or foot power, requires often enough not a tenth of a horse power to keep his work going, while the price of a suitable motor quite puts it beyond his reach. Bisschof's engines, one of which we illustrate in Figs. 1 and 2, have been designed to meet these wants both as to size and price. Quite a number of them were shown at the Paris Exhibition, not only those specially exhibited by the makers, Messrs. Mignon & Rouart, of Paris, but also others actually at work in different parts of the building, placed there in connection with the small machines which they were driving. It is intended for working at the rate of "one man power," or about 1-12·5 of a horse power, and its price is about $110. A larger size, "four man power," about one third of a horse power, is also made, at a price of about $190.

Fig 1.



BISSCHOF'S GAS ENGINE.

The construction of the machine, as shown in our engravings, is exceedingly simple. It has only two principal castings—a base plate, with which the vertical cylinder is cast, as well as the valve chamber—and the cylinder cover and stuffing box, prolonged above to form a guide for the piston rod head, and having the bearing bracket for the shaft cast along with it. The space above the piston communicates freely with the air by the rectangular opening in the sides of the cylinder near the top. The bottom of the cylinder has a single port communicating with the chamber of a plain piston valve, the only valve used, which when raised opens communication with the exhaust, and when down (as in position shown in Fig. 2), puts the cylinder in connection with the gas and air inlet openings. This valve is worked by an ordinary eccentric through the intervention of a rocking lever. The eccentric is placed about 135° in advance of the crank. About a third of the stroke up the cylinder there is a little opening on one side of the latter, opposite which, outside, is the nozzle of a small gas pipe;, and directly below this nozzle there is an ordinary burner, connected with the same pipe, the gas at which is kept always lighted. The arrangement is seen best in Fig. 1, from which also it will be seen that the two burners are protected from draughts by inclosure in a box casing. The upper burner is the real ignition jet; the function of the lower one, which is burning continuously, is simply to relight the other when it is blown out. The gas supply pipe is on the side next the fly wheel, and on the other side is the pipe of the ignition jet just mentioned. The crank shaft lies across the machine, a considerable distance from its axis, the apparent irregularity of action of this arrangement being ingeniously taken advantage of, as will be seen.

The action of the machine is as follows: The piston being at the bottom of its stroke is at first raised by the energy stored in the fly wheel and counterweight, and draws into the cylinder the mixture of air and gas through the valve. As soon as the bottom of the piston rises above the opening in the cylinder side above mentioned, the jet outside explodes the mixture, and the explosion drives the piston to the top of its stroke. In the expansion thus brought about the pressure under the piston falls below that of the atmosphere, so that in its descending course the piston is at first driven downwards by the atmosphere acting upon it. This helps to make the machine work more uniformly, although, of course, it is in reality only a single acting. The position of the connecting rod is so adjusted that it has a very direct pull on the crank just when this is most wanted, during the time when the explosion drives the piston upwards. Its oblique position comes only when the piston is descending, and for the most part when the connecting rod is doing no work, being simply carried down by the fly wheel. So far, therefore, as oblique pressures are concerned, the skew action of the connecting rod and its extreme shortness do not do any harm, while the arrangement adopted reduces the space occupied by the engine to very small dimensions.

Each of the two India rubber gas pipes is carried through a spring closer, as shown in Fig. 1. This consists simply of an upright bracket, having a thin flat spring carried up beside it, adjustable at the top by a milled finger nut. The pipe is held between the spring and the standard, and can be closed at will by turning the nut, which gives a very fine adjustment for regulating the quantity of gas passing. An eye is attached to the center of the spring for the purpose of carrying away a cord from it, so that the workman can adjust the gas supply without leaving any machine at which he is occupied.

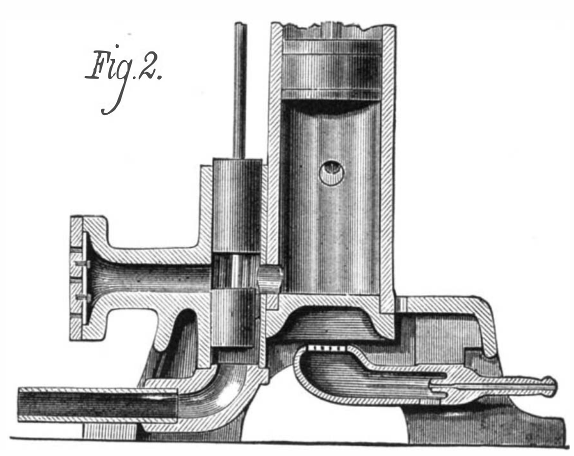
This machine works without grease or other lubricant on either valve or piston; it requires no water for cooling. The heat from the cylinder is got rid of sufficiently quickly by radiation, a number of radial ribs being cast from the cylinder to increase its surface for this purpose, with results, we understand, quite satisfactory. We are informed that on one occasion one of these engines ran 47 days and nights without stoppage and without attention, certainly no small feat for such a machine, and one which seems to bear out the points in its working just mentioned.

The little apparatus shown below the cylinder in Fig. 2 is a burner for heating it before starting. The India rubber pipe for the ignition jet is slipped over the nozzle shown to the right of the figure, and about eight minutes' burning is sufficient to heat the engine, if it has been previously quite cold, as much as is required. If the machine has been working, but has been standing for more than about twenty minutes, it is also advisable to apply the heater; in this case a couple of minutes suffice.

When working at its nominal power the engine should run from 100 to 120 revolutions a minute; for a much less power, say $\frac{1}{25}$ horse power, at from 60 to 70 turns; $\frac{1}{8}$ to $\frac{1}{10}$ horse power, at 130 to 145 turns per minute. To get the machine to work steadily at very small powers, it is necessary to carry a weighted cord round the fly wheel to act as a brake and increase the resistance.

The machine illustrated is said to use 11·6 cubic feet of gas per hour when doing work at the rate of one man power. This is equivalent to about 145 cubic feet per horse power per hour. This is of course a vastly higher consumption than that of some of the other forms of gas engine, as is inevitable from the less perfect design of the machine, but still it only amounts to a cost of about 3 cents an hour for gas, at the rate of $2.50 per 1,000 cubic feet. We are very glad to be able to illustrate such a machine as M. de Bisschof's, which, however rough its construction may be, meets with reasonable efficiency the great want of a prime motor at once cheap in first cost, suitable for use in common houses, and capable of working at very small powers with something like a correspondingly small expense, and free from all risk of explosion.

Fig 2.



BISSCHOF'S GAS ENGINE.

Useful if not New.

The following simple rules for preserving health and promoting personal comfort, if not new to some of our readers, are none the less important to every one.

The object of brushing the teeth is to remove the destructive particles of food which by their decomposition generate decay. To neutralize the acid resulting from this chemical change is the object of dentifrice. A stiff brush should be used after every meal, and a thread of silk floss or India rubber passed through between the teeth to remove particles of food. Rinsing the month in lime water neutralizes the acid.

Living and sleeping in a room in which the sun never enters is a slow form of suicide. A sun bath is the most refreshing and life giving bath that can possibly be taken.

Always keep the feet warm, and thus avoid colds. To this end, never sit in damp shoes or wear foot coverings fitting and pressing closely.

The best time to eat fruit is half an hour before breakfast.

A full bath should not be taken less than three hours after a meal. Never drink cold water before bathing. Do not take a cold bath when tired.

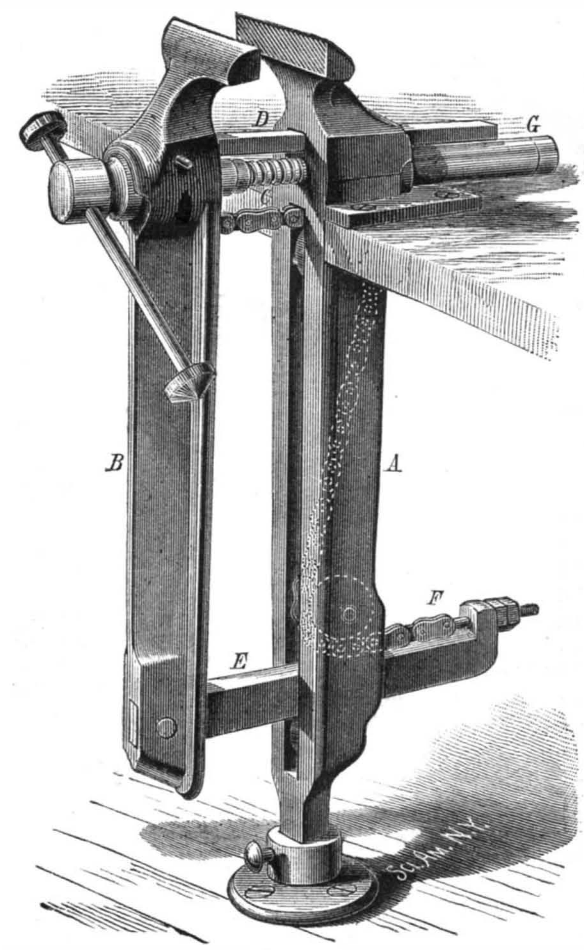
Keep a box of powdered starch on the washstand; and after washing, rub a pinch over the hands. It will prevent chapping.

If feeling cold before going to bed, exercise; do not roast over a fire.

A NEW PARALLEL VISE.

No tool in the shop receives the hard usage that naturally comes on the vise, and no tool is of greater utility, and yet, strangely enough, it is rarely that a vise can be found that is in really good order. This is partly due to faulty design, partly to poor materials and workmanship, and partly to the user.

The accompanying engraving represents a vise having



SOLOMON'S PARALLEL VISE.

many good qualities, and which received at the last Exhibition of the American Institute a medal of superiority.

This vise was recently patented by Mr. J. K. B. Solomon, and is manufactured by Messrs. Taylor & Corser, of Riegelsville, Warren Co., N. J.

The jaws, A B, which are of the long pattern, are drawn together by the screw, C, and guided by the bars, D E, which are fixed in the jaw, B, and pass through mortises in the jaw, A. A chain, F, is attached to the jaw, B, just below the screw, and passes over a pulley in the upper part of a slot in the jaw, A, and under a pulley in the lower end of the same slot, and is provided with a threaded rod which passes through an ear formed on the end of the bar, E. By means of this rod the chain is adjusted. The lower bar, E, rests upon a roller journaled in the lower end of the slot in jaw, A. The box, G, which contains an internal thread for receiving the screw, C, has a flange which drops into a socket in the back of the jaw, A, and is prevented from turning by the bar, D.

It is obvious that when the jaws are opened the chain, E, will cause the lower end of the jaw, B, to move as rapidly as its upper end. It is claimed by the manufacturers that this construction not only secures the parallelism of jaws, but it also renders them very effective.

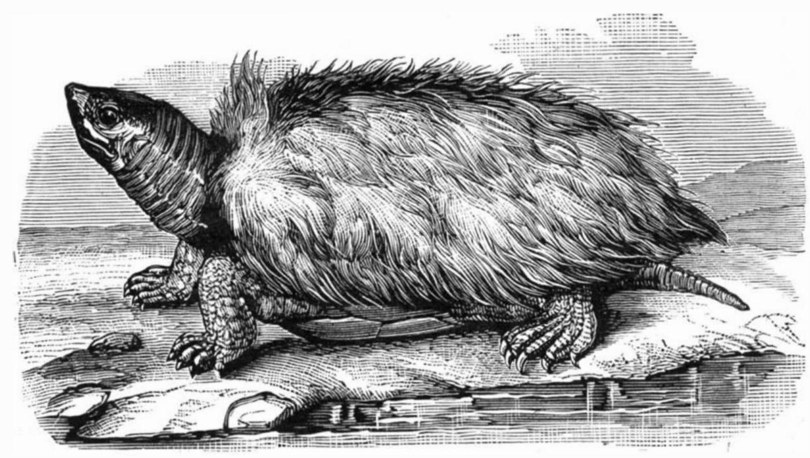
A HAIRY WATER TORTOISE FROM CHINA.

Through the kindness of Mr. White, son of the late Lord Mayor, I am enabled to give a representation of a most interesting little creature which he himself brought from China. It is a terrapin or water tortoise, which apparently has hairs growing out from its back. When it first arrived it seemed very unwell, and I do not wonder, for the poor little thing had not had anything to eat for some months. Knowing it was very intolerant of cold, I placed it in warm water, and kept it in a warm place, and the little thing shortly, to my delight, began to feed from my hand. It will snap at and devour little bits of meat, fish, shrimps, etc. As the little animal swims, the fiber of the vegetable growth hangs away from him so as to give him the appearance of an animated bunch of weeds. His face is very intelligent.

I do not know whether the growth upon this terrapin's back has been produced artificially or naturally. It is simply a water grass, something like the weedy material growing on decaying woodwork and lock gates of rivers. It is possible that the ingenious Chinese may have some way of doctoring up the living specimens of terrapins, of which I understand considerable numbers exist in the ditches and marshes of China. These Chinese, as we are all aware, are stated to have the art of making the large fresh water pearl-bearing muscles secrete pearls, and cover over metal images placed within the shells for that purpose. If they can do this with the pearl shell, I do not see that it is impossible for them to make this vegetable material grow upon the back of a tortoise.

The tortoise being a sacred emblem in China the Chinese make pets of the hairy tortoise, which they keep in basins of water during the summer months, and bury in sand during winter. A small lake in the province of Kiang-su is famous for these so-called hairy tortoises, and many persons earn a livelihood by the sale of these curious little pets, which are about two inches long.

I have been to the British Museum to see if I could find anything like this hairy terrapin, but could not do so. I shall take the liberty of forwarding this article to His Excellency the Chinese Ambassador, who, I have no doubt, with his usual kindness, will obtain some further information about this great curiosity.—*Frank Buckland, in Land and Water.*



THE HAIRY WATER TORTOISE.

THE PADDLE FISH OF THE MISSISSIPPI.

BY DANIEL C. BEARD.

Love for natural history has often led me to consult books upon that subject in search of descriptions and illustrations of creatures captured in my wanderings. I have been struck, as no doubt have many others, by the absence of any illustration and the very meager descriptions given of many of our most curious native specimens. Especially is this noticeable among the fish and reptiles. Indeed I have often had considerable difficulty in finding the proper names for creatures quite common in some sections of our country. This fact, in addition to a natural love for and interest in this subject, has induced me to make careful drawings of many of our native fish.

In the turbid waters of the great Mississippi and its tributaries, swim curiosities and monsters entirely unknown in the Eastern States, and, to judge from the short and unsatisfactory descriptions given, but little known to our scientists.

Down in the southern Mississippi and its sluggish bayous lurks a strange and uncouth fish, known to the natives as the alligator gar. This ferocious creature often attains the length of five and six feet, his mouth is large, broad, and armed with sharp teeth, and his body is covered with an almost impervious armor.

Wallowing in the mud of the bottom, like some species of marine swine, are enormous cat fish, "mud cats," frequently weighing 100 lbs. Huge slimy animals, their large gaping mouths, small eyes, yellow and blotched sides, so fat and flabby, all go to make rather a disgusting creature, and yet with all their unattractive exteriors they are valued by many as a toothsome article of food, and by the negroes are considered a special delicacy. But by far the most comical and the oddest individual is the one of which I have given you a picture.

"Shovel nose," "paddle fish," and "spoon bill" are a few of his aliases when at home where he lives, but among the initiated he is known as the *Spatularia folium.* He is found, as far as I know, only in the Mississippi and its inflowing southern streams. I have never heard of any specimens being captured excepting in nets. The bony structure of the mouth would render it rather difficult to catch this fish with any ordinary hook. According to my personal observation the maximum length of the paddle fish is from three to four feet; no doubt some grow to a much greater size.

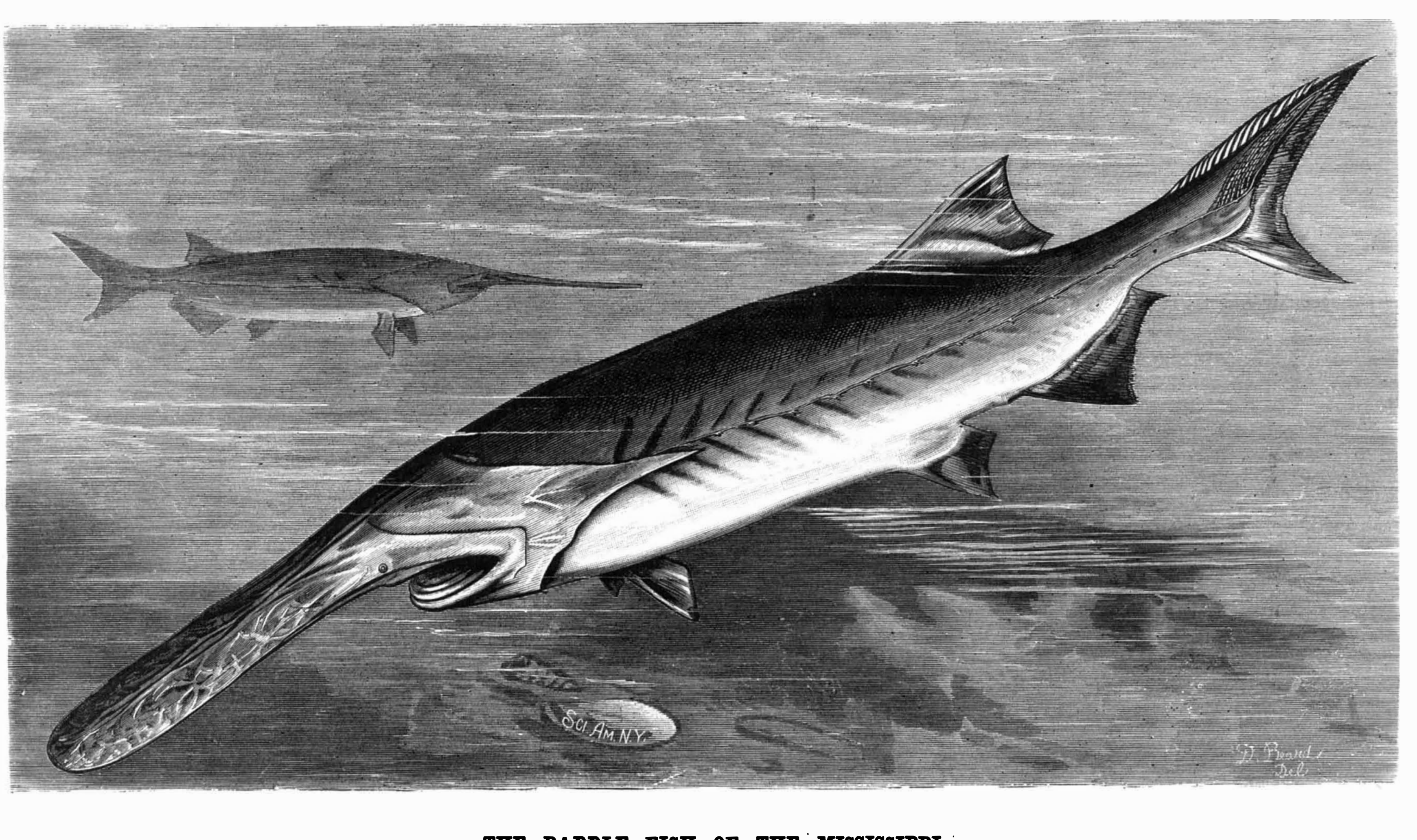
To my knowledge they are not eaten except by the darkies. The location of the fins, the shape and construction of the tail, and omitting the long exaggerated snout, the general appearance is that of the sturgeon. Inhabiting the streams with soft yielding bottoms nature has bestowed upon this ganoid an instrument well adapted for digging in search of food, for such, I am informed, is its habit.

This illustration is from a specimen secured at St. Louis, Mo. It measures from tip of tail to tip of nose three feet and four and four fifths inches; length of nose, or paddles, from tip to point between the eyes, eleven and one quarter inches—a little over one third the length of the fish. Color, silvery white upon the belly, darkening gradually to the lateral line, above this to a bluish tint, deepening into a blackish blue on the back; no scales; skin is the same texture and appearance as the blue catfish. Eyes small, and on the under sides of the head, one quarter inch in front of the lower lip, one eighth inch in diameter; two pairs of nostrils, one quarter inch in front of the eyes, and one pair of apparent nostrils just over the back of the mouth. Lateral line has the appearance of a vein with small branches running about one sixteenth of an inch and disappearing in the skin. The paddle is composed of a light porous bony substance, knit together by a network of bony stars of from six to eight rays each, that become elongated towards the center of the paddle, forming a ridge, which runs to a point where the gill covers join with the top of the head. Gill covers fleshy; operculum and suboperculum marked by fan-like rays. The length of gill covers, left side from extreme point to where it joined the top of the head, eight inches; while the same on the right side measured but four and a half inches. The lower jaw commences at a point immediately under the eyes; mouth broad, extending back three inches. No teeth perceptible to the naked eye, but could be felt upon the upper lip. I have been informed that when quite young they have sharp teeth upon the upper and lower jaws.

The illustration will show location of fins, which are composed of soft rays. This description will be sufficient, I hope, to give a general idea of this most curious fish.

The Osage Orange.

The Osage orange, otherwise known as *bois d'arc* (bow wood) or bodock (*Maclura aurantiaca*), is a beautiful and valuable tree on the banks of the Arkansas, where it is a native, and where it often attains a height of 60 feet, although in the Eastern States it is rarely planted except for hedges; its value for this purpose being due to its immunity from disease and the attacks of insects. This tree is hardy much further north than its native home, and endures the winter perfectly well even in the vicinity of New York city, and it is somewhat surprising that it is not oftener cultivated, inasmuch as it is one of our most valuable native woods. A writer in the *Cultivator and Country Gentleman* says of it, "that either for rapid growth, hardiness, durability of timber, habit and form, density of shade, and general beauty of shape and outline, when growing by itself, it is ten times more valuable, desirable, and beautiful than the catalpa of any variety of which we have lately heard so much." He remarks further that, "after twenty years' observation of it, were he about to plant a grove or lay out a timber belt for



THE PADDLE FISH OF THE MISSISSIPPI.

shelter and ornament, he knows of nothing that he would sooner select than the Osage orange. The young plants may be procured abundantly and cheaply; they start as surely as any of the soft-wooded trees; they grow rapidly, stand heat and drought admirably, and are impatient only of wet feet, so they do not take kindly to low and wet situations. Not only is the timber very hard and very durable, but it has great beauty of grain, and when sawed into veneers or plank and used in solid form, it may be made, like black walnut or mahogany, into office or household furniture of the most attractive style. Its durability is quite wonderful and deserves to be enlarged upon. Where a hedge has been winter-killed, as is sometimes the case in the North, when an intensely cold winter follows a hot and growing season, the dead fence will sometimes stand for years and perform the office of a live one. Young trees of not more than two or three inches in diameter, or the limbs of maturer ones of the same size, are not only stronger and stiffer than any other wood that can be procured, but as vine stakes they outlast any wood that has yet been tried. When dry the wood is as hard as hickory and as heavy as oak, and this may prove an objection to its being sawed into boards or planks for building or fencing."

To this tribute to the valuable qualities of the Osage orange we may add a few further details given by other authorities. One writer, for instance, states that those who live where the tree abounds say that while the exposed wood may waste away gradually, through the action of the elements, yet a rotten or decayed stick is never seen. The wood, which is of a fine yellow color, close-grained, hard, strong, and elastic, changes but little with alternate wetting and drying, and in addition to its other industrial uses is said to be especially valuable for wheels. The bark of the tree affords a fiber similar to that of the paper mulberry, and the wood abounds in a yellow coloring matter, which is especially abundant in the roots, and of an intense orange shade. The well known yellow dyewood, fustic, is the product of an allied species, *Maclura tinctoria*, growing in Central and South America.

The Milk of the Cow Tree.

No tree aroused the imagination of Humboldt so keenly as the *Broximum galactodendron*, or *Palo de leche*, or cow tree, which grows upon the slopes of the Cordilleras of Venezuela. As the nutritious juice of this tree is allied very closely to the rubber tree of Brazil—and, indeed, may yet come to supply a rubber to the European markets—the following account of its composition, communicated to the French Academy of Sciences by M. Boussingault, may not be without interest. The cow tree grows to a height of from 15 to 20 meters; its leaves are oblong, alternate, and terminated by points. The creamy juice is obtained by cutting into the inner bark. It is used by the natives in place of cow's milk. The analysis of 100 parts of the milk, containing 42 parts of fixed matter, is as follows:

Wax and saponaceous matter, 35·2; sugary substances, 2·8; caseine, albumen, 1·7; earths, alkalies, phosphates, 0·5; indeterminate substances, 1·8; water, 58·0—100·0.

The cream of the cow, according to an analysis of M. Jeannier, contains:

Butter, 34·3; milk sugar, 4·0; caseine and phosphate, 3·5; water, 58·2—100·0.

It will be observed that wax appears in the vegetable milk in about the same proportion as butter in the animal.

Insulation by Gutta Percha.

A suit was brought, in 1872, by Clinton G. Colgate, assignee of Arthur N. Eastman, against the Western Union Telegraph Company for an injunction and an accounting of profits, for the use of an invention patented by George B. Simpson. The patent claimed the insulation of telegraph wire with gutta percha, thus creating a submarine conductor of electricity. The inventor claimed to be the originator of submarine cables, and declared that it was to his invention that the success of the Atlantic cables was due. The attorneys of the Western Union Telegraph Company testified upon the trial that the company had in use about 60,000 miles of telegraph wire in which gutta percha is used as an insulator.

After six years of litigation a decision was reached in this case November 25, Judge Blatchford, of the U. S. Circuit Court, deciding that on all the points at issue the plaintiff had established his case. It is said that the case will be appealed to the U. S. Supreme Court, by the Western Union Telegraph Company.

The history of Mr. Simpson's long protracted fight with the Patent Office before his right was acknowledged is not less interesting for the exhibition it affords of pluck and persistence on the part of the inventor than for the illustration it furnishes of the injustice that may come through a misconception of the duties of the Patent Commissioner. In view of the vital importance of Simpson's invention to the success of telegraphy the world over, the following story of his efforts, as brought out during the trial, will prove of interest to our readers.

Gutta percha was imported into England from the East Indies about 1845, and was there used as a mastic cement and as a plastic material for covering reins, straps, and bands, and for moulding various articles. Its insulating properties were, however, not discovered at that time. In 1845 Professor Morse attempted to insulate a telegraph wire with beeswax, asphaltum, and cotton yarn. This mode of insulation failed. In 1846 Ezra Cornell and Professor Morse tried to carry a wire across the Hudson River at Fort Lee insulated with asphalt and hemp, and also one inclosed in glass beads and in a lead pipe. This also failed. Downing's line from Philadelphia to New York tried India rubber as an insulator for aerial wires in the spring of 1848, but this also failed. The first Magnetic Telegraph Company, or Southern Telegraph Line, tried wires covered with asphaltum and in lead pipes in the fall of 1847, at various points on their line, particularly at Passaic River.

It is claimed that the first publication in England of the insulating properties of gutta percha was made by Professor Faraday, in March, 1848. Prior to this time, however, George B. Simpson, the inventor in this case, had filed an application for a patent in the United States Patent Office, claiming the insulation of telegraph wire with gutta percha. This application was dated November 22, 1847, and was sworn to and filed in January, 1848, more than a month before Faraday's announcement. The inventor at that time was too poor to pay the fee of the Patent Office, and continued to be in the greatest poverty all his life. He filed a second or amended application for the patent in February, 1848, and a third in April, 1849, when he succeeded in paying the Patent Office fee of $30 by the assistance of the late Horace H. Day. He exhibited his invention in Baltimore in the spring and fall of 1848, and it was there tested and found successful. He also, as early as December, 1847, exhibited his invention to the late Hon. Amos Kendall and F. O. J. Smith, in Cincinnati. In 1850 his application was erroneously rejected by the Patent Office, and he was referred to the officers of the Magnetic Telegraph Company, including Mr. Kendall, as alleged prior inventors, all of whom, it appeared subsequently, derived the knowledge they received on the subject from him. The Patent Office repulsed his repeated applications. He was compelled to withdraw his fee by his agreement with Day. He worked his way out to the Pacific between 1852 and 1857, in the hope of obtaining money to renew and prosecute his application. Returning in 1858, he found his invention largely in use. He had accumulated a little money, and promptly renewed his application for the patent. He was again rejected by the Patent Office, which now confessed that the previous action in rejecting him had been erroneous, but that it was now too late to obtain a patent.

He persevered from 1858 to 1866, filing repeated applications with all the Commissioners of Patents who were in office during that time, and in 1862 presented an application to Congress for relief, and received a most favorable report on the originality and novelty of his invention. Finally, in 1867, after twenty years' litigation in the Patent Office, his efforts were crowned with success, and a patent was issued to him as the originator of the first practical method of constructing an ocean telegraph. Simpson, however, died a few months after the grant of the patent. He was then employed as paymaster in the United States army—a position procured through the influence of persons who were interested in his endeavors to secure his rights. He died of yellow fever, in New Orleans, in October, 1867.

Duplexing the Atlantic Cable.

The simultaneous transmission of two telegraphic messages in opposite directions upon one wire, now known by the name of duplex telegraphy, dates back from the year 1853. In that year Dr. Gintl, the director of state telegraphs in Austria, described a method by which this feat could be accomplished, and in July of the same year the method suggested by Gintl was tried between Prague and Vienna. An improvement on this method was suggested by a German electrician, Frischen, by Messrs. Siemens and Halske, of Berlin, and other workers at this subject. Nevertheless, owing to practical difficulties, the experiments were little more than interesting additions to our knowledge. So little hope, indeed, was there of the practical realization of this important matter that, in a standard work on telegraphy, published in 1867, after describing the early methods of duplex telegraphy, the author remarks: "Systems of telegraphing in opposite directions, and of telegraphing in the same direction more than one message at a time, must be looked upon as little more than feats in 'intellectual gymnastics,' very beautiful in their way, but quite useless in a practical point of view." Such assertions should teach all scientific writers the lesson of "hoping all things not impossible, believing all things not improbable," an attitude of mind which, Sir John Herschel remarks, should always characterize the natural philosopher, and which, in the present day, is certainly the safest one. Within six years of the publication of the foregoing statement duplex telegraphy was not only largely employed in actual telegraphy, but its use on certain busy lines became absolutely indispensable. The change from theoretical to practical success is due to an American, Mr. J. B. Stearns, who, in 1872, succeeded in overcoming the main obstacle in duplex telegraphy, namely, what is known as the static discharge from the line. This Stearns accomplished by using a "condenser;" and further, he developed a system of "duplexing" the line similar to the principle of the Wheatstone bridge.

More or less successful attempts were afterwards made to duplex submarine cables, and in the early part of 1877 Mr. J. Muirhead succeeded in duplexing the cables of the Eastern Telegraph Company by his artificial condensers. But we believe that his success was only partial. Subsequently Mr. Muirhead has been at work duplexing the Direct United States Cable, with some prospect of success, and lately Stearns, who may be called the father of duplex telegraphy, has actually achieved the great feat of perfectly duplexing the Anglo-American cable. In a message received by Mr. W. H. Preece, Mr. Stearns says, "I managed to get some specimens for you this morning, though we had no time to make the balance especially perfect for the purpose."

All the messages now sent across the Atlantic are automatically registered by means of Sir W. Thomson's delicate and beautiful siphon recorder, which spirts out little jets of ink in a fine stream on a moving ribbon of paper. When no current passes the ink marks form a straight line, but a current causes this line to deviate to the right or left, according to the direction of current. Hence the ordinary right and left strokes of a needle instrument, or the long and short dashes of a Morse, are indicated by marks above and below the middle line.

The essence of duplex telegraphy is to obtain an electrical balance round on the line, such that the sending instrument is not affected by currents circulating round it coming from the sending end, but only by currents received from the opposite end, and *vice versa*. Hence, if the balance be once obtained, double transmission is possible. This balance Stearns has succeeded in obtaining by the use of his system as applied to land lines, and without the aid of the additional arrangements of artificial condensers used by Dr. Muirhead. —*Nature.*

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, December 21, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated:

PLANETS.

	H.M.		H.M.
Mars rises	4 54 mo.	Uranus rises	9 44 eve.
Jupiter sets	7 35 eve.	Neptune in meridian	8 20 eve.
Saturn in meridian	5 50 eve.		

FIRST MAGNITUDE STARS, ETC.

	H.M.		H.M.
Alpheratz in meridian	6 01 eve.	Procyon rises	7 12 eve.
Mira (var.) in meridian	8 11 eve.	Regulus rises	9 16 eve.
Algol (var.) in meridian	8 58 eve.	Spica rises	1 57 mo.
7 stars (Pleiades) in merid.	9 38 eve.	Arcturus rises	0 59 mo.
Aldebaran in meridian	10 27 eve.	Antares rises	6 03 mo.
Capella in meridian	11 05 eve.	Vega sets	9 25 eve.
Rigel in meridian	11 06 eve.	Altair sets	8 13 eve.
Betelgeuse in meridian	11 46 eve.	Deneb sets	0 34 mo.
Sirius rises	7 37 eve.	Fomalhaut sets	8 48 eve.

MOON'S PLACE IN THE CONSTELLATIONS AT 7 P.M.

Saturday, *Scorpio*	5°	Wednesday, *Capricornus*	1°
Sunday, *Scorpio*	19°	Thursday, *Capricornus*	14°
Monday, *Sagittarius*	4°	Friday, *Capricornus*	26°
Tuesday, *Sagittarius*	17°		

REMARKS.

Mars will be 5° north of the moon December 21. Before the discovery of the moons of Mars there was no accurate method of calculating the mass of the planet. Laplace, in his "Celestial Mechanics," gives the mass as $\frac{1}{1846082}$ of the sun. Prof. Asaph Hall, the distinguished discoverer of the small Martial satellites, has calculated the mass from the motion of the satellites, and announces the result in "Observations and Orbits of the Satellites of Mars, with data for 1879." The mass of the sun being unity, he finds that of Mars to be $\frac{1}{3093500}$, with a very small possible error, which, he thinks, will be eliminated in 1879. Jupiter will be about 1° south of the moon December 26.

American Exports and Imports.

The gold values of the exports of merchandise from the United States, and imports of merchandise into the United States, during the last fiscal year, as appears from returns made to and compiled by the Bureau of Statistics, are as follows:

Exports of domestic merchandise	$680,709,268
Exports of foreign merchandise	14,156,498
Total exports of merchandise	694,865,766
Imports of merchandise	437,051,532
Excess of exports over imports of mer'dise.	$257,814,234

Compared with the previous year, the importations are less by $14,271,594, and the exportations are greater by $92,390,546.

The annual average of the excess of imports over exports of merchandise, for the ten years ended June 30, 1873, was $104,706,922; but during the last three years there has been an excess of exports over imports as follows: In 1876, $79,643,481; in 1877, $151,152,094; in 1878, $257,814,234.

Results of the Paris Exhibition.

The total admissions to the late Paris Exhibition were 16,032,725, against a total for the Centennial of 9,910,966. The Exhibition at Paris, however, was open more than a month longer than the one at Philadelphia, while the actual receipts at the latter place were about 50 per cent larger than at the former. This year at Paris, as compared with 1867, shows nearly double the number of admissions, and an increase of 75 per cent in receipts. In spite of this increase the Exhibition held during the Empire involved an expenditure of considerably less money. In 1878, 45,000,000 francs were appropriated, and a deficit is reported of 15,000,000 francs more.

REMEMBER that the SCIENTIFIC AMERICAN is published every week, and that a single number contains as much matter as many of our monthlies. Try the paper one year, and you will never do without it.

POTTERY AND GLASSWARE.

Those who admire the beautiful in form and ornamental design will be pleased with the accompanying illustrations of specimens of the artistic terra cotta and glass work exhibited at Paris. It is interesting to note how early in the development of these departments of art industry the perfection of artistic forms was reached. The most beautiful shapes of modern times are little more than copies of antique designs. In surface ornamentation the finer glassware of to-day is infinitely superior to the old; but the forms attained by the glass blowers of Cyprus, 3,500 years ago, if Di Cesnola's estimates are correct, are unsurpassed. Many of the specimens exhibited by him, during his recent lectures in this city, were strikingly beautiful. Some of them were transparent and translucent. Originally they were colorless, but some of the more modern ones were beautifully colored. The vessels were found in tombs. They had large bodies and very small neck, and had evidently held some precious liquid perfume, which was doled out by drops through the narrow necks. Those found in damp tombs showed signs of decomposition, while those found in dry places were perfectly preserved. Roman lamps were found in the tombs. The invention of lamps had been attributed to the Egyptians. Those found in Cyprian tombs were made in moulds of harder clay, in two pieces.

The rage for art decoration among ladies of leisure has given a decided impetus to the production of terra cotta and other pottery of artistic form in this country. At the recent convention of the United States Potters' Association, the President confidently asserted that the manufacture of artistic ceramics is bound to become one of the important industrial interests of this country. The average value of earthenware and china, of all grades, imported during the past six years, is nearly a million dollars in excess of the imports of the year just closing; and during the past ten years the importations have been steadily declining. From this it appears that our potters have not only kept pace with the increase in population, but are steadily reducing the amount demanded from abroad. At present the number of potteries in the United States of all kinds is 777; steam engines employed 8, with a horse power of 1,586; eight water wheels, power 122; hands employed, 6,116; capital invested, $5,294,398; yearly wages paid, $2,247,173; value of the products, $6,045,536.

New Inventions.

An improved Weather Strip of cheap and simple construction, that is tightly applied to the door sill when the door is closed, so as to shut out draught and rain, and which is raised to be off the carpet when the door is opened, has been patented by Mr. Nelson Smith, of Vinton, Iowa.

Mr. William Smith, of Carmi, Ill., has patented an improvement in Thill Supporters, which consists in a supporting arm provided with a clamp, by which it can be attached to the spring of the vehicle on which it is to be used, and an adjustable bar to secure the thills in a raised position.

Mr. J. B. Underwood, of Fayetteville, N. C., has devised a Combined Chair and Treadle Power, the object of which is to reduce the muscular force exerted in running a sewing machine or other device operated by a treadle, and to transfer the strain from the muscles of the abdomen and other parts which are injuriously affected thereby, to other muscles which are better able to exert the power and withstand the fatigue, thus confining the work to the lower part of the legs, and converting a laborious and injurious operation into one of healthful exercise.

Mr. Chauncey M. Orton, of Glens Falls, N. Y., has patented a Cover for Pots and Kettles, which may be readily applied to the kettle, and when in place will be securely held, so as to prevent it from slipping, and will afford means for handling and tipping the kettle without danger of burning the hands, or of emptying the articles from the kettle as the water is poured off.

Messrs. William H. Foster and Isaac C. Roberts, of Louisburg, Kan., have patented an improved Churn. The invention consists in the combination of the pivoted lever, provided with the cross bar and the cord, and a balance wheel, with the shaft of a churn dasher, the mechanism being contrived so that a movement of the lever produces a reciprocating rotary motion in the churn dasher.

ANCIENT GLASSWARE FROM CYPRUS.

An improved Postage Stamp Recording Cabinet has been patented by Mr. Hollis T. Taggart, of Emporium, Penn. The object of this invention is to facilitate the keeping of a record in post offices of the stamps canceled from time to time, and the invention is especially useful in post offices where the pay of the postmaster is regulated by the number of stamps canceled. The invention consists in a cabinet divided into two main parts, each of which part is subdivided into small pigeon holes.

An improved Game Table has been patented by Mr. Wm. M. Lloyd, of New York city. The object of this invention is to furnish an improved parlor game, simple, easily learned, and at the same time allowing a high degree of skill to be developed and exhibited by the players.

Mr. Michael Affel, of Ripley, Ohio, has patented an improvement in Hats, Shades, etc. This invention relates to an improved construction of hats, baskets, card racks, and similar articles, that are made of thin pieces of wood; the invention consists of a hat, basket, or other article made of a number of radial pieces, splints of wood, or other material, notched at both sides so as to interlock. They are finally connected by stitching or lacing.

Mr. Christian F. Knauer, of Urach, Würtemberg, Germany, has invented an improved Nail Extractor, by which the nail head is readily taken hold of, and the nail drawn, without bending the nail or injuring the lid of the box, so that both nail and box may be used again.

Mr. Geo. A. Coulter, of Omaha, Neb., has patented an improved Hame Fastener, consisting of a loop and retaining hook of novel and ingenious construction.

Mr. Daniel L. Holden, of Philadelphia, Pa., and Edward W. Byrn, of Washington, D. C., have devised an improved Refrigerating and Air Cooling Apparatus for cooling the air in a room or compartment in which meats or other perishable articles of food are stored. The invention is designed to operate in conjunction with an apparatus for refrigerating a non-congealable fluid which is employed as a vehicle for the cold.

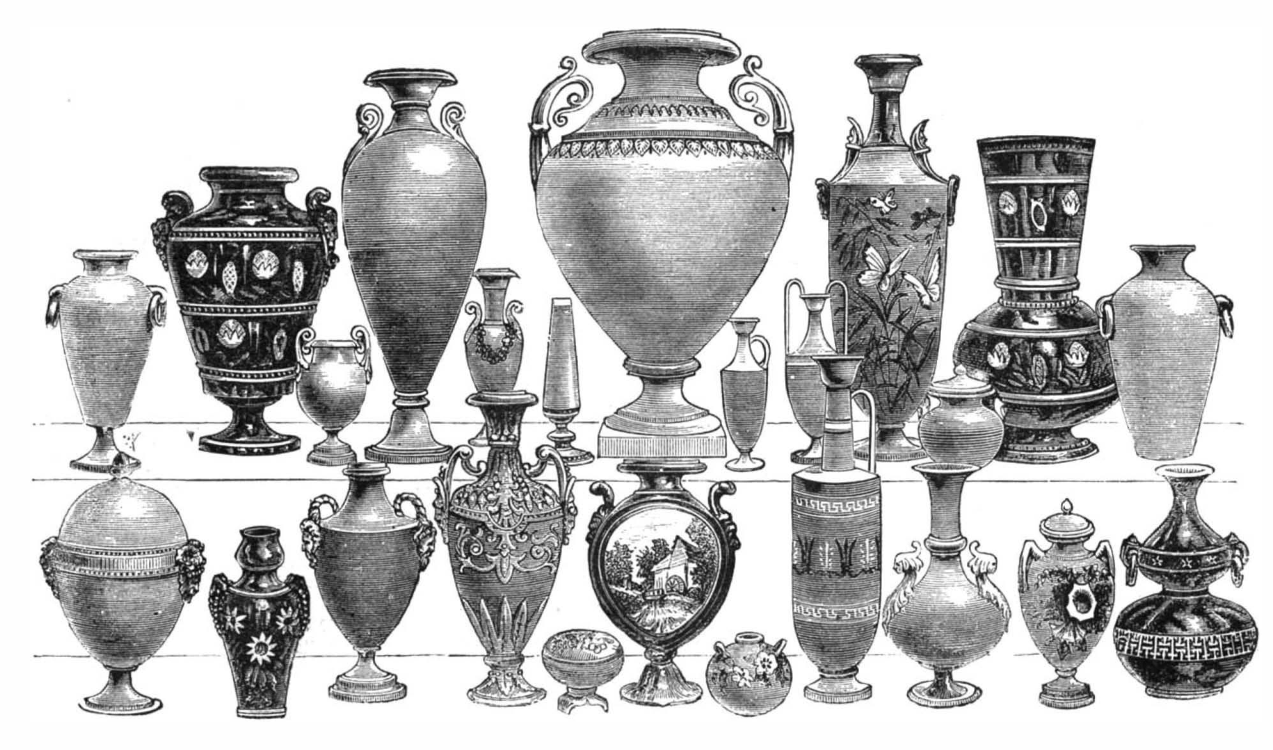
An improved Ticket Printing and Recording Machine has been patented by Messrs. John Moss, of New York city, and John H. Smith and George J. Hill, of Buffalo, N. Y. This invention is to provide a machine for the purpose of keeping an exact record of all cash transactions, receipts, or disbursements in stores, offices, manufactories, or any business establishment or place where money is paid in. It is also intended to be a check on employés and a prevention of dishonesty in clerks or others handling money received or paid out in such establishments. This is accomplished by registering on a paper strip inside the machine the amount of any transaction, and printing and stamping the same amount simultaneously upon the account, bill, or ticket inserted for that purpose, the two things being done at one operation or movement by the lever handle, and the different amounts are set in the machine for printing or stamping by knobs outside of the case attached to the operating levers.

An Improved Drier for Coffee, Cocoa, etc., has been patented by Mr. Samuel Beaven, of San Paulo, Brazil. This invention consists in a hollow vertical cylinder, having a number of foraminous trays placed one above the other, upon which the material is placed to dry. Each tray consists of two disks having openings, one disk being fixed and the other fitted to turn, whereby the openings are closed to retain the material or opened to permit it to pass through. The material is stirred by revolving rakes. The drying is effected by heated air forced upward through the apparatus by a pressure blower.

Messrs. Wm. D. Roper and Joshua W. Mitchell, of Deep Creek, Va., have patented an improved Stop, Fastener, and Lock for windows, which is so constructed that it may be easily and quickly adjusted to allow the sash to work freely when swollen and when shrunken, which will hold the sash securely in any position into which it may be raised.

An improvement in the class of hand perforating stamps or check and draft punches, in which the figures representing the amount for which the check or draft is drawn are cut bodily from the paper, for the purpose of preventing fraudulent alteration by obviating the possibility of changing the face of the check or draft to some different amount, has been patented by Mr. Henry H. Norrington, of West Bay City, Mich.

Mr. James G. Hart, of Murray, Ky., has devised an Improved Automatic Brake for Wagons. It is so constructed that the brake will be applied by the forward pressure of the vehicle in going down hill.



ANCIENT POTTERY FROM CYPRUS.

TO INVENTORS.

An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN, which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN.

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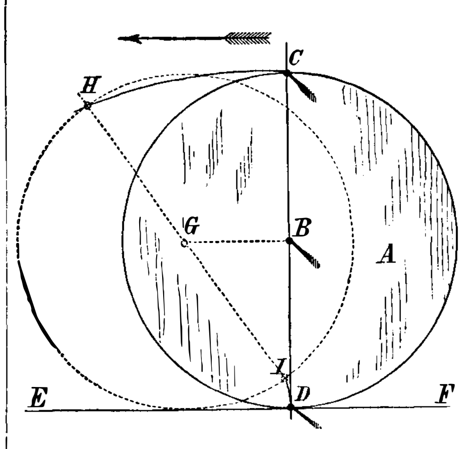
Another of the multitudinous attempts to provide an acceptable substitute for our common long-hand writing. It differs from the usual, however, in being strictly alphabetic, no compound or contracted characters, omissions, or other stenographic devices being admitted. The writing is cursive, singularly direct in its flow, and evidently easy to read. The author claims that it is correspondingly easy to write.

Notes & Queries

(1) L. M.—To restore a lens blurred by hydrofluoric acid, take a sealing wax impression of a portion of the face of the lens, stretch over the wax a piece of silk, apply a paste of fine putty powder (putty powder and water) to the face of the pad thus made, and rub the pad rapidly over the face of the lens with a gyratory motion until the surface of the lens is repolished.

(2) J. R. E., S. H. R., and others.—Regarded merely as a rotating body, all parts of the periphery of a carriage wheel move around its axis with the same velocity. Regarding the carriage wheel as a rolling body, the upper portion moves forward faster than the portion which touches the ground. Any point in the wheel will describe a cycloid curve as the wheel rolls on a plane surface. Our correspondents can satisfy themselves as to the proper solution of the problem in the following way: Take a disk, A, of thin wood or pasteboard, and secure at the center a pencil, B, and at the periphery at diametrically opposite points the pencils, C D. Put the disk on a plane surface, with its edge, against the straight edge, E F, and the three pencils in a line, forming a right angle with the straight edge. Now roll the disk forward in the direction indicated by the arrow. The pencil, B, which represents the axle



will move from B to G in a right line, the upper one, C, will describe the curve, C H, and the pencil, D, will make the curve, D. I.

(3) S. H. R. asks: 1. Does a small electrical machine (pocket size), such as is made for medical purposes, furnish electricity of sufficient intensity to experiment with the microphone? A. Yes. 2. Can the electric light be produced from a galvanic battery? A. Yes, by using several cells.

(4) C. D. K. asks: 1. What kind of moulds would give the best and smoothest castings of a mixture of tin, zinc, and bismuth? A. If the alloy contains little zinc well dried moulds of plaster of Paris or of papier mache covered with a film of oil will doubtless give satisfaction. See also SCIENTIFIC AMERICAN SUPPLEMENT, No. 17, "Casting Medals, Medallions, etc." 2. Would it stick to copper? A. Probably.

What is the process of canning sweet corn? A. The following is the method in use by many of the large canning establishments. The corn, after removing from the cob, is filled into the clean cans so as to leave no air spaces. These are placed in a large oven or other airtight vessel, and subjected to hot steam under pressure. The harder the corn the longer the exposure required to thus cure it; it is said that in some cases as much as eight hours is requisite, but usually much less than this. A large vessel of boiling water, in which the cans are immersed, may be used instead of the steam oven, but is not so effective. On removal from the oven or water bath, as the case may be, each can (they must be filled to the cover with fruit) has the cap with a very small hole tapped in its center immediately soldered on. As soon thereafter as the can stops blowing, as the escape of steam and air through the vent is termed, the hole is quickly soldered. This must be done before the air begins to enter. Other fruit is cured and canned in like manner—tomatoes rarely require longer than 15 to 20 minutes' steam curing. Where the pits are left in fruit a longer time is requisite to completely destroy all fermentative germs.

(5) N. B. D. asks (1) if the spools of an ordinary telegraph sounder can be utilized for making a telephone, or are the spools of a relay more suitable? A. The relay spools will be best. 2. The telephone line will be less than half a mile in length. Will small copper wire do for the main line? A. Yes.

(6) G. F. D. asks: 1. What is the cheapest method for producing ozone in large quantities, so that it may be applied as an oxidizing agent? A. Coat the inside of a long glass tube with tinfoil, and pass over this a second wider tube coated with tinfoil on its outer surfaces. Between these two tubes pass a current of dry oxygen, and connect the inner and outer tinfoil coatings with the terminal wires of an active induction coil. Ten to fifteen per cent of the oxygen may thus be converted into ozone. 2. What paint or varnish would be suitable for insulating wire for electrical experiments? A. Shellac dissolved to the consistence of molasses in alcohol, asphaltum varnish, melted sealing wax or paraffin, and benzol solutions of gutta percha and caoutchouc are occasionally used. 3. How is the instrument made for measuring the resistance of an electric current in ohms? A. It consists of a series of coils of measured resistance.

(7) P. McF. asks how to keep cider sweet all winter. A. Add from 0·125 to 0·25 oz. of sulphite of lime (calcium sulphite) for each gallon of the cider. It should be dissolved in a little of the cider before adding it to the barrel. Then roll the barrel.

(8) H. M. D. asks for the best way to make gelatin or glue moulds for plaster casts. A. Glue is softened by digesting it in cold water and then melted in the water bath. This affords a very thick paste, to which pure glycerin is added in the same quantity by weight as that of the dry glue taken. The mass is then further heated and stirred for some time in order to evaporate the excess of water. This mixture does not adhere to well oiled moulds, and is very elastic when cold.

How are autumn leaves preserved? A. The fresh leaves are spread and pressed into a suitable dish with alternate layers of fine, thoroughly dry sand, as hot as the hand can bear. When the sand has cooled they may be removed, smoothed under a hot iron, dipped for a few moments in clear French spirit varnish, and allowed to dry in the air. By many melted white wax or paraffin is preferred to the varnish. These latter must not be too hot. The dried leaves are dipped in the melted wax, drawn several times over the edge of the vessel to remove excess, and hung up until the film of wax has thoroughly cooled and hardened.

(9) "Watch Hand" asks how to anneal watch hands that have to be swaged three times after each annealing. A. Place the hands in charcoal dust in a cast iron box. Close and lute the box, bring it to a red heat, and allow it to cool very slowly.

(10) F. D. asks what acid to use to lessen the harsh effect of borax in soap without destroying its qualities. A. The addition of a little glycerin to the soap will render it less harsh if the saponification has been properly conducted. Acids are not employed in the way you suggest.

(11) C. F. L. asks: 1. What are the most approved methods of using petroleum under steam boilers? A. Most of the processes are patented, and by inserting a notice in the "Business and Personal" column you may open communication with the inventors. 2. Can steam be practically superheated for combining with oil, by running it through a coil of ¾ inch pipe 10 or 15 feet long, placed in the firebox? Would any danger attend the use of such a pipe in a hot blast? A. This is perfectly practicable, but the arrangement may not prove very durable. It will not be specially dangerous if means are provided for shutting off the apparatus promptly when required.

(12) H. A. L. writes: I wish to heat four barrels of water, sometimes less; which is best, a large kettle set in brick with a grate, or a small boiler 3 feet long by 15 inches diameter, with six two inch flues? Would such a boiler with 20 or 30 two inch flues, set as described, run a 4 x 5 cylinder at 300 turns, steam at 80 lbs.? A. The boiler would be preferable, and would answer for the engine.

(13) G. P. M. writes: There is a fluid instantaneous ink eraser on the market. Of what is it composed? A. The fluid eraser referred to is probably a strong, cold aqueous or acetic acid solution of calcium or potassium hypochlorite—bleaching powder or eau de Javelle.

Can I make a patented article if I make and use it myself? A. See "Rights of Investigators," p. 128, current volume of the SCIENTIFIC AMERICAN.

Can I electroplate with a Callaud battery? A. Yes; two or three cells will suffice for small work.

Is there a cheap process by which I can obtain tolerably fair copies of my own handwriting, and how is it done? A. Write with a 20 per cent aqueous solution of glycerin, sprinkle the writing with excess of finely powdered gum arabic, dust off excess, and dry in a warm place for some time. From this a cast may be taken in fusible metal. Another method is to coat a smooth metal plate with a film of wax, through which with a fine steel point to the metal below the characters are etched. The lines and surface are then blackleaded, and a copper electrotype taken in the usual manner. Still another way is to write upon a prepared block of chalk with lithographer's ink or a preparation of glue and sugar or molasses, after which the parts unprotected by the ink are etched out somewhat with a dilute acid and the block hardened by immersing it for a time in strong water glass solution.

What is used in, and what is the process of zincography? A. It is similar to lithography—a plate of zinc being used in place of the stone.

Does the SCIENTIFIC AMERICAN, Export Edition, contain "Notes and Queries" also? A. Yes.

(14) A. J. F. suggests the use of drums for turning angles in thread telephone lines. At each angle he places a drum having two heads. The thread is severed and the ends pass through the drum heads and are knotted.

(15) F. P. H. asks for a method of making cider. A. See p. 315 (8), current volume.

(16) N. E. S. writes: The Second Avenue Railroad Company have been experimenting with a car to run by compressed air instead of steam; the cars to be charged from a stationary reservoir, into which the air has been forced at a high pressure by a stationary engine. It is claimed, by some persons, that the stationary engine has not enough power to draw as many cars as it can supply with air and keep running; but I claim that it has. Who is right? A. We agree with you, as we understand your meaning.

(17) A. H. G. asks how to dissolve amber to be used as a varnish. A. Amber, 10 parts (by weight); melt in a suitable vessel over a moderate fire, and add boiled linseed oil, 20 to 30 parts. The caldron in which this operation takes place should not be more than two thirds filled; and the mixture of oil and resin kept boiling for 10 minutes. The vessel is then removed from the fire (into the open air), allowed to cool down to about 280° Fah., and from 25 to 30 parts of oil of turpentine gradually added. See also Meredith's process, p. 35, current volume, SCIENTIFIC AMERICAN.

(18) C. H. asks (1) how to make oxygen gas in a cheap and simple way for experiments. A. Mix dry potassium chlorate with about one fourth its weight of pure black oxide of manganese, and heat the mixture in a copper retort over the flame of a spirit or gas lamp. The retort should not be more than one quarter full. The gas should be passed through water to free it from traces of chlorine, etc. 2. Is there any danger of explosion from the above gas when it comes in contact with a flame, that is, when no other gas is mixed with it? A. No.

(19) W. S. R. asks for a good recipe for red and blue stencil ink. A. Shellac, 4 parts; borax, 1 part; dissolve by boiling in a small quantity of water, and dilute with hot water to the consistency of very thin sirup. To this add a sufficient quantity logwood or Brazilwood extract, or the soluble coal tar reds. For blue add to the lac solution soluble Prussian blue, or blue carmine.

(20) D. H. A. writes: A paper mill in this place is supplied with turbines. The tail race is 3 feet higher than it need be. Which will add most to the power of the wheel, to deepen the tail race and lower the wheels, or to deepen the tail race, let wheels remain where they are, airtight tubes being fitted to the wheels and extending to the water in tail race? A. As we understand the statement, we think that the increase of power would be about the same in either case.

(21) G. B. G. asks: 1. What is the composition of bright dipping acid for brass? A. Ordinary nitric acid diluted with one or two volumes of water. The work must first be cleansed from all traces of grease or oil by hot soda solution or scouring. 2. What is the mixture into which the article is dipped which gives it

a dark gray permanent color? It is called "steel bronze" dip. A. The gray or black dip referred to is prepared as follows: Hydrochloric acid, 12 lbs.; ferrous sulphate (copperas), 1 lb.; arsenious acid (pure white arsenic), 1 lb.; dissolve in the acid. Dip the articles bright in dilute nitric acid, rinse in clean water, and immerse in the bronze dip until the proper color is developed. Rinse in cold water and dry in warm sawdust. The green lacquer usually employed is made by digesting together in a warm place, with occasional agitation, shellac, 5 ozs.; sandarac, 4 ozs.; gamboge, 1 oz.; turmeric, 6 ozs.; wood spirit, 1½ gallon.

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

E. A. S.—They are iron garnets—the well formed crystals are sometimes used as jeweling.

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

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Aluminum as a Negative Element in Galvanic Batteries. By J. M. S.

Acoustic Telephones, etc. By J. J. B.

On Small Steamboats. By G. H. S.

On Economy of Weight in Gearing. By J. O. B.

On the History of the American Lead Pencil Manufacture.

[OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

October 22, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Air tight vessel, T. H. Shahan	209,297
Alloy for coin, W. W. Hubbell	209,263
Alloy used with other alloys, E.A.C. Du Plaine	209,240
Alphabet block, A. G. Trickey	209,307
Axle box lid, car, R. Wells	209,150
Axle skein, vehicle, Gestring & Fullerton	209,248
Bag fastener, E. W. Cox	209,233
Bag fastener and tag holder, D. McKenzie, Jr.	209,281
Bands, cords, and ropes, manufacturing, L. Binns	209,106
Barrel and keg, W. H. Ewing	209,163
Barrel heads, making, A. Wason	209,311
Barrels, cooling attachment for, J. Hoerr	209,262
Basket, waste paper, W. F. Hatfield	209,168
Bed bottom, T. R. Jones	209,124
Beers in kegs, preserving, W. Gaffron	209,244
Berth for vessels, self leveling, D. Huston	209,264
Bibb or cock, water, Elliott & McCool	209,161
Binder for manifold writing, G. Southard	209,141
Binder, temporary, W. H. Bailey	209,213
Boiler cleaner, steam, J. Carter	209,226
Boilers, incrustations from, F. J. Obert, Jr.	209,186
Boot and shoe insole, J. F. Nickerson	209,184
Boot, India rubber, G. Watkinson	209,312
Bracket, E. H. Bates (r)	8,464
Brake, wagon, W. M. Rape	209,291
Brush bridle, paint, M. W. Marsden	209,279
Butter package, C. H. Robison	209,136
Button and fastener, A. M. Richmond	209,135
Can for fluids, C. H. Nye	209,185
Candles, reflector for, M. C. Meigs	209,178
Cars, heating railway, J. W. Graydon	209,166
Cars, sand box for street, J. E. Shaw	209,196
Carriage top prop, J. P. Simpson	209,198
Cartridge, F. W. Marston	209,127
Casting sash weights, Davis & Godfrey	209,237
Chart, dress, W. Cornwell	209,111
Churn, W. Seachrist	209,195
Churn, reciprocating, J. E. Gibbs	209,249
Cloth measuring apparatus, T. T. Farnsworth	209,164
Cloth drying machine, D. Babcock	209,212
Clothes drier, A. A. Heaton	209,121
Clothes pounder, W. P. Dungan, Jr.	209,239
Coin detecter, counterfeit, E. Street	209,145
Cooker and steam washer, feed, J. K. Purinton	209,134
Corset clasp, J. S. Crotty	209,112
Countersink, W. R. Gill	209,252
Crane for hoisting car wheels, etc., W. M. Davis	209,236
Crayon mould section mould, C. H. Bill	209,154
Cultivator, riding, H. H. Canaday	209,224
Cultivator, wheel, D. Argerbright	209,210
Cultivator, wheel, A. Geppert	209,118
Curtain cord tightener, G. B. Katen	209,125
Curtain fixture, R. White	209,313
Cut off, H. Southworth	209,381
Dish, covered, J. Jepson	209,268
Door securer, W. Hinchliffe	209,261
Draught equalizer, M. Scott	209,296
Dredging machine, G. W. Cummings	209,159
Egg beater, W. H. Wiester	209,205
Elevators, hydraulic, C. Cookson	209,110
Engine, portable, W. T. Underwood	209,202
Evaporator and fruit drier, J. B. Sweetland	209,146
Feather renovator, J. M. Clark	209,230
Feed water heater, W. Baragwanath	209,105
Felly for vehicle wheels, Beck & Warwick	209,216
Fence post, E. Stanley	209,303
Fire escape, Rotschka & Davis	209,137
Fire extinguishing apparatus, R. K. Evans	209,242
Flour bolt, G. T. Richey	209,193
Furnace, annealing, W. S. McKenna	209,130
Furnace feeder, W. W. Chapin	209,227, 209,228
Furnace, gas generating, C. F. Dieterich	209,114
Furnace, steam boiler, J. W. Bookwalter	209,218
Furnaces, combustion in, I. Kendrick	209,273
Furnaces, cinder from blast, H. C. Grittinger	209,119
Gas, manufacturing, J. A. Stephan	209,304
Gate, Hadley & Dean	209,257
Gate fence, H. H. Allen	209,151
Grain binder, C. L. Travis	209,149
Grain cleaning machine, Kidwell & Maloney	209,173
Grain cleaning machine, Maloney & Shoemaker	209,177
Grain from vessels, unloading, C. J. Wells	209,204
Grain separator, J. Allonas	209,208
Grain separator, Smith & Chase	209,140
Grindstone frame, W. McDermott	209,280
Gun cleaner, C. E. Longden	209,276
Hammock and tent, portable, C. H. Leycester	209,275
Harvester cutter bar, E. C. Keys	209,172
Hat tip, F. W. Torwegge	209,306
Hides and skins, scouring, G. T. Sheldon	209,298
Hitching post, J. C. Peppler	209,288
Holdback, F. P. Pfleghar	209,190
Hops, disintegrating stalks of, I. D. Nordlinger	209,286
Horses' heels, pad for, M. Gallagher	209,245
Hose reel, J. W. Manard	209,278
Index, revolving, L. U. Albers	209,206
Indexing apparatus, Carlisle & Taylor	209,158
Indicator and alarm, low water, A. Haun	209,259
Indicator, station, Z. M. Hibbard	209,122
Injector, J. E. Bott	209,220
Inkstand, calendar, C. B. Howard	209,169
Insulating railway tracks, L. Bastet	209,215
Journal bearings, composition for, J. Johnson	209,170
Ladder, firemen's, R. Gilchriest	209,250
Ladle, metal founders', G. F. Butterfield	209,223
Lamp wick attachment, A. Schreiber	209,194
Lamps, lantern for street, Keefer & Orsburn	209,272
Lantern, A. W. Paull	209,188
Lantern, E. Tufts	209,308
Last channeling machine, L. Darozir	209,113
Lasting machine, Copeland & Crisp	209,232
Lifting jack, C. F. Asire	209,211
Lightning rod, H. W. Farley (r)	8,459
Locomotive, J. J. Anthony	209,209
Log turner, Tripp & Ballou	209,201
Loom let-off mechanism, J. Belicard	209,217
Loom take-up and let-off, G. S. Smith	209,300
Main and pipe, E. H. Austin	209,104
Middlings separator, W. J. Fender	209,165
Middlings separator, A. Morley	209,182
Milker, cow, S. G. Major	209,277
Mill, fulling, Arnold & Aiken	209,152
Mill, water, S. N. Stewart	209,143
Mills, measurer for fulling, T. W. Clark	209,229
Moulding machine, J. Hackett	209,256
Muff, J. H. Kappelhoff	209,271
Music leaf turner, J. J. Ougheltree	209,287
Oyster package, F. Pfeiffer	209,189
Packing, rubber, J. Johnson	209,270
Paddlewheel, feathering, S. W. Irwin	209,267
Padlock, permutation, G. C. Ridgway	209,294
Pails, bail ear for, J. Walton (r)	8,462
Pantaloons protector, W. H. Ewing	209,162
Paper damping implement, D. L. Mulford	209,183
Paper pulp, wood grinder for, W.D. & N.H. Shaw	209,197
Paper, waxing, S. Hammerschlag (r)	8,460
Pin, flower, J. H. Plummer	209,191
Pipe connections, lining for, E. H. Austin	209,103
Pipe moulding machine, F. Shickle	209,139
Pipes, etc., locker for gas and water, J. Miller	209,181
Plane, bench, P. Gallagher	209,246
Planter, corn, E. D. & O. B. Reynolds	209,293
Plow, J. Lane	209,174
Plow, T. F. McNair	209,282
Plow colter, W. McGregor	209,129
Plow standard, T. Meikle	209,284
Plow, sulky, J. Lane	209,175
Plow, sulky, T. Meikle	209,283
Pressure regulator or governor, Potter & Sloan	209,192
Pulley, G. Taylor	209,147
Pump, oil well, F. J. Hanna	209,258
Railway rail, M. B. Stafford	209,302
Railway signal, electric, C. D. Tisdale	209,148
Railway track cattle guard, Simpson & Kimball	209,299
Railways, construction of, J. S. Hyde (r)	8,465
Raker and loader, hay, D. W. Bovee	209,156
Razor strop, A. V. Brokhahne	209,107
Razor strop case, A. V. Brokhahne	209,108
Reapers, adjustable reel for, W. R. Hallett	209,120
Refrigerator, G. F. Smith (r)	8,463
Refrigerator, A. Zinsser	209,314
Roof battening, J. C. Wands	209,310
Roof, fire and water proof, T. New	209,131
Rubber tubes, vulcanizing, M. Mattson	209,128
Saddle, harness, Holmes & Eldridge	209,123
Sand paper holder, N. H. Fay (r)	8,458
Saw set, F. A. Buell	209,222
Sawing machine, scroll, H. L. Beach	209,153
Scales, spring, T. C. Miles	209,180
Sewing machine, C. K. Bradford	209,157
Sewing machine fan attachment, J. W. Fackler	209,116
Sewing machine, wax thread, J. Keith	209,126
Sheep rack, N. E. Allen	209,207
Ship building, J. B. Hall	209,167
Slate grinding machine, J. W. Hyatt	209,265
Sleigh knee, G. A. & H. J. Gilbert	209,251
Smoke and spark conveyer, R. F. Hill	209,260
Smoke stack, E. Clemons	209,231
Smoothing iron, N. J. Powell	209,133
Spinning spindle, J. C. Stanley	209,199
Spoke trimmer, P. Barringer	209,214
Spring, carriage, H. Sprague (r)	8,461
Spring, vehicle, F. Gerard	209,247
Springs, coiler for spiral, G. F. Godley	209,254
Stall for vessels, horse and cattle, B. Albee	209,102
Stamp, ore, Z. L. Kay	209,171
Stamp rods, tappet for, R. A. Johnson	209,269
Stirrup, O. V. Flora	209,117
Stock feeding device, J. L. Carpenter	209,225
Stuffing box and packing, Deavs & Brazier	209,160
Sugar centrifugal machine, Walker & Patterson	209,309
Sulky, T. H. Brown	209,109
Surveying instruments, tripod head for, W. Gurley	209,255
Syringe, W. T. Reaser	209,292
Table leaf support, W. F. Daly	209,235
Tallow, artificial, M. De la Vega	209,203
Target, ball, C. V. Boughton	209,155
Tea pot handle, F. G. & W. F. Niedringhaus	209,132
Telegraph repeater, quadruplex, T. A. Edison	209,241
Telephone, speaking, G. M. Phelps	209,289
Telephone switch, T. B. Doolittle	209,115
Telephone transmitter, J. H. Irwin	209,266
Tension wheel, O. O. Storle	209,144
Thill coupling, L. R. Crotty	209,234
Ticket and label holder, J. H. Mitchell	209,285
Top, spinning, A. Denayrouze	209,238
Toy, W. La Montagne	209,274
Umbrella support, A. A. Patterson	209,187
Valve, globe, G. Pierce	209,290
Valve, slide, J. Streily	209,305
Varnish, M. Mackay	209,176
Vise, W. X. Stevens	209,142
Wash board, W. E. Brock	209,221
Water closet, C. Rogers	209,295
Water wheel, turbine, J. W. Bookwalter	209,219
Well, paraffine from oil, J. D. Glenn	209,253
Wheat heater, A. Fulton	209,243
Whistle, fog and alarm, J. B. Tarr	209,200
Wood steaming apparatus, G. Miles	209,179
Wool washing machine, F. G. Sargent	209,138

TRADE MARKS.

Alloy of metal, Smith & Egge Manufacturing Co.	6,739
Baking powders, J. C. Grant	6,736
Braid and tape, W. H. Stafford	6,744
Bread, A. Brown	6,746
Cigars, Seubert & Warner	6,750
Cigars, J. D. Culp & Co.	6,747
Cigars, M. Jacoby	6,742
Cigars, C. G. Petersen	6,737
Cigars, cigarettes, etc, Goodwin & Co.	6,735
Cough remedies, C. White	6,752
Flavor for porter, D. D. Williamson	6,745
Medicated lozenges, Sheley & Roberts	6,743
Mineral water, Apollinaris Company	6,732
Photographs, etc., Artotype Company	6,733
Salt, A. Deakin	6,740
Shaving soap, C. Pauly	6,738
Smoking tobacco, Roulhac & Co.	6,749
Soap, F. Treukamp	6,751
Spool cotton, R. W. Ferguson	6,734
Steel pens, L. Dreka	6,741
Theatrical and gymnastic apparatus, W. Farini	6,748

DESIGNS.

Carpet, J. Magee	10,874
Carpet, J. Neil	10,875
Carpet, T. J. Stearns	10,876
Cigar box, E. Hantsche	10,873
Moulded cards, J. Hollely	10,879
Padlocks, J. Gerard	10,877
Pencil cases, C. W. Gessner	10,872
Spoon and fork handles, G. W. Hull	10,878

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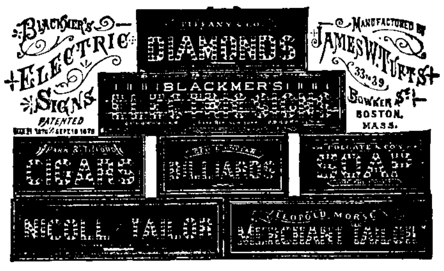

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Machine Shop,
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Dear Sir:

In reply to the letter of your Treasurer, I will just say that we have 23 of your Inspirators in actual use on our Locomotives, every one of which is giving the best of satisfaction. They are supplying all the water used by the engines to which they are attached. We find they have no equal when engines are hauling heavy trains as they are more readily adjusted, and *have greater range than any other machine*, and we do not hesitate to remove our pumps from engines having Inspirators, considering the Inspirator more reliable, and economical in the first cost and maintenance than the pumps. They are more positive in their working, and less liable to get clogged, or to break the stream when in use, and they do not require the attention of the engineer to operate them, and have *proved to be the most durable, and least expense for repairs*. We find also great advantage in their being all of one size, body and fittings, from Nos. 20 to 32 inclusive (6 sizes), and are easily changed from one engine to another if required. We have never had occasion to take one of them off for repairs, or to change its size, and we cheerfully recommend them to all R. R. companies for use.

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Master Mechanic.

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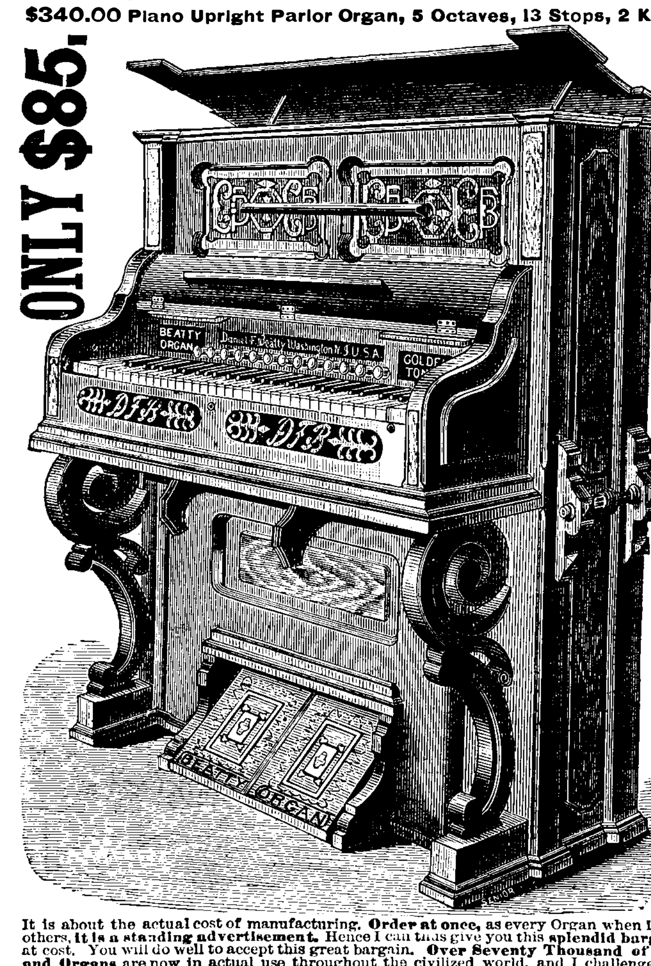

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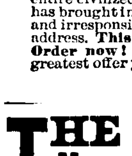

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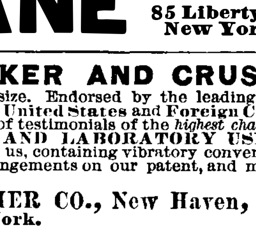

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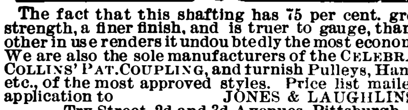

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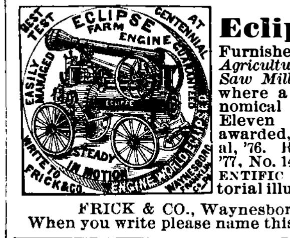

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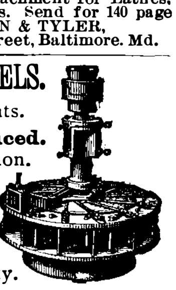

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