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SCIENTIFIC AMERICAN

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LONDON, BERRY & ORTON'S BAND SAW MILL.

Our engraving represents one of the patent band saw mills made by Messrs. London, Berry & Orton, of Philadelphia, Pa.

The general construction of this mill will be readily understood from the engraving. The working parts are all mounted on a single cast iron bed plate, so that the whole mill, down to the carriage driving pinion, is complete and self-contained. The driving belt is governed by an "idler" pulley, which, together with the feed works, is arranged so that the operator, without moving from his position, can stop or start the mill, change the feed instantly from 0 to 50 feet per minute, or change the direction of the log carriage.

These mills are built in various sizes to suit the special needs of users, the largest being capable of sawing logs eight feet in diameter. This machine appears to possess as great advantages over the circular saw mills as the latter have over the ordinary reciprocating saw mill. The kerf made by the band saw is but 1-16th instead of 5-16ths inch, as in the case of the ordinary circular saw. The employment of saws of this thickness effects a considerable saving in lumber, and also in the power required to drive the mill.

Further information may be obtained from London, Berry & Orton, successors to Richards, London & Kelley, Twenty-second street, above Arch, Philadelphia, Pa.

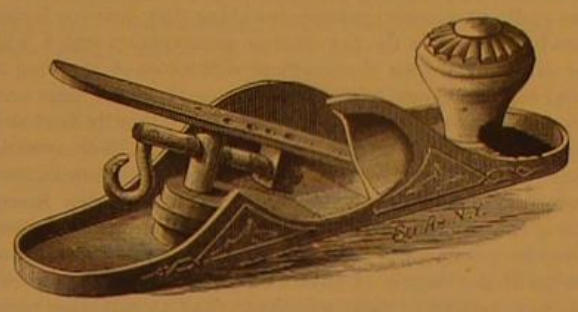
Trade Depression in England.

While our manufacturers are mostly busy, and works that have been idle for some time are brushing up, with the intention of early starting their machinery, our English contemporaries tell a sad tale about their home industries.

Taken all round, says the British *Trade Journal*, there appears to be no improvement in the prospects of trade. Cotton mills, ironworks, collieries, and manufactories of all kinds are nearly all working shorter hours, and not a few have stopped entirely. Cotton goods are reported to have been sold lately at lower prices than have ever been known before. The same might almost be said with regard to iron. Under these circumstances a reduction of wages has been a matter of sheer necessity on the part of the masters. Not infrequently it has been that employers have had to study not how to retain a profit, but how to minimize a loss. Generally speaking the laboring classes have submitted to the inevitable, but in some parts of the country the men have endeavored to hold out against the reductions.

A NEW CARPENTER'S PLANE.

The accompanying engraving shows a new adjusting device for plane bits or irons, recently patented by Mr. L. Bailey, of Hartford, Conn. It is especially designed for metallic planes, and consists in a stud which supports the bit, and is adjustable in a socket that is cast with the body of the plane. A differential screw passes through this stud, and engages a nut having a pin or stud projecting from one



BAILEY'S PLANE.

of its sides, which may be inserted in any of the several holes in the bit. The differential screw has a jointed handle which answers the purpose of a lever, by means of which the bit may be nicely adjusted.

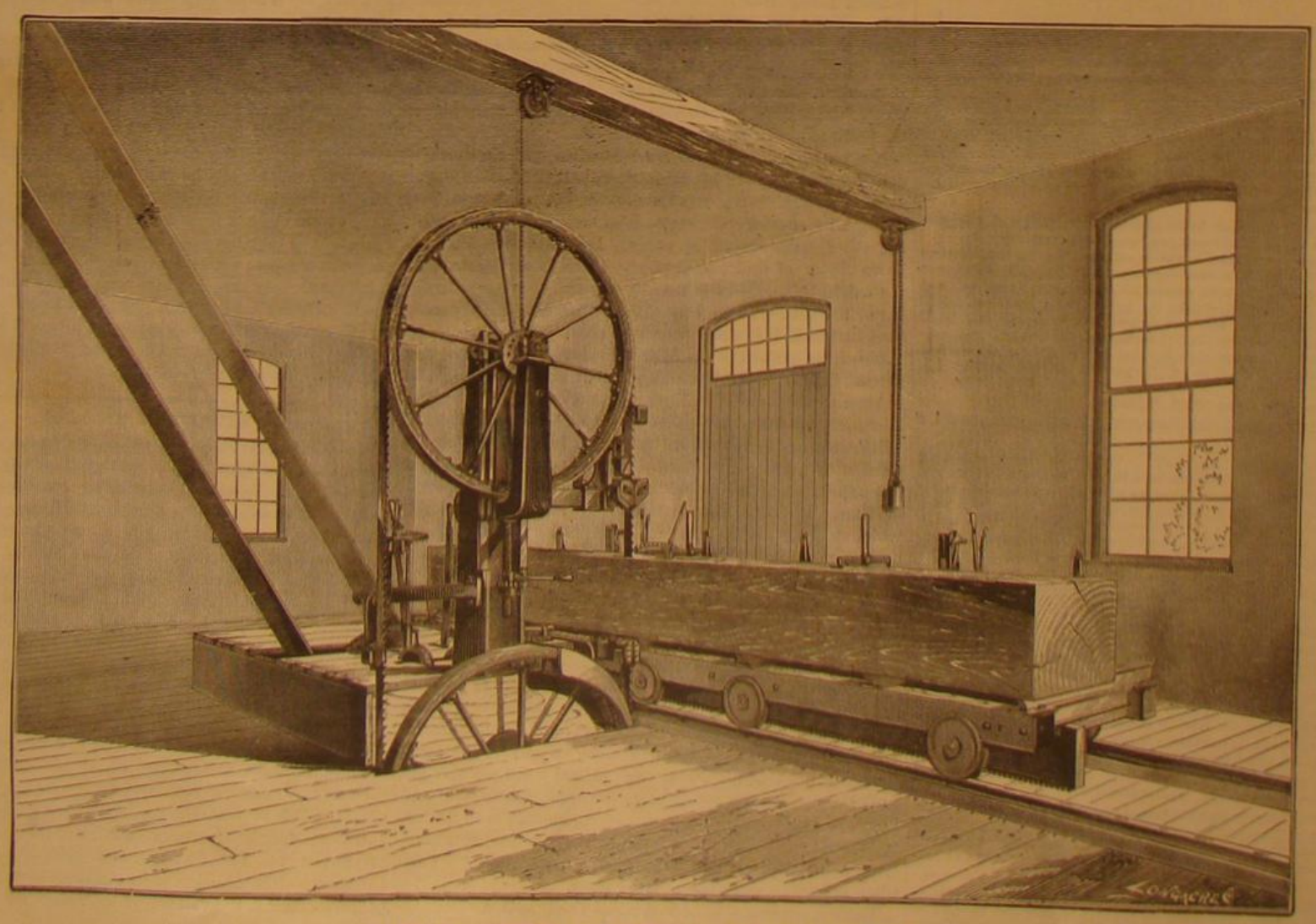
A Practical Application of the Electric Current.

A very important application of the electric current, says the British *Trade Journal*, is now being carried out by Sir William Armstrong on his estate. A volume of water descending at the outfall of a Northumberland lake has been utilized by the interposition of a turbine, by means of which the requisite revolutions are given to a dynamo electric machine. The electric current thus generated is conveyed through a stout copper wire to the private residence of Sir William at Cragside—a distance of about a mile and a half. The current is there conducted through a lamp, in which the regularity of the light is maintained by clockwork, subject to the control of an electro-magnet, which magnet reflects the strength or weakness of the current, so as to regulate the distance between the points of the carbon electrodes. It has been found necessary to provide a second wire to take the return current, so that the first cost of the light is somewhat large, but the working expense is very small. In addition to this use of the electric current as a source of light, Sir W. Armstrong intends to avail himself of the power thus brought into his house by applying it to several domestic purposes. This is to be accomplished by means of an electric engine situated in or near the house, and receiving the current transmitted from the machine at the lake outfall. In this way Sir William will be able to make a more constant use of what may be termed his electrical "plant," and thus may look forward to a satisfactory result in an economical respect. This example of the conversion and transmission of power will be viewed with great interest, the distance of a mile and a half being sufficient to indicate a much more extended sphere of action for the electric current than has hitherto been found practicable.

Toil and be Happy.

The *Christian at Work* thinks Ruskin never said a truer thing than this: "If you want knowledge, you must toil for it; if food, you must toil for it; and if pleasure, you must toil for it." Toil is the law. Pleasure comes through toil, and not by self-indulgence and indolence. When one gets to love work his life is a happy one. Said a poor man in Brooklyn, the other day, with a family of eleven to provide for: "If I were worth a million dollars, I should not wish to do much different than I do now every day, working hour after hour. I love it a thousand times better than to rest." He has for nearly half a century been surrounded by workers, and has caught the spirit of industry. He loves his work better than food or sleep. He is happy who has conquered laziness, once and forever.

A YOUNG man who gets a subordinate situation sometimes thinks it not necessary for him to give it much attention. He will wait until he gets a place of responsibility, and then he will show people what he can do. This is a very great mistake. Whatever his situation may be, he should master it in all its details, and perform all its duties faithfully.



LONDON, BERRY & ORTON'S BAND SAW MILL.

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NEW YORK, SATURDAY, JANUARY 4, 1879.

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II. TECHNOLOGY.—The Carr Disintegrating Flour Mill, with 2 engravings.—History of the American Lead Pencil Manufacture.

Inks. Recipes for several varieties of black ink, for black writing fluid, green, blue, brilliant red, carmine, violet copying, white, and three kinds of indelible inks, carbon ink, Indian ink, Japan ink, and ink powder. Gold and silver inks, ink for marking packages, purple marking ink, black and blue sympathetic inks, drawing ink, indestructible ink, shoemakers' ink. Colored stencil ink, ink for zinc tablets. Permanent ink for writing in relief on zinc. To write on silver with a black that will never go off. To prevent ink from souring. Ink eraser.

American Dairy Progress. By J. R. DODGE.

III. FRENCH UNIVERSAL EXHIBITION OF 1878.—Parian Ware, 1 illustration.

IV. CHEMISTRY AND METALLURGY.—The Direct Process of Making Wrought Iron and Steel. A paper read before the Franklin Institute. By CHARLES M. DUPUY, C.E. How to obtain iron of high value for steel. Deoxidizing iron by anthracite coal dust. Good tool steel made by a direct process. The economical utilizing of "blue billy," or the refuse ore from sulphur extraction. Phosphorus almost entirely eliminated. Economy in labor. A valuable practical description.

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VIII. ARCHÆOLOGY.—Remarkable Discoveries in Rome. Excavation of the Palatine Hill. The Ruins of the City of Romulus brought to Light. Ruins of the Temple of Jupiter Stator. The Temple of Vesta, etc. Recent Assyrian Discoveries. 4 figures.

CONFISCATION OF AMERICAN PATENTS.

Hitherto one of the special features, and, we believe, special merits, of the American patent system has been the issuing of patents for invention without restriction or drawback in the way of after charges or conditions. An inventor applies for a patent, and, if his claim is good, the patent is granted; and there the matter rests for the allotted term of years. The patentee can sell or transfer his right the same as other property. He is not obliged to develop the invention commercially, nor to pay any more fees. If through disinclination or inability the patent is not used, the right to use it is not forfeited. Of course the presumption is that the great mass of patents, if workable, will be worked, and the country will begin to profit thereby without delay. If not, the life of the patent soon expires, and the invention falls into the common stock of knowledge, to be used or neglected as its value may determine.

Our readers are aware that in the proposed amendment of the patent law (Senate Bill 300, section xi.) an attempt is made to abolish this feature of the law. The reasons for so doing are succinctly stated in the report of the Patent Committee submitted to the Senate March 8. We quote:

"One inconvenience of the enormous increase in the number of patents granted is that many of them are for things of inconsiderable practical utility. Such patents are not merely useless, they stand in the way of every future inventor who may wish to make an advantageous use of some little feature which forms an incidental part of them. There are really obstructive patents; the thing they describe is useless in itself; they do not disclose an invention which will be so valuable when the practical difficulties of applying it have been overcome as to lead any one to spend time and money in the endeavor to overcome them; they lie dead and useless, practically abandoned as worthless by their owners. Such patents have no reason for existence, for they neither constitute nor create any progress in the useful arts. Something can be done in instituting a better examination when they are granted, but not much, for attempts at the outset to judge of the degree of future usefulness are found by experience to lead to fatal mistakes. The examination must be confined to the question of novelty.

"Section 11 undertakes to extinguish these worthless patents, by requiring the payment of a fee of $50 when the patent is about four and one half years old, and $100 when it is about nine and one half years old. The sums are large enough to make an owner think twice about paying them for a patent which, after four or nine years' trial, holds out no prospect of usefulness, while at the same time they are not too onerous for patents of any value. The plan is in use in England, and in a modified form on the continent of Europe, and judging from the experience of those countries will probably extinguish one half of the patents granted. It will take hold of just those patents which, useless themselves, reappear in the form of reissues, and cause those annoyances for which the worthlessness of the invention and not the ability to obtain the reissue is really responsible."

This reasoning we hold to be clearly fallacious at several points.

Grant that many patents are of inconsiderable practical utility, shall we therefore rob the inventor of that little because it is small?

How can a patent, or the idea which it covers, be justly called worthless and at the same time desirable to another? A.'s patent is undeveloped and worthless. Why? Because B. wants to use it! "It is naught, it is naught," saith the buyer." Shall the government, therefore, agree with him to the detriment of the owner?

If a patent really lies "dead and useless, practically abandoned as worthless" by its owner, will it be killed any deader by legislative enactment? A patent that is dead through inherent worthlessness is as incompetent of harm as any other worthless bit of paper. If it has life enough to be an object of desire to anybody, there is no reason why the would-be user should not pay for the privilege of owning or using it. There is no danger that he will pay more than he thinks it is really worth to him.

But, it is argued, it is desirable to get out of the way patents that are worthless and yet may be reissued and so become troublesome. Will the reissue of a patent on an inherently worthless invention give it force and vitality?

It sometimes, indeed quite frequently, happens that an invention is "practically" worthless for many years, not through its own demerit, but because the inventor foreruns his time. Financial success implies an immediate demand, which does not always exist for an invention that is radically novel and valuable. The invention, even when unprofitable, may greatly hasten the social or industrial changes which in after years will make it a great public benefit and also a source of profit to the owner. Shall we, therefore, punish the inventor by confiscating his property because he invented too soon? In how many cases is the inventor urged on by the hope of ultimately educating the community up to the use of his invention, though the immediate prospect is blank enough, and so is encouraged to make and develop his invention to his own cost through many years? Take away the assurance that his patent once gained will hold his right until the community grows up to the appreciation of it, and you take away one of the strongest inducements to invent. "Even if I die before my reward comes," the inventor says, "the patent will remain as a legacy to my family." Very often it is all he can hope to leave them.

There is another way of looking at this question.

Suppose it true that a certain percentage of the patents issued are at once worthless and a hinderance to the progress of the arts. How large is that percentage? There are in force to-day, say, 100,000 patents; we believe that the actual number is even greater than that. How many of them are a source of "annoyance" through patent litigations and the like? To say one per cent would be a gross exaggeration, and certainly not more than half of these would have fallen under the exterminating influence of the proposed rule had it been in operation.

Accordingly, to get rid of a few patents, alleged to be mischievous, it is proposed to subject the entire class of future patentees to penalties at once uncalled for and unjust. Grant all that is charged against the "worthless" patents, so called; to get rid of them by such means would be paying altogether too much for the whistle.

AMERICAN HISTORY OF THE ELECTRIC LIGHT.

In a recent address before the Academy of Sciences, in this city, Professor Charles A. Seeley read a letter from Professor Moses G. Farmer, of Boston, in which he says that as early as 1859 he lighted up a house in Salem, Mass., by means of the subdivision of the electric light. Instead of using the dynamo-electric machine, he used a battery, and consequently, the cost of the light produced exceeded that obtained from gas. It is a singular fact in conjunction with this that, according to Professor Farmer, the lights thus obtained were turned on or off by means of platinum wires attached to buttons. For nearly a year, the professor alleges, the house in Salem was thus lighted, and that the fact is well known by the residents of Salem, and scientific men who visited the place from other towns and gazed with wonder at the extraordinary brilliancy of the light. Professor Seeley maintains that although the light generated by Professor Farmer by a battery was ascertained to be expensive, now that Siemens, Wallace, and Gramme dynamo-electrical machines have been so much improved, the light can be generated for but a trifle of the cost of carbureted hydrogen gas.

"No doubt," Professor Seeley said, "you think it strange that one electrician says he gets but 300 candle power per horse power from a dynamo-electric machine, while another says he gets 600 candle power per horse power. Probably both averments are correct. The trouble is that one is further advanced in the science than the other. The Messrs. Siemens, the well known English electricians, say that one pound of coal will produce fifteen times more light in connection with a dynamo-electric machine than will be produced by the same amount of coal turned into gas."

THE SOUTH AS A COMPETITOR OF ENGLAND.

Recently an address was delivered in Blackburn, England, before an audience of two or three hundred mill managers, overlookers, and their friends interested in the cotton industry.

The subject under discussion was the chances of England in the matter of foreign competition. After speaking of the natural advantages of the United States for producing cotton and feeding operatives, the lecturer called attention to a fact of infinite importance which is lost sight of by those who consider the power of America to enter into competition with England. "They look simply to the Northern mills, but there is a cotton industry growing up in the Southern States. It is only equal at present to one tenth of the entire United States cotton industry; but the Southern manufacturers claim to have advantage over the Northern manufacturers. They have an abundant supply of water, which is available all the year round, instead of being subject to interruption in the winter owing to frost. They have cotton close to their doors; they have a more favorable climate, and they have equally good ports of shipment, and they can compete with their rivals. If, then, the Northern mills are already entering into competition with us, and the Southern manufacturers can compete successfully with the Northern manufacturers, what is the prospect for us? The position likely to be assumed by the Southern States is a matter of infinite importance to us."

WILLIAM H. RULOFSON.

Mr. William H. Rulofson, the photographer of San Francisco, Cal., met with sudden death in that city on the 2d of November last, by accidentally falling from the roof of a new building of which he was proprietor. His age was 52 years. His decease has cast a deep gloom over a large circle of devoted admirers and friends. He was a man of rare activity, enthusiasm, and capacity. He was president of the National Photographic Association, and enjoyed the highest esteem of the members. His practical sagacity and strong common sense made him a most useful and prominent man in the community; while his genial, kindly disposition greatly endeared him to all who enjoyed his acquaintance. He leaves a wife and ten children.

An Important Railway Decision.

The United States Supreme Court has decided that the Stevens car brake is not an infringement on the Tanner patent. This reverses the decision of the United States Circuit Court for the Northern District of Illinois, in the case of Sayler *vs.* The Chicago and Northwestern Railway Company. The decision is based entirely on the question of infringement, the validity of the patent not being passed upon.

A SCIENTIFIC INVENTION WANTED.

The microphone has been successfully employed in Italy in studying volcanic and earthquake noises. In some experiments made at Vicenza the telephone emitted sounds which only could be attributed to subterranean agitations. Accordingly Professor de Rossi, of Rome, determined to make some further experiments in an underground observatory of his own at Rocca di Papa, situated on the Alban hills, on the edge of the crater of an extinct volcano. A special microphone, capable of being attached firmly to the rocks so as to feel any motion there might be, was carried down with great care into the observatory, and the reality of the mysterious noises was soon demonstrated. Though uncertain as to their causes, Professor de Rossi was soon able to divide the noises into three classes, which he calls rumblings, musketry reports, and metallic or bell-like sounds. He also discovered that the sounds were periodical at intervals of an hour, or half an hour, or even smaller fractions.

On the night of the 22d of September, at the hour when the explosions of Vesuvius and its eruptive cone were most vigorous, the microphone on the Latin hills was in the greatest agitation. On the following days the same sounds continued, following more or less exactly the course of the eruption of Vesuvius. Wishing to complete his evidence, Professor de Rossi determined to carry his microphone to a place where there was no doubt of being on ground vibrating from inner causes—to the side of Vesuvius and the Solfatara of Pozzuoli. Professor Palmieri not only put at Professor de Rossi's disposal his observatory, but did all in his power to make the experiment a fair one, himself watching at the outer door to prevent all intrusion or accidental noises. They wished here to establish the connection between the motions of the seismograph and the sounds communicated by the microphone. To ascertain this, one of the assistants of the observatory stood over the seismograph to mark the motions with signs previously agreed upon, to record the agitation preceding a shock, the actual shock itself, and whether the motion was undulatory or perpendicular. At the same time the sounds of the microphone were noted, and found to correspond exactly with the motions of the seismograph, and each different motion corresponded to a different sound. In this way it was possible to ascertain the value of the different sounds, which had naturally been impossible at Rocca di Papa; and it appeared that the perpendicular motion corresponded to the musketry reports, and the undulatory to the rumblings; while very often there was an uncertain sound, as had been noticed at Rocca di Papa.

Even more significant results were obtained by observations at the Solfatara of Pozzuoli. It was evident both at Vesuvius and at the Solfatara that the microphone was registering shocks of earthquake otherwise imperceptible; and, as the same sounds had been observed by Professor Mocenigo at Vicenza and Armellini at Rome, there can be no longer any doubt of the existence of microseismic vibrations of the earth as discovered by Bertelli and maintained by Professor de Rossi.

What is now wanted in the application of the microphone to meteorology is to obtain an instrument which will mark automatically all the variety of sounds which the microphone conveys to us; and this will be the much desired "panseismograph," which will show the number, form, and every variety of the vibrations of the earth.

MINING NOTES.

Notwithstanding the incorporation in San Francisco, in the past two weeks, of twenty mining companies with an aggregate capital of over $200,000,000—a significant indication of the spirit still existing there—the legitimate mining interests of California and Nevada continue to improve and invite attention, and quite a number of mines are spoken of as paying well, under proper management, with ores averaging only from $20 to $30 per ton. Among other reports is one that a prospector, while recently exploring on the west side of Bodie Bluff, laid bare with a few strokes of a pick an 8 inch vein of white quartz, almost filled with solid gold, and that the samples assayed over $40,000 per ton in gold and $1,500 in silver. The finding of such hand samples is not unusual, and it has not heretofore been very difficult to "get up" companies on them, but there are many unfortunates who have reason to believe that the "hand samples" contained more gold than all the rest of the mine.

The Standard Mine, of Bodie District, has made a month's shipment of $87,400. New cross cuts and new shafts are being vigorously pushed, and everything is looking well.

In San Bernadino county the finding of a rich ledge of tin ore is reported, many specimens of the ore assaying 40 per cent of tin. Rich and extensive discoveries of chrome are reported from San Luis Obispo. The Extra Company's mine, Copper City, Shasta County, continues very uniformly to ship about $1,000 per diem from a 10 stamp mill, and other mines there are prospering.

On the Comstock lode of Nevada the 2,200 foot drift of the Sierra Nevada has penetrated ore assaying from $80 to $100 per ton, and the vein so far as opened promises, it is said, to be one of the finest ore developments ever made on the Comstock. The lower levels of the Bonanza mines are gradually cooling, and the men are being put to work in them again.

The south lateral branch of the Sutro Tunnel is making excellent advance toward the Julia shaft, but owing to the great heat at the face of the header, 100° Fah., the workmen are on six hour shifts.

The Homestake mine in the Black Hills, with its 80 stamp mill, is crushing about 175 tons per day, of an ore yielding about $9 per ton. The cost of its mining and milling ranges from $2.50 to $3.50 per ton, showing a profit of about $1,000 a day. The October run was $52,000, and expenses $16,000. There could be no better evidence of good mining management than the profitable working of a $9 ore; and those who have grown despondent over their poor mines may now take courage. Indeed, we learn that already many idle mines are resuming work.

How profitable some of these long idle properties have become since reopened is shown in Colorado in the cases of the California and its western extension, the Hidden Treasure. The latter has yielded nearly or quite $180,000 since last February, with a profit of late of from $10,000 to $16,000 per month; and the California is gradually becoming equally profitable, although not sufficiently opened yet to permit of the yield that can be relied on in the coming winter and spring. The Mayflower and Lafayette mines, owned in New York city, are being developed steadily, and show ore in all the shafts as well as in the tunnel. Rich strikes were lately made in both veins, and the production will be large and regular as soon as the requisite developments are effected. The last body of ore opened mills 217 ounces of silver.

On the north shore of Lake Superior free gold tellurides, with copper pyrites, are reported as occurring in large veins, never assaying less than $50 per ton. The Victoria mine, near the Sault Ste. Marie, has developed some fine ore, running 165 ounces of silver and 25 to 65 per cent of lead.

The approach of winter threatens no relaxation of mining enterprise in any direction, and with scarce an exception the prospects are better than ever before.

ALLOYS.

In one of our foreign exchanges we find a description of some very beautiful alloys, applicable as substitutes for gold and silver in the manufacture of jewelry and similar purposes, which have been produced by Messrs. Meiffren & Co., of Marseilles.

To make an alloy having the color and appearance of gold, they place in a crucible copper as pure as possible, platinum, and tungstic acid in the proportions below stated, and when the metals are completely melted they stir and granulate them by running them into water containing 500 grammes of slaked lime and 500 grammes of carbonate of potash for every cubic meter of water. This mixture, dissolved in water, has the property of rendering the alloy still purer.

They then collect the granulated metal, dry it, and after having remelted in a crucible, they add a certain quantity of fine gold in the proportions hereinafter specified. An alloy is thus produced which, when run into ingots, presents the appearance of red gold of the standard $\frac{750}{1000}$, and to which may be applied the name of "aphthite" or unalterable.

They can change the color of the alloy by varying the proportions of the different metals. As flux they use boric acid, nitrate of soda, and chloride of sodium, previously melted together in equal proportions. The proportion of flux to be employed is 25 grammes per kilogramme of the alloy. The proportions they employ, by preference, for producing an alloy of red gold color are: Copper, 800 grammes; platinum, 25; tungstic acid, 10; and gold, 170 grammes.

The alloy used in imitation of silver consists of iron, 65 parts; nickel, 23 parts; tungsten, 4 parts; aluminum, 5 parts; and copper, 5 parts. The iron and tungsten are melted together and then granulated, as in the case of the previous alloy, except that in this instance the water into which the mixture is run contains one kilogramme of slaked lime and one of carbonate of potash per cubic meter.

The nickel, copper, and aluminum are also melted together and granulated by running into water containing the same proportions of lime and potash. Care should be taken during the melting to cover the metals contained in the two crucibles with a flux composed of one part of boric acid to one part of nitrate of potash or niter.

In the crucible containing the aluminum and copper they place a lump of sodium of about two grammes in weight when treating five kilogrammes of the three metals (nickel, copper, and aluminum) together to prevent oxidation of the aluminum, and they also add charcoal to prevent oxidation of the copper.

Before granulating the metal in each crucible, it should be well stirred with a fire-clay stirrer.

The granulated metals are dried, as in the former case, then melted together in the same crucible in the proportions above indicated, and well stirred, after which the alloy is run into ingots.

The alloy thus obtained, to which may be given the name of "sideraphthite" (or unchangeable iron), presents the same white appearance as platinum or silver, and is not more expensive than German silver. These improved metallic alloys are capable of resisting the action of sulphureted hydrogen, are unattacked by vegetable acids, and but slightly attacked by mineral acids; they are also perfectly ductile and malleable.

New View of Infection.

The theory that very small organisms, either vegetable or animal, are the cause of all infectious diseases, is very generally accepted at the present day. It passes as established and almost mathematically proven, because this theory alone is able to explain for us a series of phenomena that would otherwise be totally inexlipcable. Hence the *alpha* and *omega* of all precautions directed against infectious diseases and epidemics consist in combating and destroying these organisms.

THE BREEDING OF EELS.

The mystery which has hitherto attended the propagation of eels has at last been cleared up by the discovery of ripe ovaries by Professor Baird, and more recently Professor Packard's discovery of a male eel. Professor Baird's observation was made last year, but it was not confirmed until Mr. Eugene G. Blackford pointed out the ovaries to fishermen, fish dealers, and others, about Fulton Market a little while ago. Curiously the charged ovaries have been in plain sight from the first, the minuteness of the eggs causing their character to be unsuspected. "Oh, yes; that is what we call eel fat; it is always plenty at this time of the year," said the fishermen, when their attention was called to the egg mass. After showing the ovaries to his eel dressers, Mr. Blackford directed them to watch for any departure from the usual appearance—thus far without success. The question of the eel's sexuality has been set at rest, however, by Professor Packard's discovery. The male eel appears to be very rare. The ovaries of an eel weighing six pounds were examined recently by Mr. Frederick Mather, who found the eggs to average $\frac{1}{16}$ of an inch in diameter. Mr. Mather then proceeded to estimate the number of eggs contained in the eel, which was done by carefully subdividing the mass until a quantity which could be counted was obtained, and then the number of eggs was multiplied by the number of divisions. The mass was halved, quartered, etc., 17 times, making the last section 1-131,072 of the whole. To avoid error, this was done three times, giving the first time 68 eggs, or 8,912,896 in the whole. The second trial gave 77 eggs, or a total of 10,092,544, while the third yielded 71 eggs, which showed the mass to contain 9,306,112.

Considering the minuteness of the eggs, these different results are remarkably near each other, and Mr. Mather fixes the numbers contained in this individual fish at 9,000,000, which, when we consider that each of the ovaries was nearly a foot in length, and about a half inch in diameter at the thickest part, does not seem to be at all exaggerated.

SANITARY USES OF GUNPOWDER.

A correspondent writes us from the Sandwich Islands saying that during a long life spent in tropical fever districts he has been able to escape infection and miasma by the use of gunpowder, supplemented by a few simple precautions against sudden changes of temperature, sunstroke, bad water, and the like. He uses no water that has not been boiled and afterwards kept from air contact; but his main reliance is upon the practice of burning a thimbleful of gunpowder in his bedroom and very small quantities in his trunk, wardrobe, etc., so as to keep his clothes in an atmosphere feebly charged with gunpowder gas. In Madagascar, Reunion, Mauritius, the East Coast of Tropic Africa, and other fever-smitten lands he has found such simple means a sure preventive of epidemic and endemic diseases, and has thereby been often brought to the philosophic reflection that gunpowder is destined to invert the aim intended by its fabrication.

HAIR ON THE MUSK TURTLE.

Mr. Carl F. Gunther says that he has observed on the common musk turtle (*Test. moschata*) a growth of hair similar to that of the hairy turtle figured in a recent number of the SCIENTIFIC AMERICAN. On a young one, which he caught last fall, in a swamp in Westchester County, N. Y., the fine hairs could be readily distinguished by the aid of a magnifying glass. It sometimes happens that a semblance of hairiness is produced by vegetable growths on the shells of these sluggish creatures living in swamps. Possibly our correspondent may have been misled by such an appearance.

THE CONSTITUTION OF MATTER IN THE GASEOUS STATE.

The development of the kinetic theory of gases covers an enormous advance toward the solution of the great problem of the constitution of matter—a subject, withal, of extreme importance just at this time in view of Mr. Lockyer's reported resolution of the problem. Whether all matter is proved to be fundamentally one, as Mr. Lockyer asserts, or of several irreducible elements, as chemists have believed hitherto, the discoveries made during recent years with regard to the constitution of gases will mark an era not only in the history of chemistry, but in the wider history of human effort to penetrate the secrets of nature.

A masterly review of what has been done of late years in this direction will be found in the SCIENTIFIC AMERICAN SUPPLEMENT (No. 156), from the hand of Professor Charles Adolphe Wurtz, of the Ecole de Médecine, at Paris. Nowhere will the student find a more compact, lucid, and thorough explanation of the physics and chemistry of matter in the gaseous state. We may add that in furnishing, for the small sum of ten cents, articles of such sterling and especial value, the SUPPLEMENT is doing for American readers what has never before been attempted in any country.

Manufacturing Industries.

Believing that the readers of the SCIENTIFIC AMERICAN will be interested in a series of articles on some of our largest manufacturing industries, we have in preparation engravings for illustrating and describing several of the most important establishments in the country. The first of the series will be a representation and description of the interior of Lorillard's Tobacco Factory, Jersey City, and will appear in the next issue.

THE RAPIEFF ELECTRIC LIGHT.

This light has passed the experimental stage, and is actually employed in the printing office and composing rooms of the London *Times* newspaper.

The chief novelty of the system consists in the use of four carbons, instead of the two which, in nearly every other arrangement, form the points between which the luminous arc is produced. These carbon rods, instead of being placed parallel with one another, are so inclined that their points meet. Or to put the matter more clearly, the two upper carbons form the letter V, while the two others, forming the same letter upside down Λ, are placed so that the combination represents an X. But the lower pair are set at a right angle to the upper. In plan, therefore, the four rods would form a cross.

One great advantage in M. Rapieff's system is that a nearly burnt-out carbon may be replaced by a fresh one without any stoppage of the light. This operation, too, can be performed without the intervention of a skilled worker. In Fig. 1 the attendant—protected from the glare of the naked light by a small screen of colored glass—is in the act of replacing one of the negative carbons. The right hand lamp is shown as commonly used, with the light softened by a globe. The screw, S, in both lamps, is the means whereby the distance between the two pairs of carbons is regulated and kept constant. Indeed, we understand that the size of the arc can be so adapted to the current supplied, that a lamp can be made to represent the value of 100 gas flames, or of merely 10.

This system can be used with a magneto-electric machine of any pattern. The lights have each an independent existence, that is to say, one or two can be extinguished without affecting others in the same circuit. And the system offers the advantage of satisfactory subdivision without very great loss in the individual intensity of each light.

The carbons, as they consume away, are made slowly to approach each other, so that the arc is always of the same width, and keeps its fixed position in the space. To this effect the carbons are directed together over small pulleys at *d* (Fig. 2). The directing force is supplied by a lead weight or counterpoise, *w*, of about three pounds, which slides down the brass stems *s s'*. The weight is supported by two silk or asbestos cords from the outer ends of the carbon sticks. In this way the descent of the weight draws the four carbons equally together as they are wasted away. A curved reflector of silvered brass or porcelain is fixed a little above the inner ends of the upper carbons. By means of the screws, *f* and *e*, the width of the arc is adjusted, and by similar screws the angle at which the lower points face the upper ones can be varied, so as to direct the arc to one side or the other. The wooden base, B, carries four terminals for connecting the wire conveying the current. The base is hollow, and contains an electro-magnetic apparatus for starting the light. At first the carbon points are in contact, but when the current is put on, it passes through a dual electro-magnet in the base, the armature of which is attracted upward and pushes a rod up the hollow stem, *s'*. This rod allows the lower carbon to drop away from the upper to the full width of the arc as previously adjusted. The positive and negative currents pass to their respective upper and lower carbons by means of the stem, *s s'*, and the curved brackets. With carbons 20 inches long and 5 millimeters in diameter, the light is maintained for seven or eight hours, and with those 6 millimeters thick it is kept up for nine or ten hours. The light is equivalent to from 100 to 120 gas flames, or say about 1,000 candles. The smallest form of the lamp made gives a light estimated at five gas flames. M. Rapieff is now constructing a form of lamp made to burn upside down, in order that it may be fixed on the ceiling of rooms. Mica plates are sometimes used to screen off the heat from the cords when they are of silk. The resistance of the arc is only two or three ohms.

Fig. 1.—THE RAPIEFF ELECTRIC LIGHT.

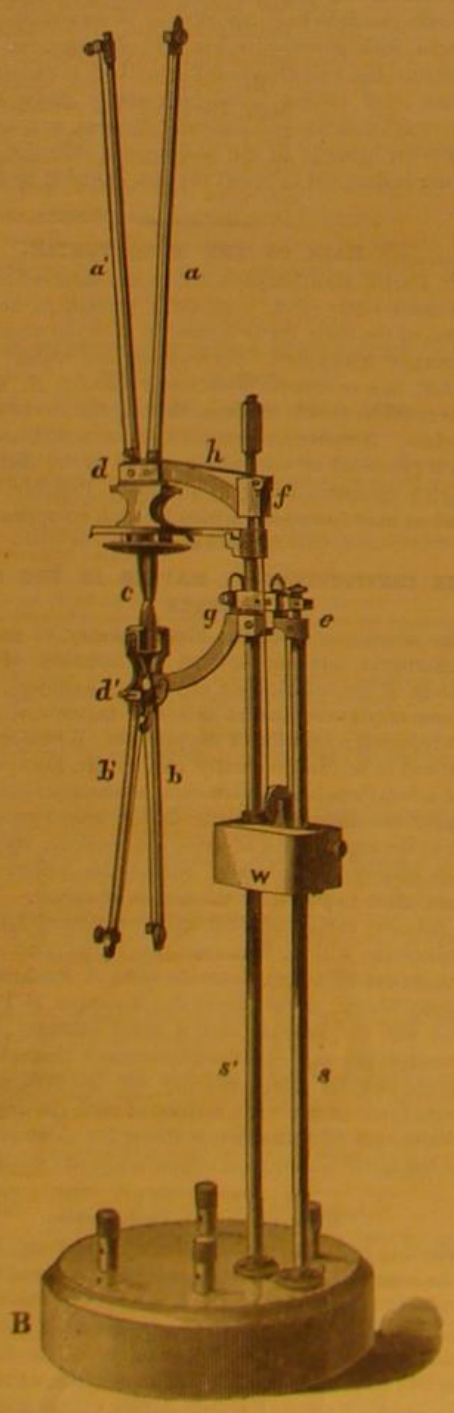


Fig. 2.—THE RAPIEFF ELECTRIC LAMP.

Fig. 3 represents a modified form of Rapieff's lamp. In it the carbons are simply inclined to each other at an angle which can be regulated by screws, *d d'*. The width of the arc can also be regulated by the same screws. The carbons are drawn together by the descent of a counterpoise, *w*, in a similar manner to that above described. In the lamp the planes of the carbon pairs are parallel to each other. A cylinder of lime, *c*, is supported over the arc, and becoming luminous increases the illuminating power of the arc by about 40 per cent. The carbons M. Rapieff employs are made by M. Carré. The light is very pure and white, and can be considerably varied in intensity by the adjusting screws. Gramme's dynamo-machines are at present used in the *Times* office, but we believe that M. Rapieff has patented one of his own. There are six lamps in each circuit in the *Times* office, but M. Rapieff has successfully exhibited as many as ten.

Action of Water and Salt Solutions on Zinc.

The results of a series of experiments made upon this subject by Snyders may be given briefly as follows:

1. Zinc decomposes salt solutions, concentrated as well as dilute, without access of air or oxygen. Hydrogen is liberated, and oxide of zinc is formed.

2. The solubility of oxide of zinc in the salt solutions hastens and aids the reaction.

3. Oxide of zinc dissolves in solutions containing but 1 per cent of salt, or even if more dilute. The solubility in different salts is different, being greatest in ammonia salts. It seems to be due to the formation of free alkali, inasmuch as it can exist in solution with a double zinc salt at certain temperatures and by certain concentration. Zinc carbonate and hydrate are not soluble in the carbonates. The solubility of zinc oxide increases as the temperature and concentration increase.

4. If the salt solution is saturated with oxide of zinc the decomposition does not go any further, but the zinc oxide formed subsequently remains undissolved. But few experiments have been made in this direction, and others will be instituted by the same person.

5. With access of oxygen free from carbonic acid the oxide dissolves more rapidly because the zinc oxidizes at the same time. The salt aids this oxidation, not directly, but by keeping the surface clean. This, too, requires to be substantiated by further experiments.

6. The solvent action is somewhat retarded by the carbonic acid of the air, owing to the formation of some basic carbonate upon the surface of the zinc.

7. The decomposing and solvent action is greatest in the case of the chlorides and with potassium sulphate, weaker with the nitrates of the alkalies and of barium, and for magnesium sulphate.

8. Zinc does not decompose solutions of alkaline carbonates or sodium phosphate in the absence of air. With access of air but little zinc is dissolved by one per cent solutions, because the zinc is protected by the zinc carbonate or phosphate formed by the reaction. In diluter solutions somewhat more zinc oxide is dissolved.

9. The action increases with increase of temperature; at the freezing point of water it is very slight.

10. Solutions of ammoniacal salts take up more zinc than the solutions of the salts of the fixed alkalies. The zinc remains bright in these solutions, and nothing separates, even if oxygen or air is permitted to enter.

11. Hard well water does not act upon zinc, even with large percentages of chlorides and sulphates. Soft water dissolves more zinc in proportion as the amount of chlorides, sulphates, and nitrates exceeds that of the carbonates and phosphates.

The poisonous nature of zinc salts, even in small doses, renders the above research of more than ordinary practical interest.

THERE is no simpler or better remedy for frost bites than the following: Extract the frost by the application of ice water till the frozen part is pliable, avoiding all artificial heat; then apply a salve made of equal parts of hog's lard and gunpowder, rubbed together until it forms a paste, and very soon the frozen parts will be well.

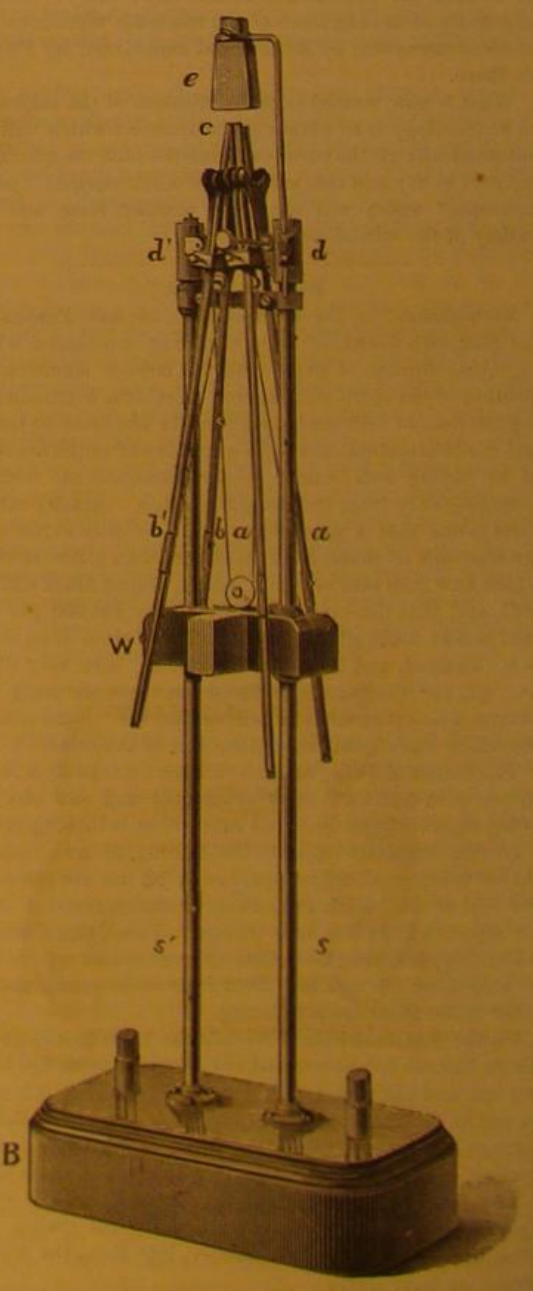


Fig. 3.—MODIFIED FORM OF RAPIEFF LAMP.

A NEW FOOT LATHE.

It is an important matter for an amateur or mechanic doing work with small tools to procure such implements as will be a source of profit, pleasure and satisfaction, instead of lasting regret that tools of another make were not purchased. Among such tools a lathe is an important item, and once purchased is not likely to be soon exchanged. A lathe which appears to fulfill all reasonable requirements is shown in the accompanying engravings. The chief novelty of this

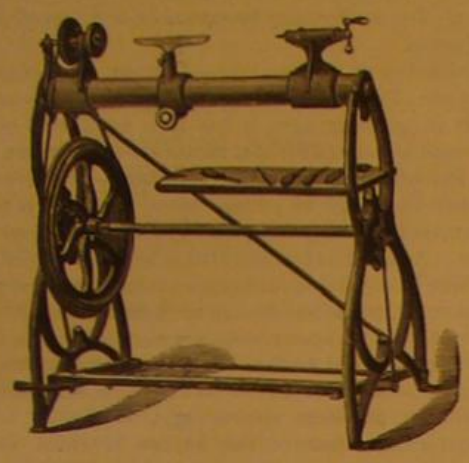


Fig. 1.—MARSH'S CYLINDER BED FOOT LATHE.

lathe is its cylindrical bed, which possesses many advantages which will be apparent to our readers. The bed is 36 inches long, and the head, tail, and tool stocks are bored to fit it.

The head stock is fastened permanently with a set screw. The tail stock traverses the whole length of the bed, and is kept in line with front center by a groove in the bed, and is readily fastened at any point by turning a hand screw, which is on the back side of lathe and not shown in cut. The tool stock also encircles the bed, moves back and forth readily, and rocks to and from the work. It is sawed open on the bottom, and provided with a screw, which is sufficient to hold it at any point by a single turn of the hand. It has a steel mandrel, two steel centers, two T rests, and a tool shelf.

It has a brass box in front journal, and true bored iron bearings throughout. It has a three cone grooved pulley, turned up true, and polished. The balance wheel is turned and grooved to correspond with cone pulley, and is weighted to counterbalance the treadle. The crank shaft runs the whole length of lathe, resting in Babbitted journals, and has a crank on each end, thus avoiding any unequal strain upon the frame, and securing steadiness. It runs lightly and freely, with high speed.

This lathe has three useful attachments: a circular saw attachment, a bracket moulding device, and a scroll saw. The circular saw attachment, shown in Fig. 2, is easily applied, and the table, which is a light iron one, dressed up true, is supported by a standard set in the tool stock, and admits of being rocked and tipped so as to saw any bevel desired. It has two light running metal gauges for slitting and cutting off.

The scroll saw attachment (Fig. 3) is very simple, and useful for sawing all kinds of scroll and fret work. It is readily attached or detached without pulling the lathe in pieces. The driving attachment of the saw has a perpendicular stroke, which is important in the perfect working scroll saw. The spring and tension are firmly attached to the tail stock without the removal of a bolt or screw. The table tilts 45° without losing its central position, and the swing around under the arm is 25 inches.

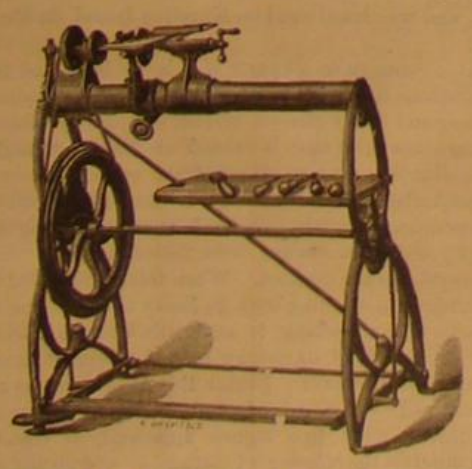


Fig. 2.—LATHE WITH CIRCULAR SAW ATTACHMENT.

The attachment shown in Fig. 4, for moulding and ornamental brackets and other scroll work, adds, with very little expense, a very desirable feature to the foot lathe. The standard of the table is threaded, and is adjusted up and down by turning it around. The capacity of the cutter is such as to follow the scroll saw into very delicate points, and open and mould them so as to give the work a more open and light as well as a more ornamental appearance. The cutters have double cutting edges, and cut as well when revolving one way as the other.

This lathe is manufactured under the recent patent of E. A. Marsh, by the Battle Creek Machinery Company, Battle Creek, Mich., from whom further information may be obtained.

Recent Engineering Inventions.

Mr. Erastus B. Kunkle, of Fort Wayne, Ind., has patented an improved Gauge Cock for Steam Boilers, which consists of a tube having its upper end closed by a nut, through which the valve stem passes, and provided with a vacuum chamber between the nut and the discharge pipe, for preventing the steam or water from passing through the threads of the nut and scalding the operator. It has a valve seat at its inner lower end, as near as possible to the boiler, leaving no space for sediment or scale to collect and clog the valve.

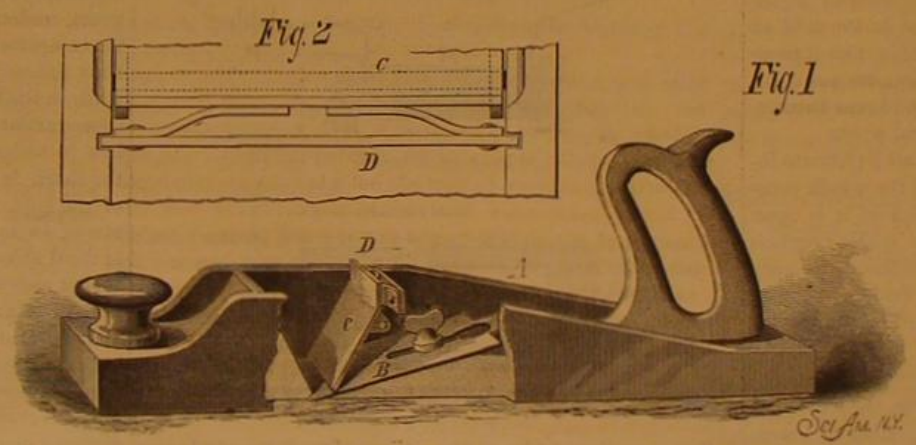
An improvement in Drilling Machines for Artesian and other Wells has been patented by Mr. Jesse Button, of New York city. The object of this invention is to construct the framework and machinery used in boring artesian and other wells in a compact and convenient form, for saving labor and space, and to enable the machine to be conveniently moved from place to place.

A NEW BENCH PLANE.

The accompanying engraving represents an improved bench plane, recently patented by Mr. Patrick Gallagher, of Eureka, Nevada. In Fig. 1 the side of the plane is broken away to show the internal construction, and Fig. 2 is a detail view of the cap supporting device.

The improvement is applicable to either a jack plane, fore plane, or jointer, of wood or iron.

The iron or bit, B, is screwed by a clamp screw in the body of the plane, A, forming a small angle with the bottom of the plane, and it is held in position near its cutting edge by the cap, C, which is pivoted on a pin that runs transversely through the plane. The position of the cap above its pivot is pressed forward by two strong springs that are



GALLAGHER'S PLANE.

supported by a cross bar, D, fitted to slots in the sides of the plane. These springs keep the cover down on the lower end of the bit or iron, holding it firmly in place. As the cutting iron lies more nearly flat than in ordinary planes it will make a smoother surface, and it is more easily adjusted than irons fastened with a wedge in the usual way.

New Inventions.

Mr. Jonathan Miller, of Trenton, N. J., has patented an improved combined Urn and Water Bottom. This is a stoneware receptacle for beverages, provided with a water bottom having communication with two tubes formed upon the outside of said urn, into one homogeneous piece therewith.

Mr. Eliot S. Hunt, of Elizabeth, N. J., has patented an improved Gate Hinge, constructed so that the gate when closed may be in line with the fence, and will allow the gate to be swung back against the fence without straining the hinges.

Mr. Francis Keil, of New York city, has devised an improvement in that class of Cylinder Latch Locks which cannot be opened from the outside of the door without its own especial key. It is simple in construction and not liable to get out of order.

Mr. John S. Birch, of Orange, N. J., has patented an improved Gun Wiper, having a novel device for connecting the wiping head to the rod, whereby the variations in the sizes of the screw shanks of different heads will not interfere with connecting different heads with the same rod.

An improved Device for Forcing Air into and through the Water contained in Wells, cisterns, tanks, and other vessels to purify it, has been patented by Messrs. Jerome S. Higgins and Riverious T. Higgins, of California, Mo.

Mr. John H. White, of Huntsville, Ala., has patented an improved Match Splint, which is triangular in form. The advantages claimed are a saving in material, producing with a minimum expenditure of material a strong splint. The sharp angles of the splint afford a ready and effective medium for rapidly communicating the flame from the head to the body of the splint, and, as a larger number of splints can be cut from a given quantity of wood, it follows that for purposes of transportation a given number of splints can be packed in a smaller space.

An improvement in Adjustable Sieves has been patented by Mr. John Dildine, of Milton, Pa. The object of this invention is to furnish an improved sieve for sifting flour,

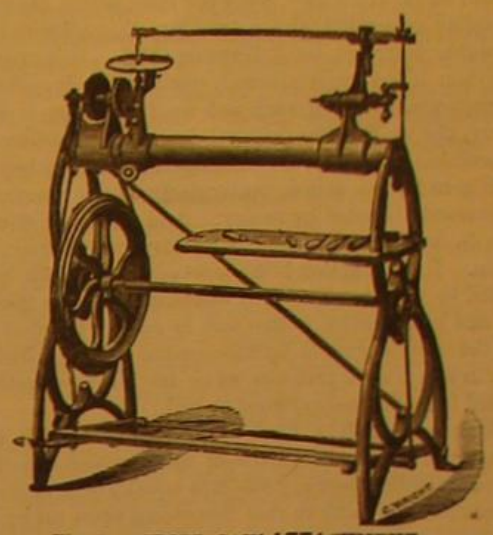


Fig. 3.—SCROLL SAW ATTACHMENT.

meal, seeds, and other things requiring to be sifted or separated. It is so constructed that it may be readily adjusted to make the meshes smaller or larger, as may be required.

Mr. Henry Hardick, of Liberty, N. Y., has patented an improved Fence. This invention consists in a metallic post having an anchoring cross bar or foot cast upon its lower end, and buttons upon one of its vertical sides, for the attachment of the wire rails; an intermediate stay post is also provided, which anchors a vertical cross tie connecting the longitudinal wire rails.

Mr. Louis R. Sassinot, of New Orleans, La., has invented an improved Portable Furnace. This invention is designed for portable clay furnaces to provide a basket frame that will at the same time serve as a permanent support.

Mr. Simon H. Wiesedeppe, of Seneca, Kan., has patented an improved Animal Trap, which is simple in construction, inexpensive, and reliable, catching the animal and holding him securely without hurting him, and without alarming other animals that may be near.

Mr. Heinrich Baum, of Höchst-on-the-Main, Germany, has patented an improvement in Coloring Matters to be used as Dyes. This invention consists in manufacturing red, yellow, and brown colors from the two disulphobetanaphtholic acids by means of diazo compounds of xyloidine.

Mr. Benjamin Landon, of Canton, Pa., has devised an improved Mouth Piece for Mail Bags, that can be easily and quickly opened and closed, and that will remain open when matter is being taken from the bag without being held, but at the same time can be securely closed and locked.

A Hose Cart, which may be used to transport hose from place to place, and in which the motion of the cart is made available for winding or unwinding the hose rapidly without straining it, has been patented by Mr. John Wilz, of Santa Cruz, Cal.

Mr. Andrew Sheridan Burt, of Omaha, Neb., has patented an improved Tent, having a double row of eyelets or grommets along the edges of the sections of canvas which form

Fig. 4.—BRACKET MOULDING ATTACHMENT.

the ridge, and having flexible knotted chain loops adapted to be laced diagonally.

Mr. Paren England, of Lincoln, Neb., has devised a combined Sash Lock and Weather Strip, designed to both lock the sash in any position, and at the same time totightly close the joint between the sash and the framing, to prevent the entrance of cold air, dust, or snow.

Theory and Practice.

At a recent meeting of the California Academy of Sciences, Professor Joseph Le Conte remarked as follows:

There is a common, deeply rooted prejudice in the popular mind—and it seems to be affecting even scientific men, on the one side, as well as practical men on the other—that there is a kind of antagonism between theory and practice.

Now, so far from this being the case, a true theory is indissolubly connected with a true practice. There is an indissoluble marriage bond between them. It is even closer than this: it has the relation of spirit and body. Science is a complex web, woven warp and woof; the warp is scientific theory, the woof is the material derived from nature. It is impossible that one should exist apart from the other. Every intelligent human action, particularly of the complex kind, is necessarily guided by theory. And this is the true difference, in fact, between human activity and ordinary animal action. Human action is the most complex, and it is always guided by theory. The only difference between good practice and bad practice is that one is guided by good theory, and the other is guided by false or bad theory. But all human action which pretends to be intelligent or rational, is guided by some theory, good or bad.

There is, I admit, a kind of theorizing, a spirit of theorizing, and a theoretical habit of mind, which is destructive of good practical work. But it is equally destructive of true science also. I refer to that theorizing upon an unsubstantial basis, that theorizing merely for the sake of theorizing, and merely for the pleasure of the intellectual activity of theorizing—merely for the self-complacent contemplation of the beauty of the theories that we create out of our minds. In this case the whole web, woof and warp, is woven out of the human mind, without the material being furnished to it by nature. It is like castle building in the air, unsubstantial and resting upon a cloud; beautiful it may be to contemplate, but rapidly disappearing before the sun. It is like spiders' webs, woven out of its own bowels, both warp and woof; beautiful and intricate in its structure, and glittering with the dew in the early morning, but quickly brushed away from the path of progress. This kind of theorizing is equally as fatal to true science as it is to practical work.

This kind of theorizing is what we would call speculation. Now speculation bears the same relation to true theorizing in the world of science, which speculation bears to legitimate enterprise in business. As speculation in the field of business is prostrating to true enterprise, and through it prostrating to the true prosperity of the community, even so speculation in the realm of science is destructive to true theorizing, and therefore destructive to real practical work.

But as enterprise is the basis upon which all legitimate industry rests, and must inevitably rest, and the whole prosperity of society must also rest with it, even so it is upon sound, cautious, inductive theorizing that the whole progress of science and also of sound practical work is based. Science is the open foe of speculation in both fields. Science is the fast friend of legitimate enterprise and legitimate industry, also, in both fields.

The Evaporation of Moisture from Leaves.

An exhaustive study on the physical functions of leaves has recently been published by Professor J. Boussingault, of Paris, in which the phenomena connected with the absorption and transpiration of leaves are treated at great length.

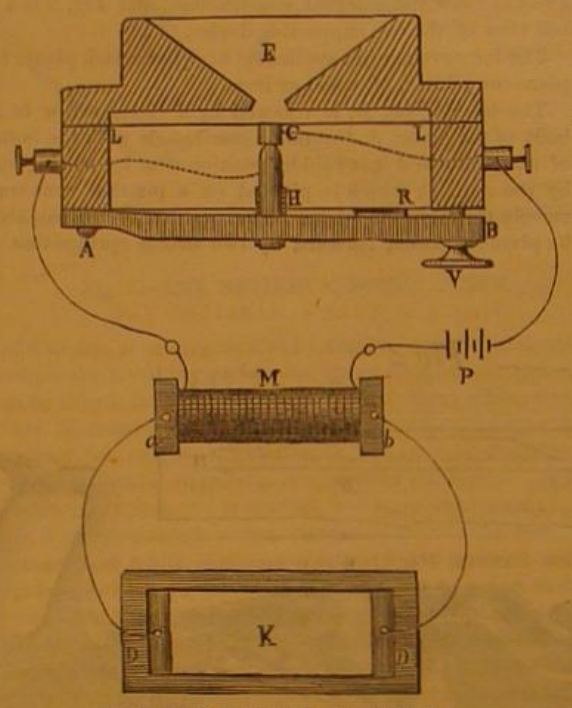
Among others, numerous experiments were made on the difference in evaporation during the day and night. Those carried out with the leaves of the grape vine gave the following hourly averages per square meter of foliage: in sunshine, 35 grammes (560 grains); in shade, 11 grammes (176 grains; during the night, 0·5 gramme (8 grains). The trellis on which the vine was trained was 39 inches high and 125 feet long, and presented a surface of 406 square feet of foliage. In sunny weather this was found to lose by evaporation in the course of 24 hours, 120 lbs. of water, and nearly half of that amount during cloudy weather. To give an idea of the enormous amount of aqueous vapor dissipated by plants in the sunshine, calculation showed that an acre of beets could lose in the course of 24 hours between 20,000 and 23,000 lbs. Another experiment made with a chestnut tree 35 years old showed that it lost over 16 gallons of water in the course of 24 hours. The structure of the leaf, however, containing 70 to 80 per cent of water, and possessing a thickness frequently of not more than four-thousandths of an inch, the question might occur why the evaporation is not much more rapid. The answer to this is found in the peculiar structure of the tissue forming the epidermis, designed especially to moderate the transpiration. In order to observe the remarkable retentive power exercised by this epidermis, one may expose for a few hours to the sun two cactus leaves of the same superficies, one of which has been deprived of its epidermis. In the case of the latter the evaporation will be about fifteen times as rapid as in the other. It is the presence of a similar tissue, forming the skins of fruits, which prevents an evaporation that would be otherwise too rapid. An apple, for instance, deprived of its skin, loses 55 times as much water as a whole specimen in the same time. The physiological energy of leaves is notably lessened by losses resulting from rapid evaporation. Thus an oleander leaf, containing 60 per cent of water, when introduced into an atmosphere containing carbonic acid, decomposed 16 cubic centimeters of this gas; one containing 36 per cent decomposed 11 cubic centimeters, and one containing but 29 per cent was without action.

IMPROVED MUSICAL CONDENSER.

Some time ago Mr. Varley constructed an apparatus, called by him the "musical or singing condenser," and the same is now being exhibited in London and attracting general attention. The apparatus, like so many others of similar character, is too complicated and incomplete for practical purposes. It consists of the receiver, the transmitting apparatus, and the condenser. The latter, K, is composed of a pile of leaves of paper and tinfoil, following alternately; the pairs 2, 4, 6, etc., are united together at one end; the pairs 1, 3, 5, etc., at the opposite end. The whole is inclosed by copper frames, D D', supplied with screws to connect the wires. The sheets may be firmly compressed, the operation not being disturbed thereby in the least.

The receiving and transmitting apparatus consists of a sort of telephone, E. The place of the diaphragm is filled by a sheet of metal foil, L L, in the center of which is fastened a cylindrical piece of carbon, G. Against the latter is placed a second carbon cylinder, H, resting on a wooden crosspiece, A B, fastened at A to one wall of the case, B, by means of a regulating screw, V, to the other wall. A spring, R, extending across the board, A B, imparts to the latter a certain degree of elasticity, which is necessary to insure success.

The metal sheet receiving the sound is connected with one of the poles of a battery, consisting of six Leclanché cells; the lower carbon cylinder is connected with the primary helix of the induction coil, M, which connects on its part with the other pole of the battery. Finally the two poles of the secondary helix of the coil are connected with the ends, D D', of the condenser.



VARLEY'S MUSICAL CONDENSER.

The secondary helix of the coil consists of twenty layers of No. 32 wire, well covered with silk; the primary helix consists of five layers of No. 16 wire. The length of the coil does not exceed 2¾ inches, and the core is ⅜ inch thick.

The receiving and transmitting apparatus must be regulated by experimenting. The two carbon points, when at rest, should not touch each other, but must be brought into contact by the slightest vibration of the metal sheet. The right position may be determined as follows: When the same note is repeatedly sounded into the collector, the carbons may be approached till the sound is distinctly reproduced. When three notes, sounded in succession into the collector, are plainly heard from the condenser, the apparatus may be considered sufficiently well regulated. The melody must be sung into the receiver while the mouth is placed as near as possible to the entrance. Voices resembling the sound of a flute are most easily reproduced.

The apparatus may be used in the same way as Edison's telephone. When it is used as a microphonic receiver, the carbon points must be brought into contact.—*L'Électricité.*

Natural History Notes.

An Aquatic Fern.—Professor D. C. Eaton, in a communication to the *Bulletin of the Torrey Botanical Club*, announces four additions to the fern flora of North America. These are all tropical species, and were detected in Florida. One of them, *Ceratopteris thalictroides*, is one of the most peculiar of ferns, and was discovered growing in the waters of Prairie Creek. It is as truly an aquatic plant as pickerel weed (*Pontederia*), or burr-reed (*Sparganium*), and has been found in still or slowly moving waters in most tropical and many sub-tropical regions. It occurs in several of the West Indies, in Mexico, New Granada, and Brazil, and in Africa, Madagascar, India, Java, Hong Kong, Australia, etc. The sterile frond varies from a perfectly simple leaf to one which is twice or three times pinnate; the simpler ones are floating, and are produced early in the season, and the more compound fronds come later, and are emergent. The veins are everywhere finely reticulated. The fertile fronds have very numerous linear, or somewhat podlike segments, with the margin reflexed to form a broad and continuous membranaceous involucre. The sporangia are scattered on the backs of the veins, and are nearly globose in form, and are more variable in respect to the ring than in any other fern. This organ is sometimes entirely wanting; at other times it is composed of a few obscure joints; and again it is broad and nearly complete. So variable is this fern that at least four genera and two suborders have been found for its reception; and, though Hooker placed it at the end of the *Pteridea*, its proper position among ferns is by no means yet settled. Up to the present but two sterile specimens of this curious plant have been found, but it is hoped that ere long the discoverer, Dr. Gurber, may be successful in his search for fruiting fronds.

Embryology of the Gar Pike.—The gar pike (*Lepidosteus*) being one of the few living survivors of those vast extinct orders of geologic ages, it has been considered especially important by naturalists that means should be taken to compare its embryology with that of other modern fishes in order that the structure of past races might be more fully known, and more light thrown on modern questions of evolution. As much as this knowledge has been needed, no one had been successful in raising the young of the gar pike till last summer, when Mr. Alexander Agassiz accomplished it. The results of his observations are recorded in a paper read before the National Academy, in this city, during November. The gar pike ascends the St. Lawrence in May, and about the 20th lays its large viscous eggs, which stick fast in an isolated way to whatever they happen to alight on. The eggs look very much like those of toads, having a large outer membrane and a small yolk. Mr. Agassiz's assistant brought to Cambridge about 500 naturally laid eggs, all but thirty of which were destroyed by mould. The young began to hatch in six days, and Mr. Agassiz began his studies, the misfortune to the eggs preventing any examination previous to the birth of the fish. He found that the little gar pikes were not so different from the young of the bony fishes as he expected. He did not make out the development of the lung; but, judging from external characters, the difference is small. Connection with the sharks was exhibited in the similarity of the branchial arches, and by the presence of the lateral fold in which the pectoral fins are formed. The manner in which the tail is developed was found to be very like what takes place in the bony fishes. Among the ganoids the dorsal cord is at first straight, then it assumes a slight curve upward at the extremity, and finally there appears, underneath, the beginning of a lobe pointing toward the complete heterocercal tail. This is likewise so in the bony fishes; but in the gar pike it is a permanent condition, while in the bony fishes the extremity of the dorsal cord becomes extinct. The mode of development of the pectoral lobe furnishes another point of resemblance. A likeness to the shark is noticeable in the brain and mode of formation of the gills. The young gar pikes are slow in their movements, swimming about but little, and attaching themselves to fixed objects by an extraordinary horseshoe-shaped ring of sucker appendages about the mouth. The summing up of Mr. Agassiz's investigations is, that the young gar pike has many characteristics in common with the sharks and skates, but is not so different from the bony fishes as has hitherto been supposed.

The Sequoias.—Mr. John Muir has an interesting paper in *Harper's* upon the "New Sequoia Forests of California." He gives therein the details of a discovery by himself of a grand forest of *Sequoias* seventy miles long, lying considerably south of the isolated groups hitherto known, and containing large numbers of saplings, which indicate that the species is still in a vigorous state of existence. It has heretofore been argued that the few groups of these trees known made it probable that the species was dying out from its last strongholds upon the earth, for it has come down to us from pre-glacial times, when it existed in Europe also, as geology testifies. Mr. Muir's researches lead him to believe that the species has never been more extensively distributed on the Sierra in post-glacial times than it is now; and that to-day it is as full of life and vigor as it was 10,000 years ago.

Instinct in a Crab.—Dr. Darwin, in his "Voyage of a Naturalist," thus describes a crab which makes its diet of cocoanuts, and which he found on Kneeling Island, in the South seas:

"It is common on all parts of this dry land, and grows to a monstrous size. It has a front pair of legs, terminated by a strong and heavy pincers, and the last pair by others which are narrow and weak. It would at first be thought quite impossible for a crab to open a strong cocoanut covered with the husk; but Mr. Liesk assures me he has repeatedly seen the operation effected. The crab begins by tearing the husk, fiber by fiber, and always from that end under which the three eyeholes are situated. When this is completed the crab commences hammering with its heavy claws on one of these eyeholes till an opening is made; then turning around its body, by the aid of its narrow pair of pincers it extracts the albuminous substance. I think this is as curious a case of instinct as I ever heard of, and likewise of adaptation in structure between two objects apparently so remote from each other in the scheme of nature as a crab and a cocoanut."

A Viviparous Cockroach.—At a recent meeting of the Entomological Society of London, Mr. Wood-Mason stated that it might interest the members of the Society to hear that in the course of his anatomical work he had discovered a remarkable case of viviparity in the orthoptera. In a large cockroach belonging to the genus *Panesthia*, the species of which inhabit the tropical forests of Southern Asia and of Australia, where they live in the rotten wood of fallen

trees The species in question was *Panesthia Javanica*, from the abdominal brood pouch of the female of which he had extracted young white specimens of 6·5 mm. in length; and these, from their being already provided with legs, antennæ, black eyes, and the full number of already hard tipped gnathites, as well as from their size, he judged were just on the point of birth when the mother was thrown into the alcohol. He further suggested that the curious and as yet unexplained *habit* evinced by several European species of cockroaches (*Blattidæ*) of carrying their egg capsules about with them for a week, or even for so long a period as a fortnight, before depositing them, might possibly be explicable as the retention of a vestige of a lost viviparous character.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although only approximate, they will enable the ordinary observer to find the planets.

M. M.

Positions of Planets for January, 1879.

Mercury.

On January 1 Mercury rises at 6h. 20m. A.M., and sets at 3h. 47m. P.M. On January 31, Mercury rises at 6h. 16m. A.M., and sets at 3h. 23m. P.M.

Mercury can be seen only in the morning. On the 16th it will be in its best position, and will rise about 6 A.M. It can probably be seen in the southeast.

Venus.

Venus will not be seen in the early part of the month. On January 1 Venus rises at 8h. 2m. A.M., and sets at 5h. 2m. P.M.

On January 31 Venus rises at 8h. 3m. A.M., and sets at 6h. 16m. P.M. Venus and Jupiter will be nearly in the same position on the evening of the 23d.

Mars.

On January 1 Mars rises at 4h. 52m. A.M., and sets at 2h. 11m. P.M.

On January 31 Mars rises at 4h. 36m. A.M., and sets at 1h. 32m. P.M.

It will be seen that Mars can be visible to the eye in the early morning only; like Mercury, it rises south of east.

Jupiter.

Jupiter sets early all through the month. It rises on January 1 at 9h. 17m. A.M., and sets at 7h. 1m. P.M.

On January 31 Jupiter rises at 7h. 39m. A.M., and sets at 5h. 39m. P.M. Jupiter and Venus have nearly the same position on January 23.

Saturn.

Our distance from Saturn is increasing, and the planet is less conspicuous, but is readily found as soon as the daylight is out. It passes the meridian on January 1 a few minutes after 5 P.M., and on the 31st at 19m. after 3 P.M., at an altitude of 45° to 46°. Saturn sets on the 1st at 10h. 57m. P.M., and on the 31st at 11m. after 9 P.M.

The satellite Titan can be seen with a small glass. On December 14 this satellite was seen far on the left of the planet (with an inverting telescope), and as it repeats its journey in sixteen days, it will be found in that position again on the 30th, and again on January 15.

The smaller satellites of Saturn can be seen only by the aid of large telescopes. At times six of the moons are seen surrounding the planet, sometimes lying along its path and sometimes grouped together around the tips of its ring.

Uranus.

The distant planet Uranus rises on January 1 at 8h. 59m. P.M., and sets at 10h. 17m. of the next morning. On January 31 Uranus rises at 6h. 56m. P.M., and sets at 8h. 17m. A.M. of the next day. This planet, which was at one time near Regulus, is now near the star Rho Leonis.

Neptune.

On January 1 Neptune rises at 52m. after noon, comes to meridian at 7h. 40m., and sets at 2h. 20m. the next morning. With small telescopes it can be seen as a star. As it comes to the meridian about 4m. earlier every evening, it is not likely to be seen even as a star after the middle of the month.

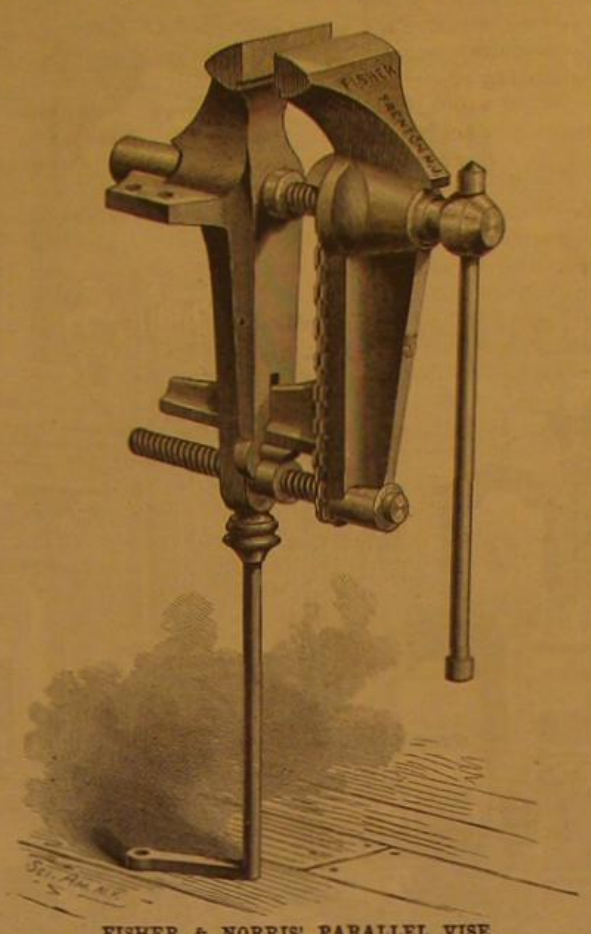
Proportions of Hulls, Engines, and Boilers of Yachts.

The following table, giving dimensions of hull and machinery as proportioned by a well known builder of steam yachts, contains particulars which will be of interest to many of our readers:

HULL.					ENGINE.				BOILER.		
Length over all.	Beam.	Draught.	Tonnage, carpenter's measurement.	Nominal horse power.	Diameter of cylinder.	Stroke.	Diameter of propeller.	Pitch.	Diameter of shell.	Height of shell.	Heating surface.
ft.	ft. in.	ft. in.	tons.		in.	in.	in.	ft.	in.	in.	sq. ft.
25	5 8	2 3	4	2	3	5	26	3	28	45	75
28	5 10	2 4	5	3	3½	5	28	3	30	46	90
32	6 4	2 6	6	4	4	6	30	3½	33	48	115
38	7 6	3 2	10	6	5½	7	36	4	36	56	170
50	9	3 6	16	10	7	9	42	5	46	76	246
60	10	4 2	26·5	15	9	12	48	5	50	82	332
68	11	4 8	37·5	20	10	12	54	6	54	86	402
75	12	4 10	43	30	12	12	56	7	60	90	504

DOUBLE SCREW PARALLEL VISE.

We give herewith an engraving of a new parallel "leg" vise, manufactured by Messrs. Fisher & Norris, of Trenton, N. J. The movable jaw of this vise is supported by an arm that passes through a mortise in the stationary one, and it is operated by two screws which are connected by an endless chain, each screw being provided with a chain wheel, so that when the upper screw is moved by the handle the lower



FISHER & NORRIS' PARALLEL VISE.

screw moves simultaneously with it, thereby insuring the parallelism of the jaws.

We are informed that the jaws are of the best tool steel welded on and properly cut and hardened, and that the screws and thread boxes are of the best refined iron, the latter being "solid cut." These vises are either with or without a swivel attachment.

NEW SAMPLE PACKAGE FOR THE MAILS.—A mail package, composed of tin, has been approved by the Postmaster General, for the transportation of samples of flour, bran, sugar, needles, nails, etc. The package has a clasp; there is no danger of its self-opening in the bags, while the contents can be readily inspected.

Correspondence.

The Supposed Volcano in the Moon.

To the Editor of the Scientific American:

The account, in your issue dated the 21st inst., of the supposed volcano in the moon, seen by Mr. John Hammes, calls to mind a theory I had some years ago, namely: meteors fall, of course, upon the moon as well as upon the earth, but the moon having no atmosphere, they reach its surface with their full cosmical velocity. If a meteor as large as some that have reached the earth should strike the moon the heat developed would turn the meteor to vapor, and an astronomer on the earth that chanced to have his telescope pointed that way would observe phenomena similar to those seen by Mr. Hammes. SAMUEL P. GARY.

Oshkosh, Wis., December 14, 1878.

A Fast Little Side-Wheeler.

To the Editor of the Scientific American:

In your issue of November 23, I was interested in the statement made by S. Firth, of Auckland, N. Z., in relation to his steam launch, and as my experience has been the opposite to his, in relation to vertical boilers, I thought it might be of interest to some of your readers.

I built a small side-wheel boat, 26 feet long and 5 feet 8 inches beam, flat bottom, with fine lines fore and aft, and depth of hull 2 feet. The paddle wheels are 4 feet 8 inches in diameter and 24 inches wide, being connected to engine by gearing—proportion, 5 to 1. The engine is horizontal, 4 inch bore and 6 inch stroke, cutting off at ¾ stroke. The average number of revolutions of engine is 300, with 100 lbs. of steam. The boiler is 36 inches high and 22 inches diameter, containing 91 flues 24 inches long by 1 inch diameter, and a fire box 18 inches diameter by 12 inches high.

I have raised 5 lbs. of steam in 20 minutes from cold water, and with anthracite coal, nut size. This boiler furnishes ample steam, with exhaust draught. The boiler never foamed any, excepting once or twice when first used, which was caused by oil being used in drilling holes for rivets, and considerable remaining inside.

This boiler performed so well that many have remarked its good qualities. Last winter the boat was lengthened 10 feet, and the wheels enlarged to 5 feet 8 inches diameter and 28 inches wide each. The boat draws 7 inches, and will carry 20 persons, drawing about 12 inches. She easily makes a mile in 8 minutes, and I think that compares well with many steam launches using the same power. Our river is shallow, which prevents our using a screw. Sometimes we can get only 14 inches of water in many places. In going through rapids we have used steam as high as 110 and 120 lbs., but never has the boiler failed in any particular.

I think the trouble with Mr. Firth's boiler was that it was too small for his engine. My experience inclines me toward the vertical boiler for this kind of purpose. I hope my experience may benefit others who can use only side-wheel boats. C. A. THOMPSON.

Owego, N. Y., Nov. 27, 1878.

Curiosities of Botany.

To the Editor of the Scientific American:

In the article on the "Proceedings of the Torrey Botanical Club," published in your issue of December 7, mention is made of a "full blown rose" from the center of which another perfect flower was growing. I wish to state that two roses were found last summer growing on the same bush, one having a cluster of five perfect buds raised on a stem from its center, and the other three.

A species of Allium was found in which the stamen, in a flower otherwise normal, was replaced by a bulblet; also in another flower one of the stamens was replaced by a perfect flower.

An ear of corn, which has grown wrong side out, is in my possession. The ear has the form of an inverted truncated cone, bearing the kernels on the walls of the hollow. The cob has a smooth exposed surface, and a texture somewhat more compact than the cob of normal ears.

Arkansas Industrial University, Fayetteville, Ark.

F. LEROY HARVEY, Prof. of Botany.

Pure and Unadulterated Baking Powders.

Believing that inestimable good will result to the public from the questions lately raised in the columns of your paper in regard to the healthfulness of certain articles used in the preparation of food, we think you will not hesitate to crown your efforts by pointing to goods of marked purity and reliability.

Cleveland's Superior Baking Powder, manufactured at Albany, N. Y., has, during the past nine years, gained a widespread popularity, and very many of your countless readers will be glad to know that it is approved and recommended for purity and healthfulness by such eminent chemists as the following:

NEW HAVEN, CONN., December 7, 1878.

Messrs. Cleveland Brothers,
911 and 913 Broadway, Albany, N. Y.:

This certifies that I have recently purchased of several grocers in this city packages of your "Superior Baking Powder," have submitted their contents to chemical analysis, and have found them to consist only of very pure and entirely wholesome materials, very suitably combined for this purpose. They contain no other acid than that of the purest grape cream of tartar, and are completely free from alum or any other deleterious or doubtful substance. They are, as to their composition, in all respects what you claim.

S. W. JOHNSON, Ph.D.,
Professor of Chemistry in the Sheffield Scientific School of Yale College; Director of the Connecticut Agricultural Experiment Station.

HOBOKEN, N. J., December 11, 1878.

Messrs. Cleveland Brothers, Albany, N. Y.:

I purchased a package of Cleveland's Superior Baking Powder of Messrs. Park & Tilford, in New York, and have made a careful analysis of the same. I find it to consist of pure cream of tartar, mingled with such other ingredients as render it an effective and desirable baking powder; and that it does not contain any alum, terra alba, or any adulteration whatever. It is, in my estimation, among the most wholesome compositions for a baking powder of which I have any knowledge. HENRY MORTON, Ph.D.,
President of the Stevens Institute of Technology.

NEW YORK CITY, December 12, 1878.

Messrs. Cleveland Brothers, Albany, N. Y.:

The results of a complete analysis on several packages of your Superior Baking Powder, purchased by myself of grocers in this city, confirm the fact that it is made of pure and healthful materials, well manufactured, and it is in every particular reliable and most wholesome. Having had the examination of the materials used in manufacturing your powder for many years, it affords me pleasure to recommend it without reserve. WM. M. HABERSHAW, F.C.S.,
Analyst for the Chemical Trade of New York; Chemist of the New York State Agricultural Society; Analytical Chemist to the New York Produce Exchange.

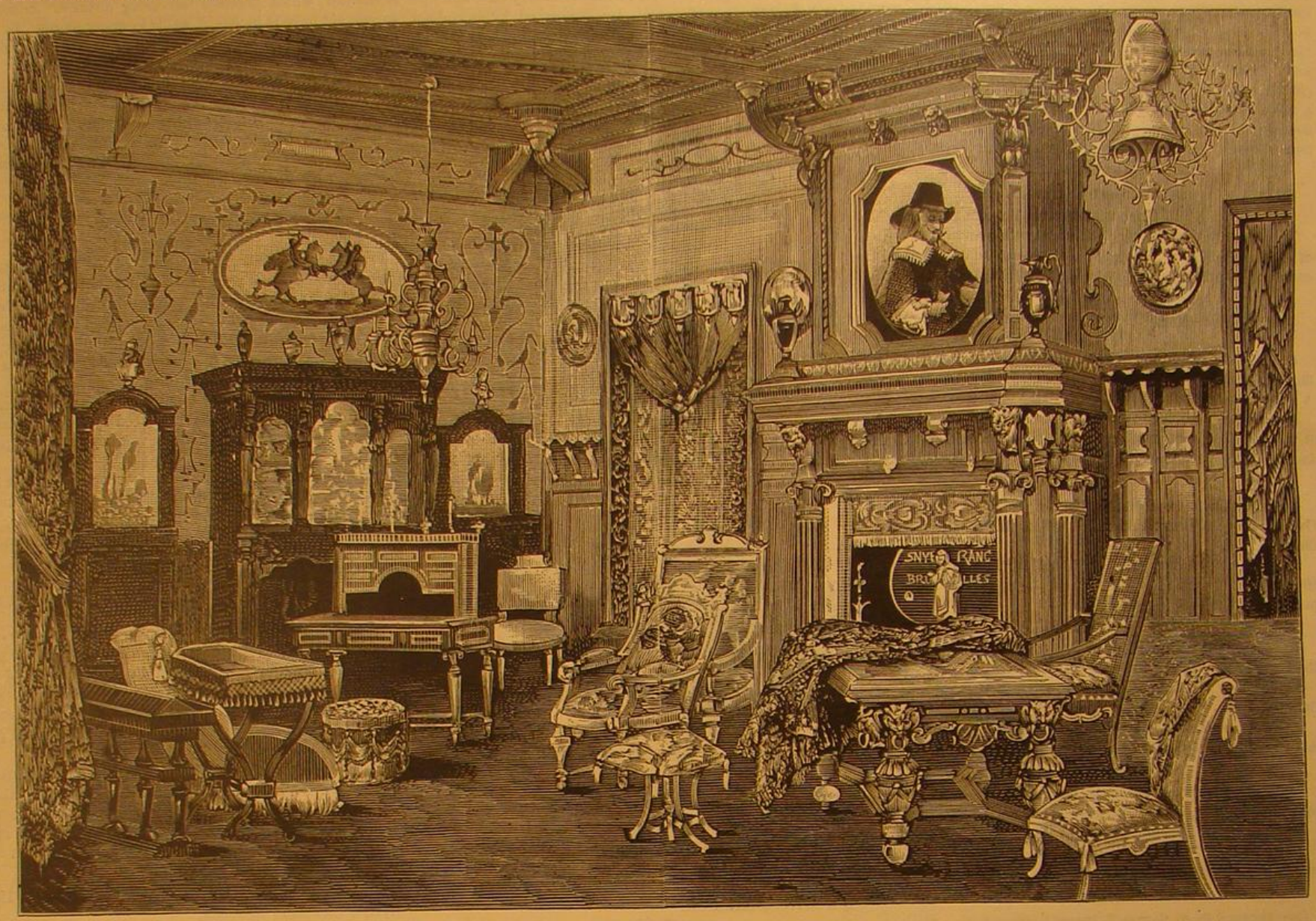
WEST PHILADELPHIA, PA., December 7, 1878.

I have made a very careful analysis of "Cleveland's Superior Baking Powder," bought from grocers in this city, and have found it to be perfectly pure, and manufactured from the best quality of cream of tartar and other materials. It is entirely free from alum, acid phosphates, terra alba, and other substances which are frequently used for the manufacture and adulteration of baking powders; and on account of its purity and healthful constituents, deserves to be highly recommended. F. A. GENTH, Ph.D.,
Professor of Chemistry and Mineralogy in the University of Pennsylvania, Philadelphia, Pa.

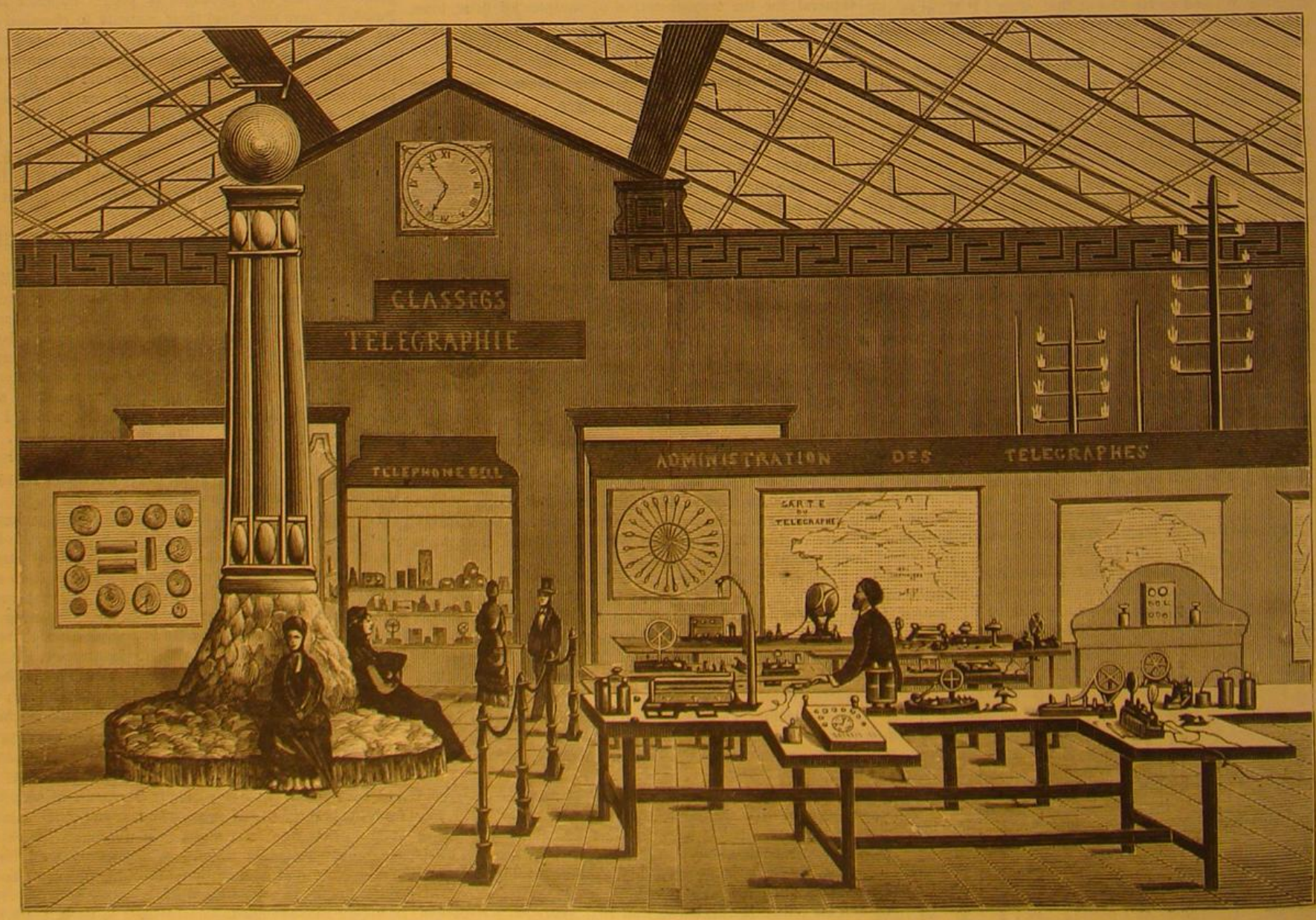
PARIS EXHIBITION.

We give on this and the opposite page, four interior views of different departments at the Paris Exhibition. The first affords an idea of Belgian furniture and interior decorations; the second is the department devoted to telegraphy: the third, French upholstery and interior decorations, and the fourth is the department of carpets, tapestry, etc., in the French section.

IMPERVIOUS RUBBER TUBING.—It is asserted that India rubber tubing may be made entirely impassable to coal gas by painting it over with a solution of silicate of sodium, otherwise known as "water glass."



BELGIAN FURNITURE AT THE EXHIBITION.

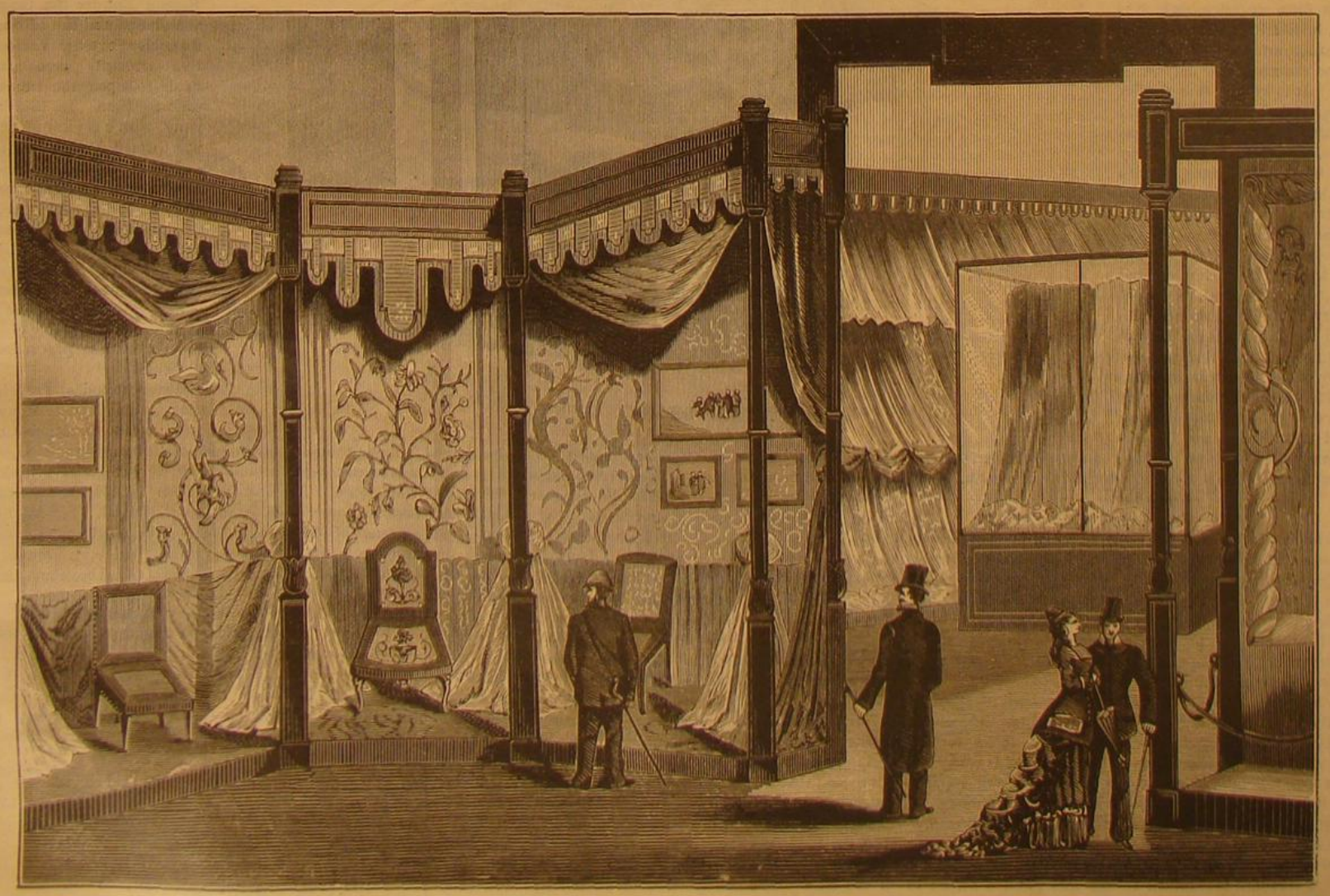


THE FRENCH TELEGRAPHIC ANNEX.

Asphalt Pavements.

Berlin has attempted to introduce asphalt pavements upon a few of her best streets. In some respects it seems of doubtful success. The roadway is very smooth and hard, pleasant to ride upon, and will prove a great saving in the expense for running stock, but also very expensive in the matter of horse flesh. When wet it is so slippery that few horses are able to traverse it with safety, and on every rainy day an immense number of loosely reined horses "take a tumble." The most recent victim was Herr Wachtel, the tenor singer, whose horses slipped, ran away, and Wachtel, attempting to jump out, was quite badly injured by his fall.

UPHOLSTERERS' AND DECORATORS' WORK, FRENCH SECTION.



CARPETS, TAPESTRY, ETC. FRENCH SECTION.

VIENNA BRONZE WORK.

Great exertions were made by the Austrian manufacturers, not only to make a fine display at Vienna, but also to carry off at Amsterdam the special prizes offered by the Dutch authorities for the best designed articles admitted to the international competition.

Among those who contributed choice specimens was Hollenbach, of Vienna, whose bronze work attracted no little admiration.

One of the finest examples of M. Hollenbach's work, a flower vase in gilt bronze, is shown in the accompanying engraving.

VIENNA BRONZE WORK.

Promised Revival of Sodom and Gomorrah.

It is reported that French capitalists have secured a grant for a railway line from Jaffa to the interior of Palestine, which will open up the Jordan valley and the whole region north of the Suez canal. In certain contingencies this road might become of great military usefulness, but it appears further that the productive resources of the country are considerable, and what is more surprising, that the Dead Sea itself can be turned to commercial account. Chief of these at present are the stores of natural combustibles for which that region is noted.

Hitherto the main obstacle to the development of steam traffic in the Levant has been the total absence of combustible material. Not only Egypt, but the shores of Syria and the Red Sea are completely stripped of wood, and the coal imported from the West commands a price ranging from $10 to $24 a ton. Now the masses of asphalt continually thrown up by the Dead Sea attest the presence of vast subterranean layers of fossil vegetable matter, and these signs were not long overlooked by the enterprising men attracted to Suez by the opening of the canal and the movement of commerce in that direction. Recently numerous soundings have been made between Jaffa and the Dead Sea, which, so far, have not disclosed any deposits of coal proper, but, on the other hand, have laid bare inexhaustible beds of lignite.

Of itself this store of lignite is likely to prove an inestimable gain to the industries and commerce of the Levant; but we should add that the juxtaposition of asphalt in great quantities furnishes the elements of a mixture of lignite and asphaltum in the form of bricks, which is equal in heating capacity to the richest bituminous coal, while its cost on the ground is only $2.50 a ton. It is known that similar bricks, made up of coal dust and bituminous debris from gas works, are much sought after by French railways, since, besides their heating power, they greatly facilitate stowage, owing to their regular shape. Of course the bitumen of lower Palestine has been known from immemorial times, and was used to impart solidity to the structures of unbaked clay in Assyria and Egypt; but it may be said that the discovery of the subterranean combustible has lifted once for all the curse which has so long rested upon Sodom and Gomorrah, and will transform the wasted shores of the Dead Sea into a focus of industry and a magazine of wealth.

New Mechanical Inventions.

An improved Wrench has been patented by Mr. William R. Leeson, of Bridgewater, England. This invention relates to adjustable spanners or monkey-wrenches, and consists in a sort of toggle bar applied between the movable jaw and the shank or handle so as to cause the latter to be firmly griped, so that when pressure is applied to the jaw in a direction tending to open or move it away from the fixed jaw the gripe becomes tighter.

An improved Mechanical movement has been patented by Mr. David E. Cripe, of North Manchester, Ind. The object of this invention is to furnish an improved device for use upon all machinery where a rectilinear motion is converted into a rotary motion, to prevent the machinery from stopping with its crank upon a dead center, so that the machinery can always be started by the movemen' of the driving pitman.

An improved Fan Attachment for Sewing Machines, etc., has been patented by Mr. James W. Chambers, of Baltimore, Md. A standard is clamped to the table, and a socket to receive the fan handle is pivoted to the standard, and is vibrated by the conjoint and alternate action of a spiral spring and a flexible cord attached to the machine.

The Drainage of Lake Fucino.

The opening lecture to the class of Civil Engineering, at the University of Edinburgh, was lately given by Professor Fleeming Jenkin. The Professor gave an account of the great project for draining Lake Fucino, in Italy, which, commenced 2,000 years ago, had at last been successfully accomplished. The lake was situated in the Abruzzi province, 53 miles east of Rome, and covered the greater part of a large table land near the small town of Avezzano. The surface of the water was 2,094 feet above the sea, but to the lake there was no natural outlet; and though the action of the wind on the water prevented it from stagnating, the neighborhood of the lake was very unhealthy. Whenever there was a succession of years in which the rainfall was heavy, the lake rose enormously, and covered the adjoining country. The nearest river was the Liris, 3¾ miles away, but the mountain Salviano and a high plain separated the two. The comparisons between what the lake was recently and what it had been in ancient times, were extremely curious, as showing the changes which took place in the rainfall over a long cycle of years. Between 1783 and 1816 the lake rose 30 feet 5 inches, and was then 74 feet deep. From the commencement of 1820 to 1835 it fell to nearly 11 feet below its level in 1783, being then 31 feet deep. In 1861 it had risen again 30 feet. The remains of drainage works on the lake showed that its area was about the same in 1816 as it was in the reign of Julius Cæsar or the Emperor Claudius; though there was evidence that it had risen much higher in prehistoric times. The average extent of the lake was 33,050 acres. It was 12·4 miles long and 6·8 miles broad. The Italian engineers calculated that the lake had been silting up at the rate of 12 inches per century—and that was an interesting geographical fact, as showing the rate at which these large lakes silted—so that the present bottom was 15 feet higher than it was in the reign of the Emperor Claudius. Julius Cæsar had conceived the utility of draining the lake for the sake of the health of the district, and also with the view of increasing the corn growing area near Rome; but his death put an end to the scheme. In the reign of Claudius the project was again revived, and the favorite Narcissus was ordered to go on with the necessary works at the public expense. Suetonius stated that for eleven years 30,000 men were employed there, and the elder Pliny said that the works were so extraordinary that no language could give any idea of them. These works consisted in boring a tunnel under Mount Salviano, 984 feet below its summit, and under the Palentine fields at an average depth of 328 feet to discharge into the river Liris the surplus water of the lake. The construction of a tunnel of about four miles in length at a great depth under a mountain was, in the then state of engineering science, a wonderful undertaking. It would not be an easy job now. The tunnel actually was made, and the lake partially drained; and it appeared from the remains of the old tunnel that the original engineer understood his work well, but that the designs were imperfectly carried out, and the work shockingly scamped by the contractor. First of all, levels could not have been well understood in those days; nevertheless, the outfall had been most correctly chosen, so as to give the reasonable fall to the water of 1½ in 1,000; the new outlet at the river Liris was within a foot or two, and at the same level as that chosen by the Roman engineer, and the Roman engineer had also selected the direction of the tunnel very properly, and had followed so correctly the configuration of the ground in making it that the modern engineers had not been able to improve upon it. The old shafts—40 in number—which had been sunk so that headings might be driven in various directions at one and the same time, had been well constructed, and had been largely taken advantage of in constructing the modern tunnel. A great difficulty the Romans must have encountered was the quantity of water which flowed from the strata; and how they got over it was not easy to say, as it was not known that they had pumps sufficient to cope with large accumulations of water. One of the most curious things about the old tunnel was the constant variation of the cross sections. Beginning with a finely arched entrance, the tunnel as it went into the hill got smaller and smaller, just as the men got tired of the work, until in the center there was only a hole large enough for a man to creep through. Then it opened out again toward the outfall. Where it could be inspected it was all right, but what was altogether out of sight had been scamped in the way indicated. During the progress of the work a great slip had occurred; and evidently, as they could not get through the loose earth, the workmen turned off to the right and made a curved gallery through the stone, some 400 feet in length, round the obstructing mass. The tunnel was opened by Claudius, who first of all witnessed a sanguinary sham sea fight on the lake, in which the convicts, gathered from all parts of Italy, were made to destroy each other. The tunnel, however, soon got blocked, and it was not until Hadrian's time that it was put right. The lake was then reduced to some 17,000 acres. The entrance to the tunnel seemed to have been kept in good order down to the 5th century, but with the fall of the Roman Empire the tunnel was abandoned and the lake resumed its ancient extent. Various abortive attempts were afterward made to open the tunnel from time to time. In 1851 a company, with a capital of £200,000, was formed for draining the lake—the concession they were to get in return being land which was reclaimed; but this enterprise, too, fell through. Prince Alexander Torlonia, who held half the shares in the concern, however, bought up the other half, and having obtained the repeal of some objectionable clauses in the concession, proceeded with the work.

He consulted a French engineer, Franz Mayu de Monsucher, under whose direction a tunnel, following the line of the old one, for carrying off 11,000 gallons of water per minute from the lake, was completed in June, 1875. The cost had been £1,750,000 sterling. The lake had now been completely drained, Torlonia had got an estate of 35,000 acres, the neighborhood was now healthy, and the general prosperity which had been brought about to the population, by this great work, had been most marked.

Trial of Brainerd's Exhaust Pipe.

Brainerd's patent variable exhaust pipe, which we illustrated on page 262, vol. xxxviii., has recently had a trial on one of the engines of the Grand Trunk Railway, Canada. Four trips were made under similar circumstances, two with the Brainerd exhaust and two with the ordinary nozzle. The following table will give an idea of the comparative value of the two nozzles:

	Brainerd's exhaust.	Ordinary nozzle.
Total weight of train in pounds	1,659,150	1,590,400
Total weight of coal burned in pounds	10,305	11,388
Total weight of coal burned in pounds per mile	4,560	5,033
Total weight of coal burned in pounds per ton of load per mile	115	125
Pounds of water evaporated	73,111	72,388
Pounds of water evaporated per pound of coal	7·09	5·01
Maximum steam pressure	135	135
Minimum steam pressure	110	120
Average steam pressure	124·5	130·5

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.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Jarvis Patent Boiler Setting burns wet peat, screenings without blast. A. F. Upton, Agent, 48 Congress St., Boston, Mass.

Assays of Ores, Analyses of Minerals, Waters, Commercial Articles, etc. Technical formulæ and processes. Fuller & Stillman, 40 & 42 Broadway, N. Y.

West Broadway, Reade and Hudson Sts., N. Y., Aug. 2, 1877. Messrs. H. W. Johns Manufacturing Company, 87 Maiden Lane, New York. Dear Sirs:—In my application of it, as Boiler and Steam Pipe Covering, your Asbestos Felting (single and double air chamber) gives most complete and thorough satisfaction, and is far superior to any of the various non-conductors that I have tried or am familiar with. I very willingly recommend it to engineers and the public generally as the best non-conductor of heat that has been put upon the market. Yours respectfully, Chas. D. Doubleday, Engineer for H. K. & F. B. Thurber & Co.

Manufacturers of Hand and Power Brick Machines. Please send circulars and prices to H. P. Gregory & Co., San Francisco.

Two Iron Coal Dumping Cars for elevated track, $80: cost $250. 310 York Ave., Philadelphia, Pa.

One half of patent for sale of Tubular Iron Grindstone Frame. J. E. Defreest, 73 Ferry St., Troy, N. Y.

Wallace Electric Light Machine, 1,500 candle power; in use only two months, and guaranteed in perfect order. Cost $400; price $200. E. T., Jr., P. O. Box 3814, N. Y.

The best Friction Clutch Pulley and Friction Hoisting Machinery in the world. D. Frisbie & Co., N. Haven, Ct.

The Lambertville Iron Works, Lambertville, N. J., build superior Engines and Boilers at bottom prices.

Empire Gum Core Packing, Soap Stone Packing, Piston Packing; all kinds. Greene, Tweed & Co., 18 Park Place, N. Y.

1,000 2d hand machines for sale. Send stamp for descriptive price list. Forsaith & Co., Manchester, N. H.

Bevins & Co.'s Hydraulic Elevator. Great power, simplicity, safety, economy, durability. 94 Liberty St. N. Y.

Hydraulic Elevators for private houses, hotels, and public buildings. Burdon Iron Works, Brooklyn, N. Y.

Galland & Co.'s improved Hydraulic Elevators. Office 206 Broadway, N. Y., (Evening Post Building, room 22.)

Consumption cured.—An old physician, retired from active practice, having had placed in his hands by an East India missionary the formula of a simple vegetable remedy for the speedy and permanent cure of consumption, bronchitis, catarrh, asthma, and all throat and lung affections, also a positive and radical cure for general debility and all nervous complaints, after having thoroughly tested its wonderful curative powers in thousands of cases, feels it his duty to make it known to his suffering fellows. The recipe will be sent free of charge, to all who desire it, with full directions for preparing and successfully using. Address, with stamp, naming this paper, Dr. J. C. Stone, 146 South Eighth Street, Philadelphia, Pa.

If you are troubled with leaky valves, use the Chapman. Warranted to give satisfaction. Chapman Valve Manufacturing Company, Boston, Mass.

For Fire or Power Pumps, address the Gould's Manf. Co., Seneca Falls, N. Y., or 15 Park Pl., N. Y. city.

Iron, Brass, and Steel Wire. Needle pointed English Steel Wire, for all purposes. W. Crabb, Newark, N. J.

The only Engine in the market attached to boiler having cold bearings. F. F. & A. B. Landis, Lancaster, Pa.

Brush Electric Light.—20 lights from one machine. Latest & best light. Telegraph Supply Co., Cleveland, O.

The Hancock Inspirator received a gold medal at Paris, as being the best boiler feeder ever made, and the Old Colony Railroad (who have twenty-three machines in constant use) have just given it their unqualified indorsement, as the cheapest and most effective feeder ever used on their locomotives. Those interested are referred to their letter of recommendation, which may be found in our advertising columns.

J. C Hoadley, Consulting Engineer and Mechanical and Scientific Expert, Lawrence, Mass.

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are to be sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

For the best advertising at lowest prices in Scientific, Mechanical, and other Newspapers, write to E. N. Freshman & Bros., Advertising Agents, 186 W. 4th St., Cin., O.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N. H.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

Rubber Hose, Suction Hose, Steam Hose, and Linen Hose, all sizes. Greene, Tweed & Co., 18 Park Pl., N. Y.

Punching Presses, Drop Hammers, and Dies for working Metals, etc. The Stiles & Parker Press Co., Middletown, Conn.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N. J.

H. Prentiss & Co., 14 Dey St., N. Y., Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Nickel Plating.—Wenzel's Patent Perforated Carbon Box Anode for holding Grain Nickel. A. C. Wenzel, 114 Center St., New York City.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

To Manufacturers.—Messrs. Bignall & Ostrander, 806-808 N. 2d St., St. Louis, Mo., have added to their present establishment a Machinery Department, from whence the wants of the Western machine-using public will be supplied. Manufacturers will do well to correspond with them.

Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the SCIENTIFIC AMERICAN Export Edition. This paper has a very large foreign circulation.

24 x 48 in. Wright's Automatic Engine, with 16 foot band wheel, 30 in. face, for sale. Price low. Atlas Works, Indianapolis, Ind.

Pulverizing Mills for all hard substances and grinding purposes. Walker Bros. & Co., 23d & Wood St., Phila., Pa.

Inventors' Models. John Ruthren, Cincinnati, O.

The Lawrence Engine is the best. See ad. page 13.

North's Lathe Dog. 347 N. 4th St., Philadelphia, Pa.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Band Saws, $100; Scroll Saws, $75; Planers, $150; Universal Wood Workers and Band Planers, $150, and upwards. Bentel, Margedant & Co., Hamilton, Ohio.

Steel Castings true to pattern, of superior strength and durability. Gearing of all kinds. Hydraulic cylinders, crank shafts, cross heads, connecting rods, and machinery castings of every description. For price list and circular, address Chester Steel Castings Company, Evelina St., Philadelphia, Pa.

The SCIENTIFIC AMERICAN Export Edition is published monthly, about the 15th of each month. Every number comprises most of the plates of the four preceding weekly numbers of the SCIENTIFIC AMERICAN, with other appropriate contents, business announcements, etc. It forms a large and splendid periodical of nearly one hundred quarto pages, each number illustrated with about one hundred engravings. It is a complete record of American progress in the arts.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Eagle Anvils, 9 cents per pound. Fully warranted.

The well named Leader Lathe is far ahead of competitors. For descriptive circular, address Frasse & Co., 62 Chatham St., New York.

Improved Meat Cutter. Capacity 600 lbs. an hour. Circular and price list, J. W. McFarland & Co., Alliance, O.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Self-feeding upright Drilling Machine of superior construction. Drills holes from ¼ to ¾ in. diameter. Pratt & Whitney Co., Manufs., Hartford, Conn.

Correct thing for Holidays, Whist and Dinner Parties, is the Vanity Fair Cigarettes, with your monogram.

Vertical & Yacht Engines. N. W. Twiss, New Haven, Ct.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Pittsburgh Steel Casting Company, Pittsburgh, Pa.

Notes & Queries

(1) J. L. J. asks: What composition for steam valves and cocks will expand the least? A. The following composition answers well: 20 parts, by weight, copper; 3 parts by weight, zinc; 3 parts by weight, tin.

(2) J. N. B.—We know of no work especially devoted to nickel plating. You will find a comprehensive article on nickel plating on p. 209, vol. 38, SCIENTIFIC AMERICAN.

(3) A. R.—You will find a receipt for cementing rubber on p. 250 (15), vol. 38, SCIENTIFIC AMERICAN.

(4) J. R.—No reward has been offered for perpetual motion.

(5) J. R. M.—Lepidolite is found at Hebron, Me., and near Middletown, Conn. It has about the following composition:

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	RbO	LiO	NaF	K	H_2O
50·32	28·54	0·73	0·51	1·01	0·24	0·7	1·77	2·6	3·12

Stillman has lately shown several lepidolites to contain cæsium—one sample from Bonn, Prussia, contained as much as 0·68 per cent, CsO.

(6) M. M. asks for the best method of cutting glass tubes used for water gauges. A. File in one side a slight notch; upon the opposite side place the two thumbs with ends of nails exactly opposite the notch; now grasp the tube with both hands and pull lengthwise on it, while you break it as you would a stick.

(7) J. H. A. G. asks how many cells of a Calland battery are necessary to heat a short strip of platina foil ⅛ of an inch wide and ¼ of an inch long, hot enough to explode gunpowder? A. Eight.

(8) W. E. K. asks: 1. What quantity and size of wire shall I use for an electro motor? A. This depends on the kind of battery used, as there exists a certain relation between the resistance of the magnet coil and that of the battery. Where a quantity battery is used the wire may be larger than when the battery is arranged for intensity. 2. I have straight soft iron cores ¾ inch in diameter, eight in number: I calculate to use both ends of the cores if possible: the cores will be about 4½ inches in length; would such an arrangement generate any power for propelling light machinery? A. Yes, but U-magnets would be better. 3. What size wire is generally used for winding the permanent magnets of dynamo-electric machines, and also what size for winding the electro-magnets? A. Where permanent magnets are used they are not wound. When electro-magnets are employed, the size of wire varies greatly with the use to which the machine is applied; the same is true of the armature.

(9) S. D. C. asks: 1. How many pounds pressure will a boiler stand which is made of heavy tin, 10 inches diameter, 15 inches high, having 7 or 8 1¼ inch tubes? A. Safe working pressure, 15 to 20 lbs. per square inch. 2. Give directions for making a good machine which will furnish sufficient electricity to produce an electric light, said machine to be run by a small engine. A. See SCIENTIFIC AMERICAN SUPPLEMENTS Nos. 17 and 151.

(10) W. H. A. asks: 1. What is the weight of a United States gallon of water, and how many cubic inches in it? A. 8·33 lbs., 230·8 cubic inches. 2. What material will fit a piston in a cylinder water tight, so that when working the amount of friction shall be as small as possible? A. Any hard metal, accurately fitted. 3. Does it take as much power to raise a piston (fitting air tight in a cylinder) with water standing under it so that the water will rise as piston rises, as it requires to form a vacuum beneath piston? A. Yes.

(11) W. S. L. asks: 1. What size of copper wire gives the best effect in an electro magnet, such as is used in the De Meritens machine? A. For a small machine we think No. 14 or 16 would do. 2. Can the wire be purchased already covered, and where? A. From dealers in this city who advertise in our columns. 3. Is the effect the same if the permanent magnets are revolved instead of the electro-magets? If so, it would seem as if the wear of brushes, springs, or commutations, would be avoided by this plan. A. Permanent magnets lose their magnetism by jarring; it is, therefore, best that they should remain stationary. 4. Will steel wire bent into proper shape, hardened, magnetized, and wound into a bundle, magnet shape, make a magnet equally powerful with a compound plate magnet as used in the De Meritens machine? A. We think not, but it might answer very well. 5. Can the magnets be made with a set of bar magnets? A. Yes. 6. Will cotton do for covering for the wire? A. Yes. 7. Have you a recent work on the subject of Magneto-Electricity and the Electric Light? A. We intend publishing papers on these subjects at an early day in the SCIENTIFIC AMERICAN SUPPLEMENT.

(12) T. S. M. asks which will consume the most power, to place the driving pinion in a hoisting machine above or below the center of the large spur wheel? A. We think it will make no difference.

(13) G. E. F. asks: 1. How to make or mix the substance used in cold water pens. A. Mix any of the soluble coal tar dyes with gum water to form a thick paste, and after filling the case, dry at a gentle heat. 2. Also a good mucilage. A. Triturate 1 ounce of gum arabic with about 4 fluid ounces of hot water in a mortar, and add a few drops of clove oil. Or make a solution of dextrine in about 3½ parts of boiling water.

(14) W. E. G. asks what would be the power of an engine 2 inches bore and 4 inches stroke. Will an oscillating engine of the same size produce the same power with the same amount of steam, say 60 lbs.? What size should a boiler be for such an engine? Would an engine of this size run a lathe that swings 12 inches for turning iron? A. There will be no difference in the power of the two engines, if properly constructed. To determine the horse power, multiply together the mean pressure during stroke in pounds per square inch, the area of the piston in square inches, the length of stroke in feet, and twice the number of revolutions per minute, and divide the product by 33,000. Make a boiler whose heating surface is in the proportion of from 15 to 20 square feet per horse power. The engine can be used to run the lathe.

(15) J. F. S. writes: I am about to select a trade or profession. I have a taste for mechanical trades of all kinds, farming and mercantile business. I have a chance to go as runner in a bank in New York, or to go on a 400 acre farm in Indiana. 1. Which shall I do? A. Go on the farm by all means. 2. How can I distinguish oleomargarine butter from the genuine article? A. According to Professors Sechartier and Taylor, oleomargarine may be distinguished from pure dairy butter by examining a sample under a good microscope. The latter presents a nearly uniform color; the forms seen consist of oil globules and crystals of salt. When observed by polarized light very little change is observed, but if the specimen contain oleomargarine the field is speckled over with shining particles which change color with every quarter turn of the analyzer. A power of 75 diameters exhibits these changes very markedly. With a power of 250 diameters more or less animal tissue may usually be detected.

(16) H. S. asks how to solder German silver. I have tried what they call silver solder, with a blow pipe and a spirit lamp; the solder will not melt. A. Rub a lump of borax with a drop or so of water on a common slate or porcelain slab, until a thick paste is produced. Clean the surfaces to be soldered and paint on the borax paste; dip your silver solder in the borax paste and place it in position on the work. Pin the work on a charcoal or piece of pumice stone, with common tacks (not tinned), direct the reducing flame of a blow pipe upon the work until it becomes red hot, then project it on the solder. The small silver three cent pieces make excellent solder for German silver, brass, copper, iron, and steel. SCIENTIFIC AMERICAN SUPPLEMENT No. 20, contains full practical directions for soldering.

(17) J. S. writes: I have a quantity of lard oil that I think contains salt or acid. How can I test it? A. If the oil contains pure acid, a scrap of blue litmus paper rubbed with it will indicate the fact by turning red. A notable amount of salt is readily detected by taste. A little hot water will extract salt from the lard, and a drop of nitrate of silver solution (aqueous) added to the clear water from the oil will occasion a white curdy precipitate, if salt is present even in very small quantity.

(18) A. A. asks: 1. How many Bunsen cells of such size as could be made in a common glass tumbler would it take to furnish electricity enough for an electric light to light a room twenty feet square? A. About 100. 2. How many of capacity of 1 quart for glass jar? A. 50. 3. What is the size of jar most suitable for battery for electric light? A. One quart. 4. Would porous cells made of fine potter's clay of proper size and shape be suitable? A. Yes. 5. Is a glazed earthen jar as good as glass for outer jar? A. Yes. 6. Are common plant jars as good for porous cups as those made of finer and more compact clay. A. No.

(19) A. C. F. asks what size of steam pipe to use for an engine 8 inches x 10 inches stroke, running at 180 revolutions per minute at 60 lbs. pressure. A. A pipe 2 inches in diameter will answer.

(20) C. A. W. asks: Is the effect of the shock from an induction coil good or bad upon the body in good physical condition? A. Strong electrical shocks are injurious.

(21) J. C. F. asks: 1. In damping the diaphragm of phonograph described in SUPPLEMENT No. 133, do you simply cut small pieces of rubber tubing and place on the diaphragm? A. Short pieces of rubber tubing are placed between the diaphragm and its support, and are allowed to exert a slight pressure on the diaphragm. 2. Will fine copper wire insulated with gutta-percha do for the coil in a telephone as well as silk covered? A. The gutta percha covering is generally too thick; silk covered is preferable.

(22) W. D. S. asks: 1. In the best kind of safety valves for steam boilers does the area for escaping steam gradually increase as the pressure increases? A. According to experiments made by the United States Boiler Inspectors, common safety valves, when properly proportioned, are as efficient as those which give an enlarged area for increased pressure. 2. Are the air compartments in ships' rooms done off for floating power alone, or are they sometimes used for storage? A. The compartments having doors are ordinarily used for storage. 3. Would an invention be valuable that would automatically close the doors between the air compartments without any machinery in case a hole was made in the vessel below the water line? A. We think it quite likely, if superior to the arrangements in use.

(23) W. A. M. writes: I have a bottle of pure bay oil, will you please inform me how I can make bay rum suitable for toilet purposes? A. 10 fluid drachms of oil of bay rum; 1 fluid drachm of oil of pimento; 2 fluid ounces of aceticether; 3 gallons of alcohol 95 per cent; 2½ gallons of water; mix, and after two weeks' repose, filter.

(24) G. C. asks: What is the best method of protecting the lungs against dust while sweeping? A. Breathe through a moistened sponge.

(25) E. G. McD. asks how to make marking fluid for the backs of Brussels carpets. A. An excellent ink for this purpose is prepared by triturating 4 parts of powdered soluble nigrosine in about 15 parts of hot water, and straining the hot solution repeatedly through fine silk or filtering through filter paper, using a hot funnel. See also inks in SCIENTIFIC AMERICAN SUPPLEMENT No. 157.

(26) Engineer asks which of the two is the largest—the Cincinnati water works, or the new water works about completed at Pittsburg, also their relative capacities. A. Perhaps correspondents from these localities will kindly send us particulars.—ED.

(27) W. Z. B. asks: 1. Can water be forced into a boiler above the water line? It may not be advisable, but can it be done? A. Yes. 2. Our office is heated by coils of pipe which drain themselves completely, where they, and their outlets, are subject to no other pressure than that of the atmosphere. If both outlets are connected to the dome of a boiler carrying 60 lbs. of steam, placed below these outlets, will the pipes still drain themselves? A. Yes, if there is sufficient fall, and the pipes are properly arranged. 3. Our water works give a pressure of 125 lbs. to the inch. If a pipe was connected from the main to the dome of a boiler carrying 60 lbs., would water enter the boiler? A. Yes.

(28) W. asks: 1. Will steam or water deposit scale when not coming in contact with heated surfaces? A. Water may do so. 2. Will steam when not superheated cause oxidation of brass? A. To some slight extent.

(29) T. D. H. says: 1. I have a telegraph line about 300 feet, No. 14 copper wire, gas pipe grounded, and on it are two learners' instruments and two bells (box pattern). How many jars will I want of Lockwood or Watson batteries to work it? A. Four. 2. What is the comparative strength and usefulness on a line of these two batteries? A. There is not much difference. 3. If an office ground both line and local on one binding post, and thence by one wire to the ground, is there any danger of a return current if one be grounded and the other in use? A. No. 4. What will take knot and dust marks (from cracks) out of an engraving? A. Moisten the parts thoroughly with soft water, and press strongly between hot sheets of bibulous paper. When cool moisten with strong cold solution of fresh sodium hypochlorite, and when sufficiently clean, moisten again with a little sodium hyposulphite solution, and, after a time, absorb excess of moisture with clean blotting paper, and press between sheets of the same with hot irons until perfectly dry.

(30) W. S. D. writes: 1. I have made a steam engine cylinder 1¼x2 inches; now I want a boiler, can I get steam enough by using a boiler on a common cook stove—boiler to be about 8 inches in diameter made of cast iron? I want it to run a bracket saw on large work. If this will not do, how can I generate sufficient steam? Of what can I make a boiler; and how large? A. If you set the boiler in the fire, you can probably make enough steam. It would be better to form it of copper, from 8 to 10 inches in diameter. 2. Is cold rolled iron as good as steel for piston rods, arbors, etc? A. It is not as strong, comparing good qualities of each. 3. How shall I temper machine steel to have it the toughest? A. You can make the steel very hard, by heating it and plunging into cold water. After this, you can temper to any less degree of hardness, by reheating, and allowing it to cool somewhat, before plunging into cold water.

(31) E. W. T. asks: What form would be the best to copy to make a small magneto-electric machine, costing from $8 to $10? I want a continuous current for physiological experiments. A. Probably Clarke's machine would be best for your purpose, but we do not think you can make one for the price named.

(32) J. G. A. and C. K. will find receipts for ebonizing woods on pp. 191 (19), 219 (67), and 251, vol. 38, SCIENTIFIC AMERICAN.

(33) W. B. S. writes: In heating our factory we take steam from the steam dome, and the return or drain pipe into the heater then (after the pipes are heated up) turned into the mud drum. It seems there is enough greater pressure at the mud drum to prevent the return water from flowing back into the boiler by a head of about eight feet or more generally. How can this be remedied? A. Ordinarily, this is not enough head to secure good circulation, in an extensive system of radiators, unless all the return pipes can lead with a fall into a vertical main. Fortunately the difficulty can be easily solved by adding a good trap.

(34) S. G. B. asks if there is a difference between one "square foot" and one foot square. A. Square foot is the more comprehensive term, since it includes the "foot square" (*i. e.*, a square one foot each way) and all other figures having the same area, 144 square inches. The first is a unit of measure, without regard to form; the second is a particular form of a particular size.

(35) A. G. L. asks: 1. Is there anything that will prevent kerosene oil from smoking when used for cooking purposes? I used three tubes similar to those used on torches, but a black deposit soon formed on the bottom of the kettle. A. The burner for a kerosene stove should be made on exactly the same principle as a first class lamp burner. 2. Can I make the electric light by using a battery composed of zinc and copper plates immersed in solution of 9 parts water, 1 part sulphuric acid, the plates being 3 x 4 in., ⅜ in. thick; how many cells would be sufficient? A. 50 such cells would produce a light, but not for a great length of time, as a battery of this kind is not constant. 3. What size copper wire is best for connections? A. No. 12 or 14. 4. When I melt zinc in an iron ladle it is brittle; is it fit for battery plates? A. Yes.

(36) R. W. S. asks: If a malleable iron casting ¼ of an inch thick by 2½ wide, is securely held at each end by a solid support, so that there is two inches of unsupported metal between the supports, what pressure in pounds brought to bear upon the center of the casting will break it? A. Trautwine gives the following rule: Breaking weight in pounds

$$= \frac{(\text{Depth in inches})^2 \times (\text{Breadth in inches})}{\text{Clear length in feet}} \times 4200$$

This rule is for the case in which the ends are immovably fixed.

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

S. F.—It is a micaceous sand. Not valuable. We could not indicate the probable value of the stone from your description alone.—J. G.—It is magnetic iron sand—magnetic iron oxide or magnetite. It will make an excellent quality of iron if properly smelted. It may be freed from sand and other impurities by means of large magnets.—J. B.—The light colored specimens are principally marcasite (an iron sulphide), with traces of copper and arsenic, in slate. The other sample contains a large per cent of lead (galena) and chalcopyrite (iron copper sulphide). The ore will probably prove of value.—J. T.—The quartz contains galena (lead sulphide) and a little chalcopyrite and zinc. The property is doubtless of some value.

COMMUNICATIONS RECEIVED.

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

Wagon Wheel Problem. By M. S. C.
On Subdivision of Electric Current. By J. T. P.
Metric System. By R. F.
Facts and Figures for Mathematicians. By L. S. B.
Electric Light Telegraph. By F. P.
Acoustic Telephone. By E. D. V.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Many of our correspondents make inquiries which cannot properly be answered in these columns. Such inquiries, if signed by initials only, are liable to be cast into the waste basket.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

[OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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

November 5, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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How to Remove Stains and Grease Spots from Linen, Cotton, Woolen, and Silk Goods. Table giving at a glance the Proper Method of Removing Glue, Grease, Varnish, Paint, Fruit and Wine Stains, Ink, and Iron rust, Coal Tar, and Acids.—Waterproof Paper and Ink for Documents.

III. CHEMISTRY AND METALLURGY.—Outlines of Chemistry. By HENRY M. MCINTIRE. Copper, Lead, Minium, Thallium, Mercury, Silver, Gold, Platinum, Palladium, Rhodium, Ruthenium, Osmium, Iridium, Organic Chemistry, Ethyl Alcohol, Ether, Acetic Acid, Oxalic Acid, Tartaric Acid, Citric Acid, Glycerin, Saccharine Bodies, Starch, Cellulose—Ammonium Nitrate. BY SPENCER PICKERING.

IV. ELECTRICITY, LIGHT, HEAT, ETC.—Galvanic Batteries. By GEO. M. HOPKINS. How to Make and Use the Daniell, the Siemens-Halske, three forms of Gravity, the Meidinger, Menotte, Thomson's modification of Menotte, the Calland, the Menotte, Sir William Thomson's, the Muirhead, and the Watson Batteries, with their characteristics, and 11 figures.—The Invisibility of the Electric Light.—Actual Cost of Using Electric Lights.

The Royal Society.

V. NATURAL HISTORY, GEOLOGY, ETC.—Recent Arctic Explorations. Map of the Northern coasts of Europe and Asia, showing the navigable route from Norway to Japan, discovered by Professor Nordenskjold, with a narrative of his three voyages in the Arctic sea.

VI. ARCHÆOLOGY.—Peruvian Antiquities. By E. R. HEATH. Remarkable ruins and walls. Pizarro's prison. The wonderful huacas. The gold records of Truxillo. Immense burying grounds.

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A REMEDY WORSE THAN THE DISEASE.

Senator Windom's direct assault upon the patent system as a whole proving a hopeless failure, he returns to the charge in an amendment for the encouragement of infringers. It provides that no recovery of damages or costs shall be had against the defendant in any suit brought for the alleged infringement of a patent by the use of any patented device, process, invention, or discovery, if it shall appear that the defendant purchased the same for his own private use from the manufacturer thereof or from a dealer engaged in the open sale of the same, unless it shall also appear that the defendant at the time of such purchase had knowledge or actual notice of the existence of such patent, but this provision shall not apply to purchasers from foreign manufacturers or dealers.

Senator Booth very pertinently argued that, by the terms of the constitutional provision with respect to patent rights, Congress was empowered to grant to inventors and authors only "the exclusive right" to their respective writings and discoveries; and asked: "Now, how can that be an exclusive right if Congress says by law that a person other than the inventor may use the invention and not be liable in damages? A patent is as much property in the hands of its owner as a horse or an ox. From its incorporeal nature it is impossible to punish its piracy by criminal law as you do the larceny of personal property. The committee were unanimously of opinion that the inventor would be stripped of all his security if he were not allowed to follow the patented thing wherever he could find it, not that he might bring vexatious and annoying suits against every one who might innocently use a device, but in order that he might cut off the market against a piratical manufacturer."

Further on Mr. Booth said: "The amendment offered by the Senator from Minnesota says that an infringer in certain cases shall not be liable to damages unless he had actual notice of the existence of the patent. Of course that destroys the remedy in all those cases, for it is absolutely impossible that the patentee should know who is going to use his patent or that he should give notice to everybody. In the case of great manufacturing companies and railroad corporations, to whom is notice to be given? Then, as to the word 'knowledge' in the amendment, we know how hard it is to bring knowledge home to an individual, especially where 'ignorance is bliss.' But how can you bring knowledge home to a corporation that has no soul to receive it? Inventions, as has been said before, are nearly all the work of laboring men, men who toil with their hands. In that field they seek the prizes of life and receive their patent of nobility. Under the amendment of the Senator from Minnesota these achievements of these toiling men may be absorbed by manufacturing companies and railroad corporations who simply choose to close their doors to the truth and shut their eyes to the light. Under this theory the best patent adviser of a corporation or a manufacturing company would be the lawyer who knew the least law and would always advise his clients that there was no existing patent.

"But the loss does not fall, as I have indicated, chiefly upon inventors, great as that is; but by removing the incentive to invention you dry up the very spring at its source."

The mischievous tendency of Mr. Windom's amendment needs no more forcible illustration. It is but another attempt to prevent a local and limited wrong by wholesale injustice to many. There is not an existing institution which may not be and has not been made the instrument or the excuse for wrong doing. Shall we abolish our courts because judges have been incompetent and juries corrupt? Or the church because it has been used as a cloak for rascality? Equally unwise would it be to abolish the inventor's right to his own, because a morally innocent user of a patented article may possibly suffer wrong through the misconduct of another. That in Minnesota and elsewhere men have misused the provisions of the patent law for blackmailing operations, no one will deny. Possibly such things can be prevented by an amendment of the law, which shall not at the same time open the door for the admission of greater wrongs. If so, the country would be glad to see it done. But neither country nor Congress, we believe, will assent to any remedy so much worse than the disease as that proposed by Mr. Windom.

A PLAN OF CO-OPERATIVE CHARITY.

There are two classes of people who need and should have assistance: first, those who, through physical incapacity, are unable to provide for themselves wholly or in part; second, those who are able and willing to work, yet are without employment. The first class includes orphan children and aged people having no friends or relatives able to care for them, the sick, the crippled, and the like. These need the assistance of the charitable, and it should be given kindly, and as abundantly as the means of the charitable may justify. The second class includes some in temporary want from accidental causes, and vastly more chronically in want through incapacity to compete with average workers in point of skill, intelligence, or endurance.

Is it not possible to employ the latter class to their own advantage, and at the same time as a means for providing more comprehensively for the wants of those that are entirely helpless—this, too, without diminishing in the least the productive value of the labors of others?

Call the two classes respectively A and B. Charity says that B should be provided with work according to the individual capacity of its members. To furnish that work requires capital and supervision, which under the circumstances must be provided without charge. Obviously it will not do for charity to provide work beyond the demands of trade and at the same time pay the market rate of wages to the incompetent. That would hurt the self-supporting classes certainly by diminishing the value of their labor, possibly, also, by seriously diminishing the demand for labor. For the regular manufacturer to compete in the open market with the products of organizations charging nothing for capital or supervision would be impossible except by paying his workmen less or working them harder, neither of which would be a satisfactory result of charity. On the other hand, it would utterly destroy the beneficence of the nominally charitable labor organizations, if the slightest suspicion could arise that the managers of it were speculating on the necessities of the poor.

There are in any community, say, one thousand men and women of class B. They are out of work, and there is no demand for their labor. Yet they would be glad to do anything for the time to gain an honest support. They will work for half the usual rate of wages rather than waste their time in idleness or be an absolute burden upon the charitable; and it is infinitely better for them and for the community that they should be so employed in default of something better.

There are in the same community a larger or smaller number of class A, whose wants are now meagerly supplied by charity. At present the larger part of them affect but imperceptibly the market for food, fuel, clothing, and the like. They simply go without, and to a considerable extent the members of class B fall under the same rule.

Now we believe it quite possible, without adding to the already heavy burden upon the charitable, save in organization and direction, also without materially affecting the status of the self-supporting workers of the community, to make work for the unemployed, for the better supplying of the needs of both A and B. In this way. Provide productive occupation for the unemployed; pay for such work all that it is worth; and use the products of it exclusively for charitable purposes. So far as possible let the inmates of all asylums, hospitals, and the like be clothed by the labor of those employed by charity. In like manner let those furnished with employment have the benefit of the products of charitable workshops. Also, so far as possible, let all outdoor assistance be drawn from the same stores.

For example: A sewing woman is out of work. True charity would set her to work for pay. But it will not do for organized charity to furnish the needed work and pay the same for it as is received by the sewing woman who finds work for herself. Nor would it do to pay less and throw the cheapened product upon the market to compete with the unassisted work of the self-supporting. But by means of the furnished work charity might secure, with a given outlay of money, a double good—employment for the unemployed, and a larger bounty for the helpless. And it would also furnish a suitable means for sifting out from the deserving poor the lazy and undeserving. The wider the association of such charity workshops the wider the range of employment that might be furnished, and the greater the aggregate benefit. And by means of them willing workers out of work through the natural operations or misfortunes of trade would run no risk of pauperism; and at the same time their limited pay might be made to go much further than otherwise in supplying their necessities, without cheapening in the least the value of independent labor.

MISS HOSMER'S MOTOR.

The controversy between Miss Hosmer and Mr. Chapman with regard to the magnetic motor which both claim as their own has developed one fact of considerable interest. It comes out in an interview with her which Mr. Louis J. Jennings reports to the *World*. To prove the futility of Mr. Chapman's claim, Miss Hosmer said that the model which that gentleman was at work on in London "is and has always been entirely worthless. Nothing whatever can be done with it or made out of it. It is on the wrong principle altogether; and, indeed, it is only within the past fortnight, in this very house, that I hit upon the expedient by which the difficulties that have puzzled me could be overcome. Thus, although Mr. Chapman claims the invention, he is ignorant at this moment of the only mode by which it can be turned to practical account. He has claimed the discovery before it was perfected. The means of surmounting all obstacles occurred to me only the other day, and you would see the truth and importance of what I am saying to you if I could reveal the secret to you."

There is a frankness in all this which is inexpressibly charming. Seeing, however, that the model in question—a "worthless" thing, "on the wrong principle altogether"—was confidently described by both Miss Hosmer and Mr. Chapman, not to speak of the *Post's* correspondent, as the most wonderful invention of the age (not excepting the Keeley motor), the cautiously minded may well be excused for not throwing up their hats until the new expedient is proved to be really better.

MEAN DISTANCE OF WATER MOLECULES.—Hermann Herwig concludes that no two molecular layers in water can be more than 1-86 of a millionth of a millimeter apart, and that the same is true with regard to the mean distances of adjacent molecular centers. Sir Wm. Thomson had previously estimated the least value of the same distances at 0·05 millionths of a millimeter. These two estimates, one being less than four-fold the other, furnish satisfactory approximations to the true value.—*Ann. der Phys. u. Chem.*

THE FIRST ELECTRIC LAMPS.

There seems to be little doubt but that Professor Moses G. Farmer, at present connected with the torpedo station at Newport, was the first to make successful experiments with the electric light in this country, and that his discovery dates as far back as 1859. A correspondent of the New York *World* communicates to that paper a recent interview with Professor Farmer, which he commences with the following extract of a letter, written by the Professor some time since to a gentleman in Salem, Mass.:

"Some few of the citizens of Salem (among them ex-Mayor Williams, Mr. George D. Phippen, Mr. J. H. Phippen, and perhaps others) will doubtless recollect a parlor at No. 11 Pearl street, Salem, Mass., which was lighted every evening during the month of July, 1859, by the electric light, and this electric light was subdivided too! This was nineteen years ago, and it was undoubtedly the first private dwelling house ever lighted by electricity. A galvanic battery of some three dozen six-gallon jars was placed in the cellar of the house, and it furnished the electric current, which was conveyed by suitable conducting wires to the mantelpiece of the parlor, where were located two electric lamps on each end of the mantelpiece. (I would not wonder if the screw holes were there at this day.) Either lamp could be lighted at pleasure or both at once by simply turning a little button to the right for a light, to the left for a dark. No matches, no danger, no care to the household, nor to any one except to the man who attended to the battery. The light was noticed as being soft, mild, agreeable to the eye, and more delightful to read or sew by than any light ever seen before. Its use was discontinued at that time for the simple reason that the acids and zinc consumed in the battery made the light cost about four times as much as an equivalent amount of gas light."

Professor Farmer was requested to give his views—first, upon the gas company scare; second, as to the merits of the electric light; third, regarding the mode of conducting it through the public streets; fourth, as to its cost; fifth, regarding the production of electricity.

Speaking of the scare in the gas stock market, the Professor said he thought it was certainly premature, for at present there was not more than one hundred electric lights in practical use throughout the land, and, compared with the number required for the illumination of the country, they were as nothing. "Suppose," said he, "you wanted to give light to the citizens of New York, each one requiring equal to a 10-foot gas burner. Reckoning on the basis of 1,000,000 people you would want 10,000,000 candle lights. If you wanted it divided up into small lights you could not expect to get more than 500 candles per horse power, and that would require at least 20,000 horse power to light the city. In order to accomplish this there would have to be made machines, steam engines (to a large extent purposely for it), magneto-electric machines to furnish the electricity, and it would not be advisable to have them average more than 5,000 candles each for fear of getting out of repair. That would require 2,000 magneto-electric machines, which could not be produced in a moment. It would perhaps be desirable to have 5 electric lamps to each machine, and that would require at least 20,000 lamps.

"While some of the manufacturers are prepared to supply in a certain time their particular style of lamp, yet the public has not decided which is the best to use. No lamp at present in use has such manifest superiority that every person will buy that particular one. None at present in use is properly adapted to minute and profitable subdivision of the electric light. This is an entirely different condition of things to gas illumination, in that factories already exist, and the means of supplying gas fixtures, tubing and piping. Gas pipes are already laid in the streets, which would be utterly worthless for the distribution of electricity for the purposes of the electric light, and while competent electrical engineers are sufficiently well acquainted, theoretically and practically, with the distribution of electricity for telegraphic purposes, yet a distinct branch of electrical engineering science needs to be inaugurated and carefully studied before any expensive system of electric distribution should be entered upon; and although I expect to see the electric light widely introduced, and that very soon, yet I do not conceive that it is going to supplant and displace, to a very large extent, the consumption of gas immediately. But it may and doubtless will have the effect to stimulate and hasten the use of gas for heating purposes as well as those for illumination, and so I expect the consumption of gas to increase rather than decrease after the effect of the scare is over. I venture the opinion that in five years from now there will be more gas consumed than there is to-day, proportionately also with the increase of the population. One of the effects of the introduction of the electric light for the purpose of illumination will be the stimulating inventors to produce apparatus for the consumption of gas for heating purposes."

Touching the merits of the electric light, Professor Farmer said it would eventually approximate the quality of daylight for the display of goods and merchandise in warehouses. It would be vastly superior to gas for the illumination of workshops and manufactories, for with the same expenditure a better and greater diffusion of light would be obtained. He considered a room fairly lighted that has one candlelight to 125 cubic feet of space, very well lighted with one candle to 75 cubic feet of space, but with the electric light properly distributed it would be easy to have one candlelight to each forty or fifty cubic feet of space, and this would be accounted a very brilliant illumination. The light, he thought, would render great service in the mining regions, lessen the expense and diminish the dangers. It will render it perfectly feasible to carry on great enterprises by night as well as by day, such as tunnels, bridges, and constructive operations in general, and prove useful for billiard halls, which are lighted with difficulty by gas, and if necessary great agricultural operations could be carried on by night at profitable expense in harvest time. The lighting of streets and other public thoroughfares will be accomplished satisfactorily and at much less expense than the present mode of lighting by gas, and so there would be more illumination for less money; and a good street lamp at night is preferable to a policeman.

With reference to the mode of conducting electricity through the streets, the Professor said that copper wire was the cheapest conductor, and so will be universally used. The best mode of insulating wires underground for conducting electricity for electric illumination was as yet undeveloped, and will need careful investigation, because the frequent accidents to which subterranean wires are exposed will necessitate the having of a corps of electrical engineers for this special occupation or art, for while it is somewhat of the same character as conducting electricity for telegraphic purposes, still the conditions would be that of another department.

Regarding the cost where power is already in use for manufacturing purposes and where there is an available surplus and it can be used for the production of the electric light, as at Fall River, Providence, Lowell, Manchester, Nashua, Cohoes (N. Y.), and multitudes of other places, the electric light can be furnished very much cheaper than gas is at present supplied, perhaps for from one quarter to a half the cost. There are two elements that enter into the cost of the electric light—the cost of the power consumed in producing it, which costs only when used, and the cost of interest on the plant, which is as great when not in use, for it, like a blister, draws all night long. So if the light is only to be used for an hour or two the cost of interest and depreciation might exceed the cost of the power consumed. For instance, the horse power in some cases could be furnished at $70 per year, while the interest and depreciation on a 5,000 candle machine might cost as much more. So if the light is to be used but a small portion of the time, it would be relatively considerably more expensive than if required to be used all the time. The cotton manufactory would be at one extreme and the coal mine at the other.

Of the production of electricity, Mr. Farmer said that it cannot be stored and the storehouse drawn on at pleasure. It must be produced as and when wanted. The electricity for the purpose of illumination is produced by the movement of coils of copper wire in the neighborhood of magnets. Electricity is developed in condition whenever it is moved across the lines of force streaming from a magnet. The electricity is more powerful the more rapid this motion; more powerful the longer the wire, and more powerful the greater the intensity of magnetism in the magnet. These are the fundamental facts that underlie the construction of all magneto-electric machines. Any more technical description of the process of producing electricity would scarcely be understood by the general reader. In concluding the interview, Mr. Farmer said: "While our gas stocks have depreciated, and may not, possibly, return to their former value, I do not look to see the companies cease to pay good, fat dividends."

AMERICAN INDUSTRIES.—No. 1.

BY HAMILTON S. WICKS.

It is proposed, in this series of articles, to give a concise and intelligent description of the leading industries of this continent. Those situated near, and holding immediate relation with the commerce of the metropolis, will be first considered. Just opposite this city, and immediately dependent on it, lies Jersey city, a workshop of the metropolis of no little importance. Its shipping interests are large, and it is the site of such extensive manufacturing industries as Lorillard's Tobacco Works, The Dixon Crucible Co., Colgate's Soap Works, extensive sugar refineries, iron and steel works, etc. etc.

The first of these industries we illustrate and describe is the Lorillard Tobacco and Snuff Manufactory, and an engraving illustrating some of the processes is shown on the first page.

HOW TOBACCO AND SNUFF ARE MADE.

Since the reign of William III. of England the use of tobacco has become a universal custom throughout the civilized world, although long before his time it had been used quite extensively, having been originally introduced to the attention of European colonists by the Aborigines of this country. Many of the most profound thinkers have been inveterate smokers, chewers, and snuffers; and not a few have lived to an advanced old age with the pipe, snuff and tobacco box as their constant companions.

The tobacco industry of America is a very important one. It utilizes the soil of large tracts of land in many Southern and Western States. It gives employment to hundreds of thousands of people, both in the field and in the factories. It interests large aggregations of capital, and pays into the national treasury fully 34 per cent of the internal revenue.

For the full illustration of this industry it would be necessary to visit some of the quaint villages of Virginia and Kentucky, such as Lynchburg or Henderson, where about this season of the year the planters bring in to market their wagon loads of tobacco leaf, where the speculators or "pinhookers" (as they are called) barter with them for its sale in lump, and where the old time negroes stationed on every corner with long "tobacco horns" call the merchants to the commission sales at the different warerooms. This portion of the industry, as well as the tedious culture of the leaf on the plantations, is merely initiatory, though none the less interesting and useful. The most complicated, and also very interesting and important part of the industry is the manufacturing of the leaf into the various grades of chewing, smoking, and snuffing tobacco that the market demands.

The illustrations on the first page of interior views of P. Lorillard's extensive tobacco factory will prove interesting, as showing the different processes of manufacture. The reader must understand that the leaf used in large manufactories is selected with the greatest care by experts, who determine by the color and smell the quality requisite for any particular grade. The manufacture of plug tobacco is the most extensive in the Lorillard establishment. The machine in the illustration entitled "Rolling the Lumps," is the plug making machine, one of the most ingenious machines known to the trade and wholly controlled by the firm. After it has been sweetened, flavored, and dried the leaf is fed into this machine as "fillers." Being placed as evenly as possible in the long trough by girls it is pressed and cut into the exact size of plugs required by the wonderful automatic action of the machine. The illustrations showing the method of "Covering Lumps" and the "Pressing" give very accurate ideas of those processes. Each plug is weighed after coming from the plug machine, and a standard weight is obtained by taking from or adding to each before covering them. A broad handsome leaf is now wrapped by expert hands about the plug, and it is ready for the pressing room. Here the plugs are put into smooth iron "cells" within a large frame and submitted to powerful hydraulic pressure for several hours. A finishing pressure is afterward given them in another set of hydraulic presses called "pots." Each plug is stamped with the Lorillard tin tag, which is a guarantee of its genuineness.

For the manufacture of fine-cut chewing tobacco the same care in selecting the leaf is exercised as in the plug. The "Dipping of the Leaf" is shown in the illustration; a solution of licorice and sugar, etc., being used for the purpose, and on this and the quality of the leaf depends the character of the tobacco. After stemming the leaf, it is taken to the cutting room, shown in the illustration entitled "Making Fine-cut." Here it is arranged in a trough and forced by the endless chain through a small square aperture, where it is cut into long silken threads by a powerful knife, which makes 1,200 revolutions per minute. All that now remains is to dry and prepare it for the market. Smoking tobacco is similarly made.

In the manufacture of snuff time is required. The process of fermentation lasts from six months to a year or more. Before going into the grinding mills, shown in the illustration, it is thoroughly cured, and after being ground and before it is filled into the bladders for sale it is again cured, until its fragrance and mildness are of the most approved quality. The factories of the Lorillard tobacco works occupy a full block, 405 feet in length and 210 feet in width, in Jersey City, N. J., and bounded by Washington, Warren, Bay, and First streets, and nearly the whole of another block in addition. The house has an age of 118 years, having been originally founded in 1760 by Pierre Lorillard, a French Huguenot. In the year 1870 the present firm took control of affairs, with Mr. Charles Siedler as general partner. The factory in Jersey City as it now stands was erected in 1875, and is the largest institution of the kind in the world. Last year the sale of plug tobacco exceeded 10,000,000 pounds. Of tobacco and snuff the sales aggregated more than 14,000,000 pounds, and $3,500,000 revenue tax was paid to the Government. There is no State in the Union, with the exception of Virginia, that made such a good show either in the manufacturing of tobacco or the tax paid as this one house. An army of over 2,500 men, boys, women, and girls is kept constantly employed. About $14,000 is dispensed weekly for the labor, and it would amount to a calamity to these people if such an institution were to cease its operations from any cause even temporarily.

PATENT OFFICE PRACTICE.

Commissioner Paine announces that hereafter letters patent and certificates of registration will be perfected and ready for delivery upon the day of their date. The last issue, under the rule heretofore existing, will bear date of December 17, 1878. Then there will be a hiatus until January 7, 1879, on which day, and subsequently, patents and certificates will be deliverable as soon as signed.

The *Official Gazette* of even date with the weekly issue will continue the usual announcements respecting the perfected patents and certificates of that date, but no information, either by *Gazette* or otherwise, will be given as to any pending case about to issue, except to the party in interest, until such case has been finally signed and sealed.

A NOVEL thermoscope and hydroscope, the invention of Col. Aristide Gerard, has recently been patented both in this country and in Europe, and is controlled by the Automatic Safety Company, of No. 40 Charles street, New Orleans, La. This invention is designed for the speedy detection of abnormal heat or water in steamers and other vessels, and is said to be very effective.

Центральна Наукова Бібліотека ВОН УАН 110630

CHICHESTER WATER WORKS.

The prominent position now taken among engineering questions by those of water supply, especially to small places, will make the following illustrated description of Chichester water works of considerable interest to our readers. The works contain several features of engineering interest, and are such as are suitable for a large number of towns.

The source of supply is a well sunk in the chalk, adjacent to a powerful spring one and a quarter miles west of the city. The exact position of the well was determined by the certainty of an adequate supply being obtainable near the spring, while its location so far from Chichester was fixed with a view to avoid the contaminated water inclosed in the geological basin over which the city stands.

The works consist of a pumping station at the source of supply, a main pipe, 2½ miles long, passing through the city to a service reservoir and tower, and four miles of distribution pipes. They were designed to supply eventually a population of 10,000 persons with 20 gallons per head per day. At the pumping station the sinking of the well was commenced with wooden cylinders 6 feet diameter inside the curbs, for a depth of 17 feet, after which it was continued with wrought iron cylinders 5 feet 8 inches inside diameter. The cylinders were 9 feet long, connected by angle irons 3 inches by 3 inches. The plates were $\frac{7}{16}$ inch thick, and the rivets were countersunk on the outer side. The wooden cylinders were lined with brickwork in cement, and the junction between the brickwork and iron was securely calked with oak wedges. A foundation for the superstructure of the engine house and the engines was secured by a dome of cement concrete.

The engines and pumps are in duplicate, each designed to raise on trial 10,000 gallons per hour against a head of 200 feet, with a consumption of 3½ lbs. of Welsh coal per horse power estimated by the water lifted, and in actual work they each lift 11,500 gallons per hour against a head of 160 feet, with a consumption of 4 lbs. per horse power.

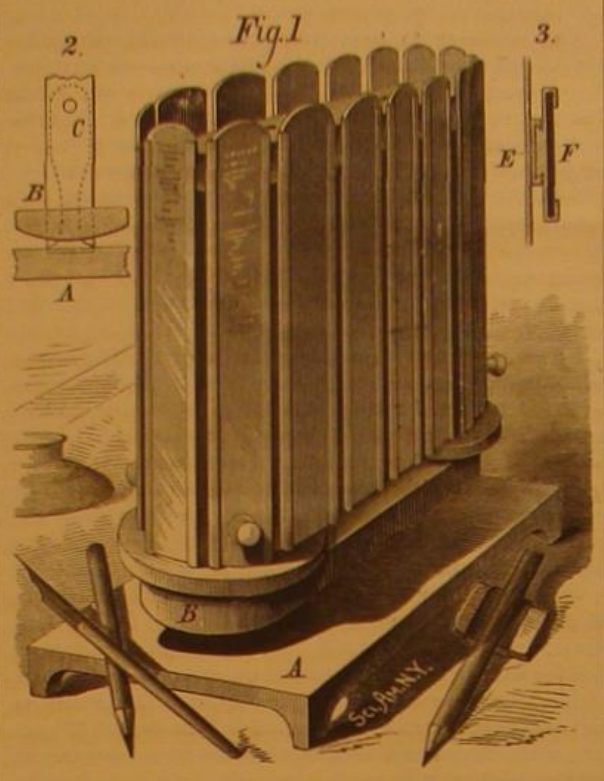
The engine is horizontal and of the usual compound type, with the high pressure cylinder toward the crank and in front of the low pressure cylinder. The diameter of the high pressure cylinder is 9½ inches, and that of the low pressure is 18 inches, and the stroke is 2 feet.

On the end of the crank shaft is placed a disk, from which the pump is driven direct from the main shaft. The pump is of the plunger and bucket type. The diameter of the plunger is 8 inches, that of the bucket 11 inches, and the stroke 1 foot 6 inches. Steam is supplied from two Cornish boilers of 4 feet diameter and 14 feet in length, with one flue in each of 2 feet 2½ inches diameter. The speed of the engines was designed to be 30 strokes per minute, and in actual work they run from 28 to 35 strokes per minute.

It is proposed to check the engines more by employing a slide valve on the steam pipe, which is to be kept open by the pressure of the column of water, and to be instantly closed by a spring when the pressure is relaxed.

The reservoir was designed to hold 100,000 gallons only, though provision was made for doubling its capacity eventually if necessary. It is 10 feet deep, and is built on a subsoil of wet sand and gravel, of Portland cement and gravel concrete (1 to 6), rendered with cement and sand (1 to 3), and floated on the inside surfaces with cement and sand (1 to 1). The main is taken through the wall so as to project about 6 feet into the reservoir. This projection was bedded in and surrounded with cement, and then built round with a block of concrete, having all its outer surfaces rendered in cement. All angles and corners were run with a fillet of cement, and thus a completely watertight job was effected without puddle. The whole was arched over in brickwork, and covered with an earth embankment.

Fig. 1



ALBER'S REVOLVING INDEX.

The highest ground available for the reservoir is only 60 feet above Chichester Cross, which may be taken as the average available head at the reservoir for almost all the district to be supplied. This head is increased to about 100 feet at the Cross when the pumps are at work, but inasmuch as the supply to the higher parts of the district would thus have depended on the pumps, and would have been intermittent and uncertain, a high level service was arranged by which a cistern is filled daily for each consumer requiring it, and a tank at the high level is always kept full and available for the extinction of fire.

To effect this, instead of a stand pipe, the tower, shown in the engraving, was built with a tank at the top 40 feet higher than the reservoir, into which, when a valve on the main at its base is closed, the water rises up an 8 inch pipe and through a self-closing 8 inch valve seated in the bottom of the tank. The ordinary outlet from the tank being only through the overflow at the top, and thence into the reservoir, the tank is always kept full. The high service cisterns of the consumers are filled from the rising main, which has thus an additional 40 feet of head thrown upon it during the time that the engines are pumping into or over the tank for the purpose of filling the cisterns. The 8 inch self-closing valve in the bottom of the tank contains a 4 inch valve, which works with it on the same spindle, except when raised by a chain pulled from the chamber on the ground floor of the tower.

In case of a fire occurring when the pumps are not at work, and the pressure in the city is consequently low, the valve on the main at the bottom of the tower being closed, and the chain pulled, an extra head of 40 feet is thrown upon the pipes. *The quantity of* water in the tank is sufficient to supply one hose of the Metropolitan Fire Brigade pattern for about thirty minutes, and would allow time for getting out the fire engine and for starting the engines at the pumping station.

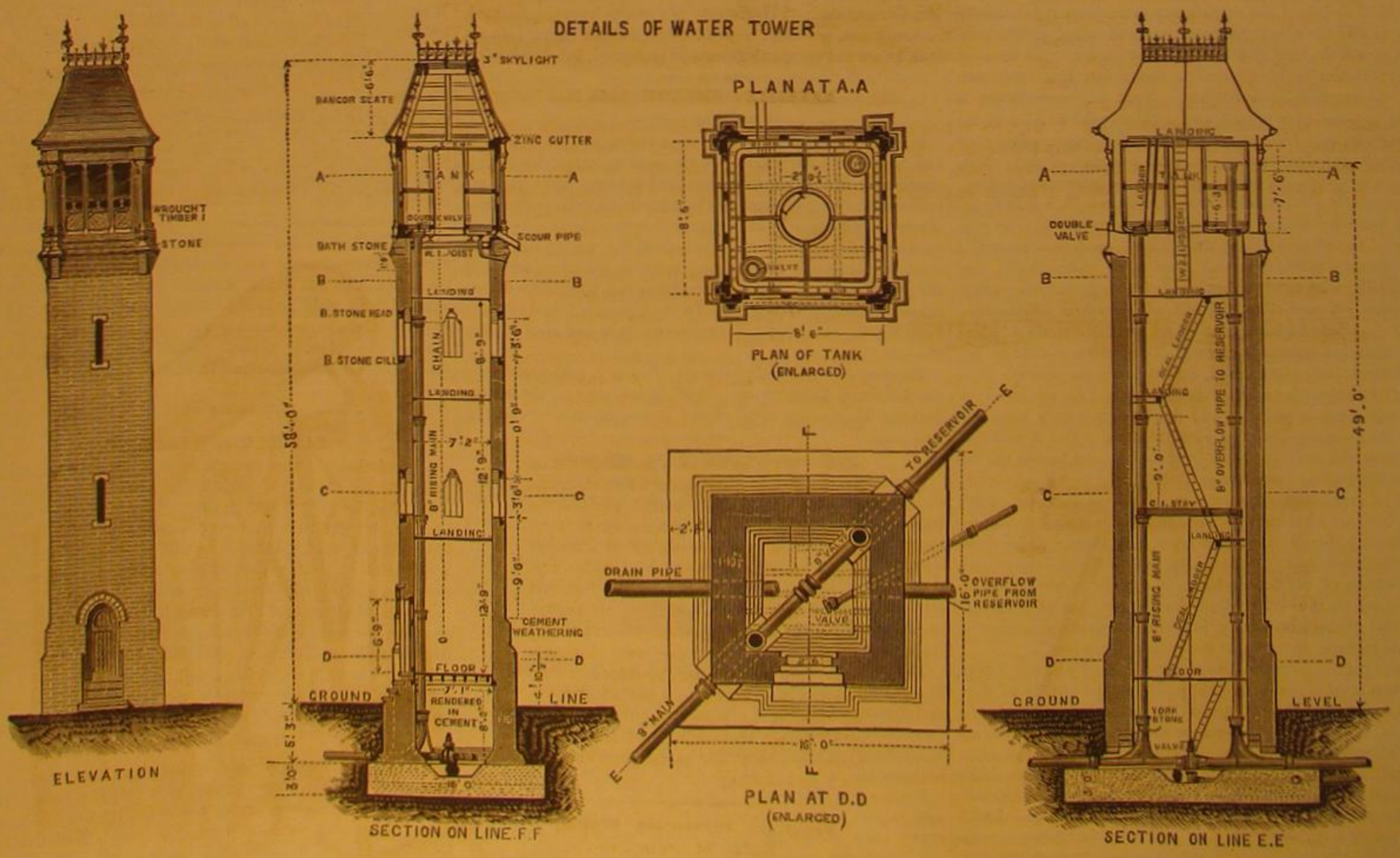
It is conceivable that such "fire reservoirs" might be applied on a large scale where high pressures would be otherwise difficult to obtain, and that they might be promptly brought into operation when needed by a telegraphic message to the man in charge.

The cost of the whole works, including a large sum spent in a parliamentary contest, amounts now to £14,500, and estimating that another £1,500 will be wanted to complete the distribution pipes, etc., for the supply of 10,000 persons, the total cost will be £16,000, equal to £1 12s. per head. The engineer of the company is Mr. Shelford, of Westminster, under whose direction the works were completed.

A NEW REVOLVING INDEX.

The accompanying engraving represents a revolving index recently patented by Mr. Lübbe U. Albers, of Carthage, Ill. It is intended for the use of book-keepers and others requiring a ready means of referring to different names or items contained by the index.

To the center of the base, A, is attached a standard, C, which passes through the lower bar, B, of the frame that supports the vertical rollers around which the endless belt, E, passes. To this belt are attached a number of strips of sheet metal, which are bent outward to form slides for receiving the strips, F, of sheet metal which contain the strips on which are written the names, number of page, etc. These strips have at their upper ends the alphabet, and several of the strips, F, have small knobs for convenience in turning the endless belt. The belt and its supports may be inclined at any desired angle, and the strips may be removed when filled and filed for future reference. The advantages of this device will be apparent to those who require an index. It certainly will effect a considerable saving in time. For further particulars address the inventor as above.



CHICHESTER WATER TOWER.

SACK HOLDERS AND LIFTERS AT THE EXHIBITION.

"So much sack."—SHAKESPEARE.

The uses of convenient implements are spreading into all the industrial occupations, as we in the United States know better than any other people, for we have more inventions of that character than are to be found elsewhere.

Fig. 1.—ROSE'S SACK LIFTER.

Churns of curious design, washing machines, egg beaters, apple parers, and scores of other conveniences for domestic uses and ordinary occupations are advertised and labeled as "American."

The word "sack" is said to be the only one that is the same in all languages. Here is one thing in common between the Hebrew, Irish, Greek, Cornish, French, Latin, English, Hungarian, Icelandic, and Gothic; here they unite. How this came about it is hard to say, but the legend goes that when tongues were confused at the Tower of Babel, the workmen finding that something was going wrong, each called for his sack to carry home his tools in, and that was the only word they all remembered.

The sack lifter of Messrs. Rose Frères, Fig. 1, is similar to Marshall's sack elevator, Fig. 2, but has a standing frame which is portable, but not designed to be used as a truck. The sliding bag holder is lifted by cord from a winch on the frame, and held by a click in a ratchet wheel on the crank shaft.

Marshall's sack elevator, Fig. 2, is a truck, with stay rod to hold it upright, and a winch by which the sliding frame holding the bag is elevated so that a person can take it upon his shoulder and carry it off without the assistance of a second person in lifting. It is specially intended for a person in attendance upon a thrashing machine; one man to tie the bags as they are filled, lift them, shoulder, and carry them off to the granary.

Romaine's sack filler and weigher, Fig. 3, requires but little description to elucidate it. A spout with sliding door admits the grain, flour, or whatnot from the floor above. The bag is clipped by a ring to the funnel, which is suspended from a crotch on the end of the weigh beam. The latter is upheld by a tripod. Price from 150 to 325 francs; weighing from 200 to 100 kilos.

The small army mill, Fig. 4, stands upon three legs and grinds into a sack which is suspended beneath. It is worked by two men, grinds 20 kilogrammes per hour, costs 200 francs; four of them, packed in two boxes, are the load for a mule on the march.

The sack lifter and emptier, by Rose Frères, Fig. 5, enables one person to lift and to transfer the contents of one sack into another. It acts by means of a winch and rope, but the sliding frame is guided in such a manner that after attaining a certain elevation it tips over and brings the mouth of the sack to the open end of the bag ready to receive it.

The French sack holder of Bodin is so much like the Gilbert, Fig. 8, with the addition of wheels, that it needs but to say, in addition to giving the illustration, Fig. 6, page 20, that its weight is 28 kilos, and its price 50 francs.

John the Baptist Normand fits the handles of the truck with notches, so that the spreading frame for the sack mouth may be adjusted in height for the length of the sack. The frame has four hooks on to which the hem of the bag is caught (Fig. 7). Price 35 francs.

The Gilbert (English) sack holder (Fig. 8) is a slanting frame, with a strut to support it, and a clip ring at top to spread the mouth of the sack. To state its purpose would be merely to make a list of things that can be put into a sack, which is needless. It dispenses with a man to hold the sack, and furnishes a rest for the measure in emptying. Its price is £1 3s.; with wheels, £1 12s.

EDWARD H. KNIGHT.

Paris, October 5, 1878.

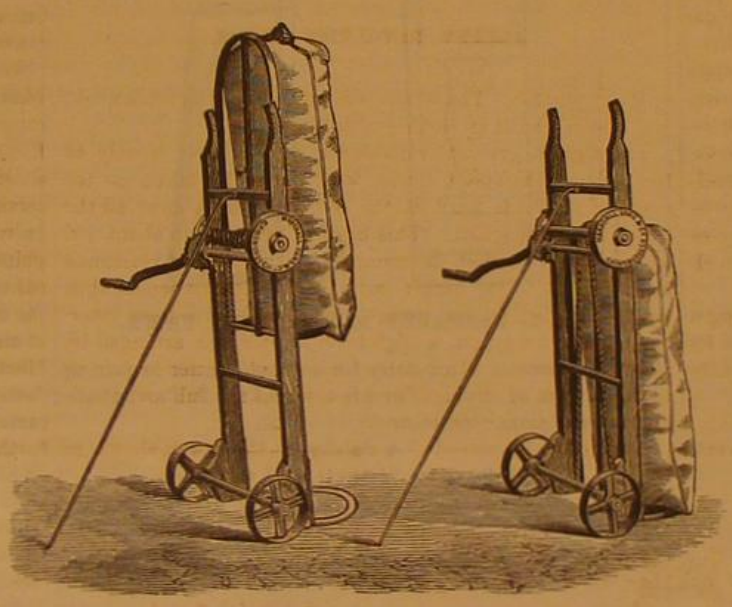


Fig. 2.—MARSHALL'S (ENGLISH) SACK ELEVATOR.

Fig. 4.—ARMY MILL.

Amateur Inventors.

The Philadelphia *Ledger* takes to task those papers which have sneered at Miss Hosmer's electric light invention on the ground that "amateurs rarely discover anything worth patenting." Of course, an amateur who knows nothing about mechanics, adds the writer, is not likely to make valuable contributions to mechanical progress; but there are many amateurs self-educated in science and mechanics, and from this class some of the most original inventions have come. Miss Hosmer's profession—art—has furnished the world with at least two great inventors, who, though amateurs in one sense, led the way for "scientifically educated and practically experienced mechanicians." Robert Fulton and Professor Morse were both American painters, and both became distinguished American inventors, although they were amateurs in their particular fields of investigation. The history of invention points to the fact that entirely novel ways of doing things are likely to first suggest themselves to those who, being amateurs, have not become set in their ways of doing every-day work. Watt, although a mathematical instrument maker, did not stick to his trade, but invented many essential parts of the steam engine; Corliss was a country storekeeper; Elias Howe was more of a farmer than a mechanic when he made his first sewing machine, and Edison has "picked up" all that he knows about electricity, mechanics, and magnetism. Education and practical experience are very desirable things, but because an inventor's calling seems to show that he has neither one nor the other is no reason for throwing discredit on his invention in advance of experiment with it, and particularly before it has been described.

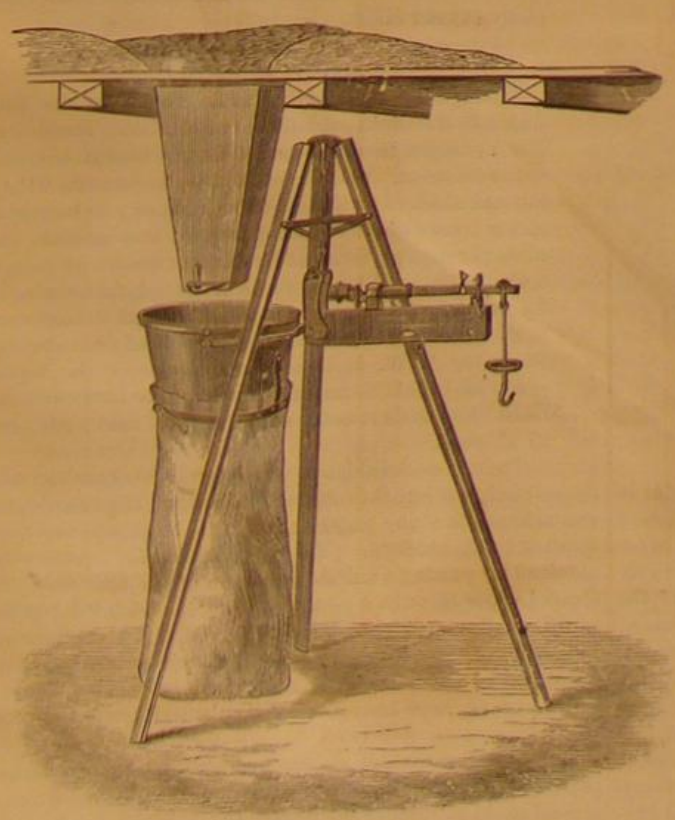


Fig. 3.—ROMAINE'S SACK FILLER AND WEIGHER.

Paper for Preventing Fraud.

Mr. A. Nesbit, of Gracechurch street, London, is the manufacturer of a paper for checks, bank notes, deeds, law documents, or other instruments of a similar character, so as to prevent alterations by the use of chemicals, including acids and cyanide of potassium. For this purpose he mixes with the paper pulp or passes the manufactured paper through an alkaline solution of peroxide of iron (or any salt of peroxide of iron) and ferrocyanide of potassium, or other base, in which the iron is kept from precipitating by the addition to the solution of tartaric acid, citric acid, sugar tartrates or citrates, or other organic substances having the power of preventing the precipitation of oxide of iron by an alkali, or sulphocyanide may be substituted for ferrocyanide, or ferricyanide may be substituted for ferrocyanide, and the salt of protoxide of iron for one of peroxide of iron. Upon the application of a chemical to paper manufactured or treated according to the invention a color or stain will be produced, whether the chemical be applied over ink or not.

Fig. 5.—ROSE'S SACK LIFTER AND EMPTIER.

Erin go Bragh.

A fictitious cable dispatch of inordinate length, purporting to emanate from a staff correspondent who has, says the New York *Tribune*, been sent across the seas to find Mr. Edison, is an amusing *jeu d'esprit* in *Saunders Irish News*.

When the correspondent landed in New York, President Hayes went tearing down Broadway to the Battery in an open carriage drawn by six cream colored horses, and preceded by a number of outriders in scarlet and gold, and a squadron of siege artillery in full gallop. As they approached, the President descended from his carriage, saluted the correspondent on both cheeks, and immediately raised a cheer, which was at once taken up by his party, and repeated from the Battery to the Central Park. The President carried his guest off to the White House, where they had bird's-nest soup, bluefish, bread fruit, pilaff, and oysters in every style. After lunch the President drove the correspondent out (without the artillery) to see the sights in the immediate neighborhood—the Falls of Niagara, the prairies, the Yosemite Valley, and giant trees in Mariposa County. When he learned that the Irishman had crossed the seas to talk with Mr. Edison, the President urged him to do nothing of the

sort. He remarked that the inventor was hardly ever at home, being generally in the Patent Office registering some new discovery, and besides he was so highly charged with electricity that it was dangerous to approach him. The President remarked that the inventor was frequently seen with a regular nimbus around his head, a sort of domesticated aurora borealis, and one man who shook hands with him in a casual way, went home, took to his bed, and was prostrated by the violence of the electrical shock.

Anhydrous Sulphuric Acid.

The well known oil of vitriol, as our readers know, is a compound of sulphur, oxygen, and hydrogen, in the proportion of 16, 32, 1; and has received the formula H_2SO_4, or $H_2O.SO_3$. Although we are not able to remove from this any water, as the last formula seems to indicate, yet a compound is known which will combine with water to produce the oil of vitriol, or common sulphuric acid, and hence it was called anhydrous sulphuric acid, or sulphuric anhydride, and supposed to have the formula SO_3. It is a white, silky solid, forming long needles like asbestos, and can be obtained in two or three different ways, usually by distilling so-called Nordhausen or fuming sulphuric acid at a moderate heat. It is also made by oxidizing sulphurous anhydride, SO_2.

Weber's investigations have proven that these crystals are not anhydrous, but mixed with a hydrate. By repeated distillations, fractional distillations, and recrystallization, he obtained the pure anhydride, which is, at common temperatures, a mobile, colorless liquid, which solidifies on cooling strongly to long transparent crystals, resembling those of saltpeter, but totally unlike those white, opaque, silky crystals formerly mistaken for sulphuric anhydride. The pure anhydride melts at 14·8° C. (58·6° Fah.) and boils at 46·2° C. (115° F.). The slightest trace of moisture converts it into the well known silky crystals. Weber succeeded in separating two hydrates, one having the composition $H_2SO_4.3SO_3 = H_2S_4O_{13}$, and the other, $H_2SO_4.SO_3 = H_2S_2O_7$.

He also investigated the blue compound produced when sulphur and anhydrous sulphuric acid are brought into contact, and first described by Vogel in 1812, and finds that it has the composition S_3O_2. When dry flowers of sulphur are thrown into freshly prepared liquid sulphuric anhydride (SO_3) the sulphur melts to blue drops, which sink below and soon solidify. When a sufficient amount has collected the liquid anhydride is poured off, and the residue then removed by gently warming. It forms a crystalline crust which looks like malachite and decomposes, slowly at common temperatures, faster if heated, into sulphurous acid and sulphur ($2S_3O_2 = S + 3SO_2$). It dissolves with a blue color in so-called fuming, or Nordhausen, sulphuric acid. Water decomposes it, setting free sulphur and sulphuric and sulphurous acid and thiosulphuric acid. This blue color was made by Bucholz in 1804, by heating sulphur in fuming sulphuric acid.

This adds another to the already long list of oxygen compounds of sulphur, to which Berthelot not long since (*Comp. Rendus*, 86, 20) added persulphuric acid S_2O_7, so that to all the oxides and acids of chromium there are corresponding oxides of sulphur, and it only remains to find more oxides and acids of chromium to correspond to those of sulphur.

Crystallized Javelle Water and Chlorozone.

This absurdly contradictory name, eau de Javelle cristallisée, is given to a commercial article made in France, which is intended to take the place of chloride of lime or bleaching powder for washing and bleaching cotton, linen, and paper stuff. The claims made for it are its perfect solubility in water, uniform and certain action upon the fiber without injury to it, saving of cost by lessening the number of operations in the bleaching process, and, finally, more convenient and cheaper to transport. We have no details as to what it really will do, but it seems probable that if rightly made and used, it may, in many cases, surpass chloride of lime, provided its present high price be somewhat reduced. The well known Javelle water is merely a solution of hypochlorite of potash, and much used as a bleaching agent, as is also the corresponding salt of soda, eau de Labarraque. Neither of these are crystallizable, so that there can be no such thing in reality as crystallized Javelle water. The product under discussion has the following composition: 80 per cent crystallized carbonate of soda, 8·5 per cent chloride of sodium (salt), 11·5 per cent hypochlorite of soda. The best name for it is sal soda impregnated with hypochlorite of soda. The manufacturers claim for it the power of cleaning and bleaching in one operation, without previously having put the stuff through an alkaline lye for the purpose of cleaning it perfectly. The carbonate of soda, they claim, is the cleansing principle, and the hypochlorite destroys the coloring matter. The two act simultaneously, which of course saves time. We are not aware whether in practice this is true, but it is possible.

Particular emphasis is also put upon the assertion that the stuff to be bleached is not injured by this salt, as it is frequently enough when chloride of lime is used: first, because the action is slow and regular; next, the total absence of lime renders the formation of any injurious lime precipitation in the goods impossible; finally, the solution is not totally worthless after the bleaching is done, but can always, owing to the relatively high percentage of soda in it, be employed for washing either immediately or after it has been rendered caustic by heating it with quicklime. The salt, as it is sent to market, is quite well crystallized, resembling sal soda. It possesses the characteristic odor of chloride of lime, dissolves perfectly in water to a clear solution, which should not be underrated for practical purposes, as no decantation or letting it settle is necessary, and a solution of any desired strength can be made at once. It must be kept in a dry place, as it absorbs moisture readily and would soon become wet through. The manufacturers claim that it keeps well, which we doubt, for the analysis of a specimen kept in a closed glass gave only 1·33 per cent of active chlorine.

Fig. 6.—BODIN'S SACK-HOLDING TRUCK.

Chlorozone is another new commercial article. It is made by saturating a cold solution of the caustic or carbonated alkali with a current of hypochlorous acid mixed with air. The hypochlorite indicates nearly 40° Baumé, and 100° to 120° chlorimetry. By the addition of calcined soda it forms solid chlorozone, as a compact mass that can be broken up, but melts at 68° Fah. The price is not much above that of chloride of lime.—*Schweizer Gewerbeblatt.*

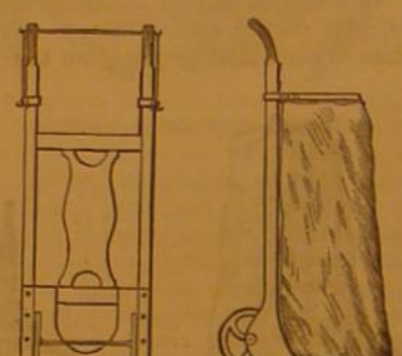


Fig. 7.—NORMAND'S SACK-HOLDING TRUCK.

Chemistry in Schools and Colleges.

It is scarce a century since chemistry began to exist as a science, yet few sciences have contributed so much to the happiness and pleasure of mankind. The problems before her are infinite, but one after another are slowly being solved. So many are the fields for her labor and so varied her work, that we cannot wonder that many people have very strange, contradictory, and absurd notions of what chemistry is. One thinks it consists chiefly in concocting unpalatable potions, another in making awful stenches; some confound the chemist with the magician, others think he must be an apothecary or a physician. But chemistry moves on in spite of opposition or ridicule, and even gains in public popularity. Although the grand fundamental laws of the science, the great underlying principles which are to explain all its phenomena—as Newton's law does those in astronomy—have not yet been discovered or evolved, and the accepted theories of to-day may be overturned to-morrow, yet chemistry is no longer what it once was—an accumulation of facts, of disconnected phenomena, with which the memory may be overloaded without profit. Its facts have been reduced to system, some of its laws are understood, and the harmony of its several parts are known. For this reason, as well as for its practical and economical uses, it has taken its place in the list of subjects which constitute a liberal education. Hence we find few schools for either sex where two or three hours a week are not devoted to this subject, and even in private and preparatory schools it is taught by experiments and lectures, not as dry text-book catechism, and the mind is at least incited to know something of this world about us.

Fig. 8.—GILBERT'S SACK HOLDER.

At a period when the value of natural and physical sciences as a source of mental discipline is beginning to be acknowledged, and science itself to be respected and honored here as elsewhere, it is somewhat remarkable to see one of our oldest colleges abolish the study of chemistry in her regular course. Yet this is what Columbia College has really done. True, the name of chemistry still appears in her list of studies, but it is studied no longer. It is but an outward pretense, a sham, an empty name, a skeleton without flesh, a shell without contents.

One of her youngest classes assemble once a week to listen to lectures upon chemistry by one of her best and ablest professors; but what can the greatest of chemists teach in 25 hours to a class who have had no preparation for his teaching? Chemistry is there made to precede physics, the larger fundamental science of which it is itself one of the larger subdivisions. Hence the lecturer must either prepare the soil himself or have the seed fall upon hard ground. To lecture upon the spectroscope to men who know nothing about light, or upon gases to men who know nothing of the laws of mechanics and pneumatics, is to waste half the labor. To assume that the students have learned, before they entered college, subjects too abstruse to be taught them while in college, is the height of absurdity, and yet strangely enough the Columbia Grammar School teaches more chemistry, and teaches it more thoroughly, than does the college. The senior class may, if they choose, attend a few lectures upon advanced chemistry along with students of the School of Mines who have devoted one or two years to this branch, and not having had any preparation at all sufficient, are again unprepared to profit by it. Let us ask why this change has been made and the amount of chemistry reduced to one fourth of what was already too little. Columbia is about to erect new buildings and wants to save the expense of a chemical lecture room. She also wants to economize on the salaries of her professors in science to enable her to employ more instructors in law and in history. To this the welfare of her students and her own good reputation are subservient. Let her seek concealment as she may, truth must prevail.

Salicylic Acid with Boracic Acid.

Both of the above acids are extensively employed as antiseptics in foods, as neither of them alone imparts any unpleasant flavor, but if both are used together a decidedly bitter taste results. This fact was first noticed by Dr. Hager, who examined a milk with a bitter taste, but failed to find any particular bitter substance in it. On further examination it was found that borax had been added to protect it against the heat of summer, and afterward a little salicylic acid was added for its preservation during transportation.

Another case was where a mixture of 2 parts salicylic acid, 2 of borax, 30 of alcohol, and 200 of water had an exceptionally bitter taste. In both cases the bitter taste was produced by this combination of salicylic acid with borax. That it was due to the acid and not to the soda, was proved by the bitterness being imparted at once to a solution of salicylic acid on putting in some boracic acid.

Consequently the use of both antiseptics at once must be avoided, and only one employed at a time. To test the truth of Dr. Hager's assertion, our readers need only to dissolve a grain or two of boracic acid in alcohol on a watch-glass and then add a crystal of salicylic acid; in a few seconds the taste will be almost as bitter as that of sulphate of quinine. Perhaps salicylic acid can be employed as a quick and certain test for boracic acid in food, especially canned meats.

Methyl Aldehyd.

Aldehyd is a name given to the first substance produced by the slight oxidation of an alcohol. It contains less hydrogen than the alcohol from which it is made, hence its name. Methyl alcohol has the formula CH_4O, but the aldehyd is CH_2O. The difficulty in its preparation consists in its passing rapidly into another and more permanent form of oxidation, known as formic acid CH_2O_2. When a piece of hot platinum wire or foil is suspended above a vessel of alcohol it continues to glow, owing to the slow oxidation of the alcohol. Professor A. W. Hofmann has condensed the liquid given off in this form of glow-lamp, or lamp without flame, and finds it never contains more than 1 per cent of aldehyd.

The amount of aldehyd was determined quantitatively by converting it into the sulphur compound. The experiment was changed in many ways to obtain a more concentrated solution of the aldehyd. The most successful results were obtained by passing a suitable mixture of air and methylic alcohol vapor through a platinum tube, in which is a bundle of thin platinum wire, and gently heated. On condensing the escaping vapors it contains on the average not less than 5 per cent of alcohol. If suitably mounted such an apparatus can be kept in operation without interruption for months.

If the undecomposed alcohol be removed by distillation (when some aldehyd escapes also) and the residue frozen several times to remove the water, the aldehyd can be concentrated to 10 per cent and upward.

Correspondence.

Baking Powders and Glucose Sirups.

BY ROBERT PETER, M.D.

(Professor of Chemistry, etc., in Kentucky Agricultural and Mechanical College; Chemist to the State Geological Survey, etc., etc.)

Although several communications have appeared in the SCIENTIFIC AMERICAN on these subjects, the writer believes they are not yet exhausted of their interest. The possibilities connected with their bearing on health or disease and mortality deserve further discussion, for which I have no doubt you will freely give a few more columns in your highly useful periodical.

The obvious fact is, as proved by the analyses of baking powders by others as well as by myself, that desiccated alum is substituted for cream of tartar in many of our popular "baking powders."

The United States Patent Office has sanctioned this use or abuse of alum by their letters patent, and alum is very much cheaper than cream of tartar; answers equally well to set free the carbonic acid which makes the bread light, and may also make a whiter loaf than that dearer article. The manufacturer can make more profit at a lower selling price, with alum powder; more especially if he mixes them with a large proportion of starch.

The chemical facts are as follows: By heating the ammonia alum to a certain temperature it will be caused to part with its water of crystallization, and will lose part or all of its combined ammonia, according to the temperature and time of exposure to it, leaving simply aluminum sulphate, mixed with more or less free sulphuric acid and undecomposed aluminum sulphate. This mixture when brought together with bicarbonate of soda, in the paste or dough, in the presence of the water will decompose the soda salt, especially when moderately heated, and the carbonic acid of that salt set free will inflate the pastry and make it light and spongy. At the same time the alumina of the alum is separated in the form of aluminum hydrate, and harmless sodium sulphate, or Glauber's salt, is produced.

The nature and results of the chemical decomposition are correctly stated by Professor Doremus, as well as by the patentees of these baking powders. There is no alum in the bread or other article prepared with these powders, but only the products of its decomposition, viz.: Glauber's salt, in too small quantity to be active, and precipitated aluminum hydrate.

But at this point a new question arises, and one of weighty import: Is it not probable that the continued ingestion of aluminum hydrate with our daily food, may, in the long run, induce disease and shorten life?

It is true that when alumina is in combination with silica, as it is in clays, it is not readily soluble or decomposable in weak acids; but alumina combined only with water, or even when the water has been separated by ignition, is much more soluble. The heat which suffices to bake bread will not separate the water from aluminum hydrate, and it hence exists in the bread in a condition readily to form salts with even weak acids. What, then, is the probable action of this aluminum hydrate in the processes of the digestion and assimilation of the food in which it exists as an ingredient? In the stomach, under the action of the acid gastric juice, it is likely to be dissolved, and to form aluminum chloride; but, because of the great affinity of alumina for albuminous and other organic matters as well as for phosphoric acid, it probably enters into combination with these, to a certain extent at least. If these compounds are insoluble in the stomach solution, no other harm will result but a waste of a certain quantity of the essential phosphates and albuminates of our food, which waste may be measurably supplemented by the introduction of some bone superphosphate into the baking powders.

But it is more probable that at least a portion of the aluminous compound is retained in solution in the acid chyme and is absorbed into the blood vessels in the coats of the stomach, to act locally in thickening or otherwise altering their delicate coats; or meeting with the slightly alkaline venous blood, rich in albuminous compounds, to induce a tendency to coagulation, which, however slight, may in the course of time cause obstructions in important glandular organs, especially in the kidneys and liver, interfering with their healthy functions, and in the end causing fatal disorder.

The portion of the albuminous compound which is not absorbed from the stomach will doubtless be decomposed in the duodenum, where it will be rendered insoluble by contact with the alkaline bile; but in the cæcum it will again be subjected to an acid solvent, and a second danger of absorption consequently occurs. These are probabilities of deep import. Aluminum chloride, like tin chloride, forms insoluble compounds with albuminous, gelatinous, and other organic matters, and when introduced into the blood in quantity cause sudden death, and doubtless when taken up in repeated minute quantities, will cause alterations of tissues and coagulations of the circulating fluids resulting in obstructions and disease.

The use of chloride of tin by reckless manufacturers of glucose sirups, etc., proved by numerous analyses by others as well as by myself, is especially to be reprehended, as these products, sold under various names, as "golden sirup," "maple sirup," "sugar-house molasses," etc., or the glucose in the solid form mixed in the soft granular sugars, are in very general use, greatly to the detriment of the general health. The people everywhere should be put on their guard against this insidious slow poisoning and advised against the use of any sirup, etc., which leaves a metallic taste in the mouth. Three pounds of good pure Louisiana brown sugar, boiled in a clean iron vessel with a pint of water, will make a perfectly wholesome sirup, far preferable to any of the tainted sirups of the present market.

Aluminum and tin salts are both used as mordants by the dyer, because of the strong attraction of the oxides of these metals for organic compounds. Aluminum salts for the same reason are used in preparing white leather, and the observations of Orfila show that when given to animals they cause a thickening of the coats of the stomach and bowels, and an appearance as though they had been tanned.

It is true that Orfila contended for the harmless nature of alum in small doses, and Wibmer and others experimented on themselves by taking it in small doses for some weeks together without any sensible evil results. Very probably the slight impairment of tissue was not sufficient to produce manifest disease. But had they continued their experiments for years at all their daily meals, no doubt the functions of the stomach would have become impaired by the thickening of its coats and the alteration of its glandular tissue under the action of the dissolved aluminum salts, and dyspepsia or chronic inflammation would be the result in time.

That alumina is not friendly to organic life is shown by its almost general absence from the composition of vegetables and animals. In only a very few plants of the lowest order is it found as a regular constituent. The propriety of introducing it into our daily food is not properly to be ascertained by costly and broadly hazardous experiments upon the people at large, or with the object of cheapening the production and increasing the profit on baking powders. Nor is there any necessity for such heroic tampering with the public health. Why lay aside the time-honored yeast or ferment, which, when skillfully and carefully prepared and used, is without injurious influence? Or, if we must have "quick-rising," why not use the pure cream of tartar and good bicarbonate of soda until something equally harmless is discovered?

The writer is informed that there occur many more cases of Bright's disease and other forms of disease of the kidneys than formerly. Are we to attribute this to chloride of tin in glucose sirups and sugars, or to alum in baking powders, or are not both very liable to suspicion?

Even the cream tartar baking powders may come in for some share of guilty responsibility because of the greater amount of alkaline salts determined to the kidneys by their habitual use, and that most *chemical* of all baking powders, Horsford's, which, with the commendation of Liebig, might seem to be pathologically innocent, as it is chemically excellent, may yet, by a possibility, give to the renal organs too much earthy phosphates to excrete in solution. "Give us," therefore, our "old-fashioned daily bread" until something better is discovered than is found in all the baking powders.

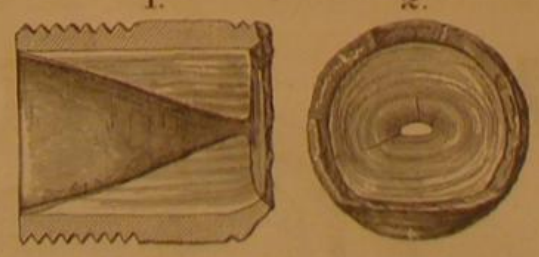
Choked Feed P.pes.

To the Editor of the Scientific American:

I send to you by mail a ¾ inch nipple that was taken from the feed pipe of a ten horse power portable thrashing engine.

The engine was brought to the shop to have a new check valve put on, as the one that was on was badly worn. To remove the old one, we cut off this nipple close to the boiler, and were surprised to find that the pipe where it entered the boiler had been reduced in area to about 0·01 of a square inch, by deposits of lime.

The persons in charge of the engine said that they had had no trouble in keeping the boiler well supplied with water, and had used it several days this season, before bringing it to the shop, using the steam at 100 lbs. pressure.



The pump plunger was attached to the cross head of the engine. Had the pump been driven by a belt they would have experienced much trouble in driving it.

Several months ago, a man owning a saw mill brought his force pump to be repaired. He said that he could not drive it with an eight inch belt, while it used to be driven easily with a four inch belt. After examining the pump, I told him that it was all right, and could do nothing for it, that the pipes from the pump to the boiler might be filled with lime (as the water passed through a heater before it came to the pump), thereby obstructing the passage of the water. He did not think much of the idea, but went home with his pump. The next day he returned with the pipes; some of them had become so filled with lime that the passage remaining was not more than one tenth of a square inch in area.

Yours respectfully,

IRA CARNES.

A Model New England Farm.

Mr. Burnett, the owner of the three hundred acres in Southboro, Mass., known as Deerfoot farm, makes a specialty of breeding, raising, and fattening hogs, and converting them into various articles of food, and of the products of the dairy. The conversion of the carcasses into hams and bacon, and the manufacture of sausages and lard are carried on in the most systematic manner and on an extensive scale, extra pains being taken to produce for the private consumption of customers in Boston, New York, and Philadelphia, the choicest and most palatable articles. Mr. Burnett raises about 350 hogs annually, and purchases from the farmers of Vermont 1,500 fat Berkshires, which make the best pork. After being dressed the hogs are kept in a refrigerator for forty-eight hours, when they are cut up, the hams and bacon cured in the most approved manner, the lard dried out and canned free from adulteration, and the pork packed in kegs of 15 and 25 lbs. weight; the sausage meat chopped by machinery and seasoned with the best quality of sage and pepper that can be obtained, and then made into sausages. Mr. Burnett's bacon has taken the place of imported English bacon in the Boston market, and become so popular in Philadelphia that one dealer has offered to take the entire product of Deerfoot farm, which amounts to 300 sides a day, while 3,000 hams are cured annually. The product of sausages averages about 1,000 lbs. a day. Another specialty of Mr. Burnett is the canning of pigs' feet, which are sold largely in the season to yachting parties. The piggery at Deerfoot farm is an extensive affair, located at some distance from the main buildings, and consists of a building 80 by 40 feet, with a wing 60 by 20 feet, containing pens, in which were seen about 250 swine of all ages, from the sucking pig to the hog ready for the scalding vat. The animals are fed twice a day, on a cooked mixture of two thirds corn meal and one third ground oats, which Mr. Burnett has demonstrated to be the most profitable food for fattening hogs. In the dairy the Devonshire process of producing clotted cream is used. New milk, scalded, is placed in long, large pans, which are placed under a refrigerator, where it is cooled rapidly, the temperature being reduced in three hours from 160° to 32°, and cream raised to the thickness of three fourths of an inch, which ordinarily required forty-eight hours. This cream will keep sweet several days, and is sold for 60 cents a quart to Boston families. Mr. Burnett also manufactures from 250 to 300 lbs. of butter a week from the milk of fifty cows, of which 25 are thoroughbred Jerseys. The butter sells readily at 75 cents a pound.—*Boston Transcript.*

Defeat of the Cochrane Ring.

It is our pleasing duty to record two defeats which the American Middlings Purifier Company has sustained. The first was in the injunction suit brought by the ring against Messrs. Vail & Shotwell, of New York city. As our readers remember, this case was argued before Judge Blatchford last summer, and the supposed proofs of infringement were collected by the plaintiffs with the greatest care. Judge Blatchford has refused the injunction on the very sufficient grounds that infringement was not proved by the plaintiffs. In the course of the hearing Judge Blatchford made a very important and sensible ruling in regard to the former decisions of the United States Supreme Court. He held that the decision given by that court last winter, when the millers made their motion to restrain the Cochrane patents, virtually destroyed the previous decision of the court in the case of the American Middlings Purifier Company *vs.* Deener, Cissel & Welch, so far as precedent was concerned, and that suits brought under the Cochrane patents must be tried as new cases in all respects.

The other victory is of equal importance. In May, 1877, in their first flush of success, while the first decision of the United States Supreme Court in their favor was still fresh in the minds of millers, the ring brought suit against the Haxall-Crenshaw Company, of Richmond, Va., proprietors of the famous "Haxall Mills." The claim of infringement was made and the damages claimed were placed at the modest sum of $100,000. The hearing was before the United States District Court for the Eastern District of Virginia, and the case was dismissed by the court during the past month. In a letter of recent date to the Hon. George Bain, of St. Louis, Mr. Philip Haxall, Vice-President of the Haxall-Crenshaw Company, says: "We have intended to take the first opportunity to advise you that we have gotten the suit of the Cochrane ring against us dismissed from court, and presume they will let us alone henceforth. It has been evident to us for some time that they did not wish it brought to trial, and we suppose they will put off their suits against Western millers in the same way until they have collected all the money they can from small millers."

There can be no doubt that Mr. Haxall is correct in his surmises as to the future policy of the ring. The result in his case undoubtedly foreshadows the outcome of all the suits which are now pending against millers, but the ring will certainly try to make the most of their time by terrifying millers whose means are limited into paying royalties rather than go to the expense of a legal trial. The Defense Association is to be congratulated on its victories, and we hope soon to chronicle the crushing defeat of the ring at St. Louis.

The final hearing of the cases at St. Louis is waiting solely upon the convenience of the judges, Judge Dillon's engagements having prevented him from going to St. Louis to try the cases. It is proposed to have both the St. Paul suits (American Middlings Purifier Company *vs.* J. A. Christian & Co., of Minneapolis) and the St. Louis suits argued at the latter place, in which event Judge Nelson, the District Judge for Minnesota, would sit with Judges Dillon and Treat.—*American Miller.*

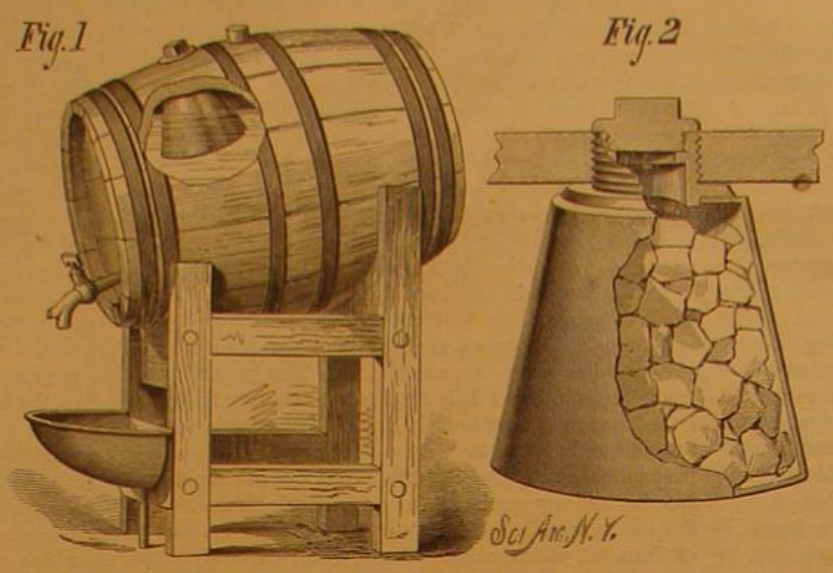
A NOVEL COOLER.

Brewers and dealers in beer, ale, and similar liquors well know the difficulty experienced in the transportation of barrels and kegs of such liquors in warm weather. To avoid the use of refrigerators, either in transporting or retailing the liquors, Mr. John Hoerr, of Denison, Texas, has devised and patented a cooling attachment for barrels, kegs, etc., by which, with a small amount of ice, the contents may be kept cool for a considerable length of time.

The invention consists of a vessel of galvanized or enameled iron secured to a cast metal neck, which is screwed permanently into one of the staves or heads of the barrel. This vessel is filled with ice and salt, and closed by a screw plug. As the ice vessel has no connection with the interior of the barrel, the ice and salt can be replenished as required without disturbing the contents of the barrel.

The inventor states that the device may be used to prevent freezing as well as to maintain a low temperature, and sends us the particulars of an experiment tried by him to test the efficiency of the cooler:

"On October 23d I had one keg of beer shipped to me by express from St. Louis, Mo. the keg being provided with one of my cooling attachments. On November 3d I tapped the keg at 8 o'clock A.M., at 80° in the shade, and found the beer to stand 63°. I poured one quart of boiling water into the cooler, turning the keg upside down; in fifteen minutes it had reached the temperature of 74°. I then emptied the cooler and charged it with 2 pounds of ice and a small handful of salt, bringing the temperature of the beer to 66° in thirty minutes, and five hours after it stood at 65°, the external temperature being 82° in the shade. I then recharged the cooler with ice and salt as before, and thirty-eight minutes after the beer stood at 58°."



HOERR'S COOLING ATTACHMENT FOR BARRELS.

THE CASSON-DORMOY FURNACE.

The accompanying engraving represents a highly successful gas puddling and mechanical stoking furnace, known as the Casson-Dormoy furnace.

This furnace has a gas producer in lieu of the ordinary grate. The puddling chamber is perfectly circular, the sides and bottom plates being so arranged as to expand and contract with the variations in the temperature of the furnace.

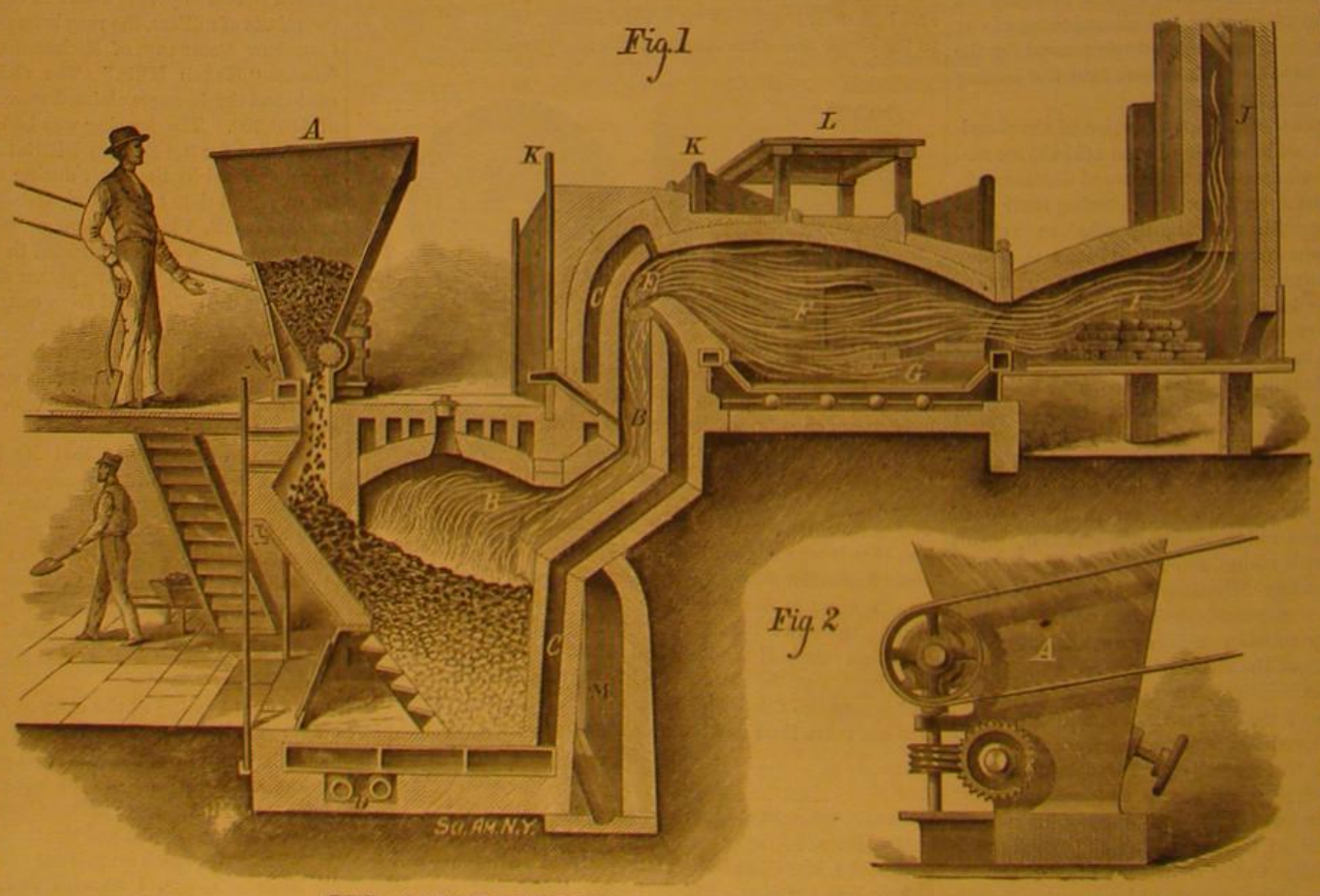
The gas producer, B, is constructed similar in form to the "Siemens," but instead of the air being heated in a "regenerator," it is drawn or blown down the sides of the furnace chimney or flue, and under the bottom crown and walls of the producer, the gases being fired at the bridge; by this means a temperature of about 800° is obtained. The condition of the furnace is completely under the control of the puddler, who, by arranging the blast valves, obtains either an oxidizing or reducing flame, as the condition of the iron may require. The producer is fed from a large hopper, A, filled with slack. At the lower end of the hopper there are 2 revolving drums driven by a ½ H. P. engine, thus dispensing entirely with manual feeding. The feeding mechanism is shown in detail in Fig. 2. By means of dampers fixed in the gas flues, C, the producer can at any time be disconnected from the puddling chambers; this is done every Saturday, or holiday times, and causes the necessity of relighting the producers. At Round Oak Works the producers have remained three weeks without any feeding, and have been nine months without being put out.

The puddling basin, G, rests on a brick pillar 1 foot 4 inches from the ground. On this is set a wrought iron circular open dish, with sides about 4 inches deep; within this dish eight or more friction balls, 5 inches diameter, are placed at equal distances from each other. On these spheres two cast iron semicircular plates are laid; on these plates again four side or segment plates are bolted together externally by means of wrought iron pins, and forming a complete circle. Upon these are placed loosely the shelf or table plates which rest upon brackets fixed to the rail. Buckstaves, K, support the walls of the furnace. All the plates forming the basin are thus free to expand and contract with the variations in the temperature. The dish below being kept full of water, the evaporation produced from the above efficiently cools the bottom and sides and consequently the fettling. By the absence of inequalities and corners its shape does away with the difficulties usually attending the working of a mechanical rabble, at the same time effecting a considerable saving in fettling.

The circular form of basin easily enables the rabbling to be worked by machinery, as there are no jambs that the rabbles cannot reach in their courses from right to left and back again.

The pig-heating chamber, I, is fixed between the puddling basin and the chimney or boiler, and besides serving as a neck to the furnace, heats the pigs preparatory to their being passed over the bridge into the furnace.

When the iron is ready to ball the heating chamber, I, is charged a few pigs at a time; when all the balls are drawn out of the puddling basin, G, these pigs are passed over the bridge, and as soon as they are melted, the rabbles, which are so set that they cannot catch into each other in crossing, are fixed to the machine and worked at a slow motion for about five minutes; the speed is then quickened until the iron boils, when the slower speed is put on till the iron drops. The heating chamber, I, is then charged. The rabbles are then removed, and the real work of the puddler begins by his balling up the iron in the usual manner. The balls, which are of the ordinary size, are drawn from each door and the cinder tapped. A few shovelfuls of hammer slag are thrown on the bed, and the pigs, which have meanwhile been supplied into the preparatory chamber, are again passed over. These generally melt on the bed in ten minutes or a quarter of an hour. The charges of about 13 cwt. usually take from an hour and twenty to an hour and thirty minutes.



THE CASSON-DORMOY GAS PUDDLING MACHINE.

New Mechanical Inventions.

Mr. John F. Cameron, of New York city, is the inventor of an improved Air Ship or vessel, which is claimed to be so constructed that it may be propelled and guided through the air horizontally, or at any desired angle up or down, while carrying passengers and freight.

Mr. Floyd Heavener, of Laramie City, Wyoming Territory, has patented an improvement in Clothes Line Reel, designed to wind up the clothes line when it is to be taken into the house, and to stretch the same taut when disposed for use.

Mr. Patrick H. Childress, of Waynesborough, Va., has patented an improved Millstone Driver. This invention relates to an improvement upon the millstone driver for which letters patent were granted the same inventor August 13, 1878, in which the driver was made in two pivoted sections, and their inner ends jointed together by forks formed upon the said inner ends of the driver sections and an interposed ring which encircled the spindle.

Mr. Eugene Vicaire, of Paris, France, has invented an improved Device for Transmitting Motion, which is designed to destroy the effect of the inertia of the moving parts. It consists in a peculiar form of compound beam or lever provided with a counter weight.

Mr. Henry Pollock, of Fredericton, New Brunswick, Canada, has patented an improved Thread Cutting Attachment for Sewing Machines, by which the thread may be cut quickly. The cutter may be instantly lowered below the table when not required for use.

Mr. John F. Seymour, of New York city, has devised a novel Machine for Drying Sheets of Postage Stamps and other gummed paper or material, which saves the time, labor, and space required when the gummed sheets are dried in the usual way.

An improved Automatic Car Coupling, that may be coupled without going in between the cars, the coupling link being held in the exact position for entering the connecting draw head, and adapted to couple with draw heads of cars of different heights, has been patented by Mr. Charles W. Cornell, of Wauseon, Ohio.

Mr. Henry Staib, of Blossburg, Pa., has patented a Machine for Finishing or Rolling Leather, which will permit the operator to control the pressure and apply the most power when it is needed—that is, at the time of greatest pressure. It will let off and free the leather from the operating rollers instantaneously.

Mr. William H. G. Savage, of Kingston, Ontario, Canada, has devised an improved Permutation Lock, in which the adaptability of the face plate in connection with the set screw furnishes a very simple means of setting the lock to any desired combination, and changing the combination to a new one whenever necessary.

Mr. Ephraim R. Dingley, of New York city, has devised an improved Railroad Track, in which the rail is provided with a concaved rubber bearing block, extending around and over one side of the head of the rail, to destroy the side vibration of the rail and the ringing sound of the car wheels.

Mr. George W. Prescott, of Battle Creek, Mich., has invented an improved Cone and Fastenings for Smokestacks of Locomotive and Portable Engines. It is so constructed as to break up the cinders and prevent them from cutting the netting and smokestack without impeding the exhaust.

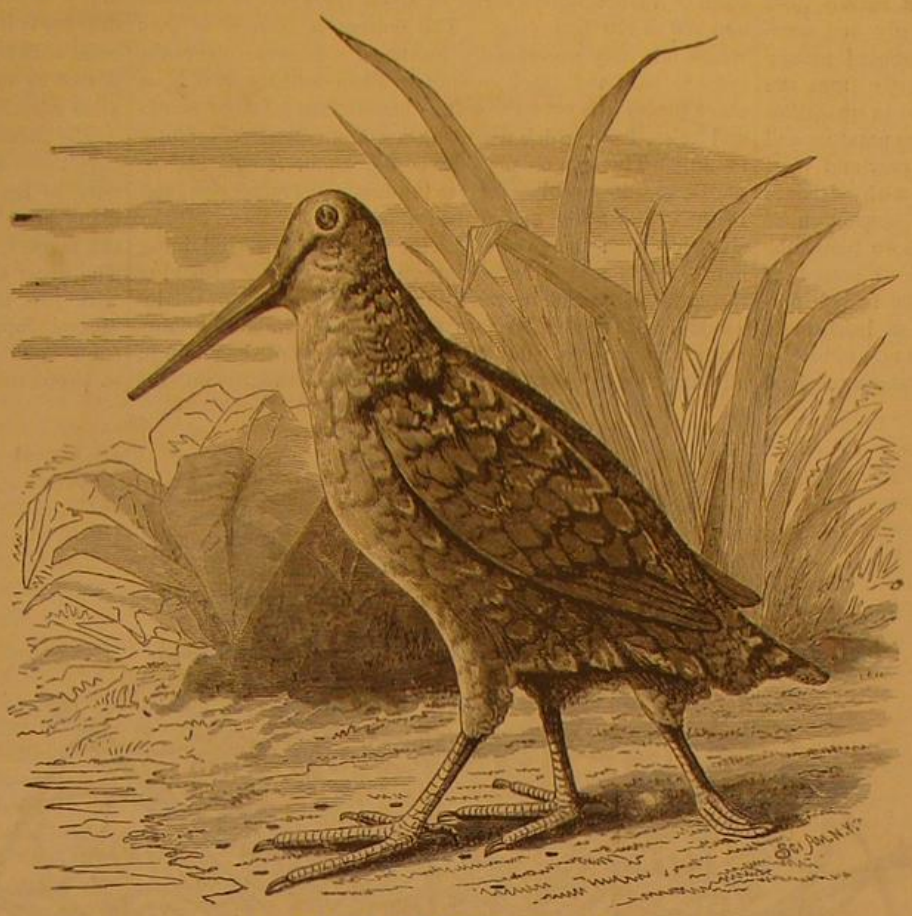
Mr. Asa E. Stratton, Jr., of Brazoria, Texas., has patented an improved Car Axle Bearing, which consists in a box having a chambered back for containing oil, and having grooves along the straight edges of its bearing surface for receiving a wick, the ends of which extend through holes in the box into the oil reservoir.

Mr. Edward Huber, of Marion, Ohio, has patented an improved Feed Water Heater, which consists in the peculiar construction and arrangement of a circular jacket, arranged about the smoke chamber of the boiler, having a supply pipe and a discharge pipe leading to the boiler, so that the water, in passing through said jacket to the boiler, is not only heated before being delivered into the boiler, but also serves to prevent the smoke chamber from being burned out.

Mr. Thomas Whitfield, of Chicago, Ill., has patented an improved Apparatus for Filling and Capping Capsules, by which capsules may be readily filled with a graduated amount of powder and securely capped at the same time.

A THREE LEGGED WOODCOCK.

It is rare that monstrosities in nature are ever able to hold their own in the struggle for existence. An exception appears, however, in the illustration herewith: a three legged woodcock, shot by Mr. Jules Reynal, near White Plains, New York, last September. The third leg was attached just below the vent, and dragged, as shown in the cut. It appears to have been in reality two legs in one, the double bones showing quite clearly, and the six toes being distinct and nearly perfect. The bird has been sent to Professor Baird, of the Smithsonian Institution, from whom we hope to receive an account of the internal anatomy of this curious freak of nature. The bird when shot was well grown and in good condition.



A THREE LEGGED WOODCOCK.

Experiment with Carnivorous Plants.

To test fairly and on a large scale the conclusions arrived at by both the venerable Charles Darwin and his son Francis, with respect to the benefit derived by carnivorous plants from the insects they destroy, Mr. Peter Henderson, of Jersey City, has tried the following experiment. He procured, in March, from Keenansville, North Carolina, a large number of *Dionæa mucipula*, which reached him in fine condition.

Selecting from the lot two hundred of the strongest plants, he thoroughly rinsed them in water, so that every particle of soil and all other matter foreign to the plants was removed. He then procured two boxes, three feet by three feet and three inches deep; these were filled with moss (sphagnum) and sand mixed, in about the proportion of four parts moss to one of sand, forming a soil somewhat similar to that which they had been growing in naturally; this compost had been also subjected to the rinsing process so as to clear it from impurities. One hundred of the fly-traps were planted in each box, the plants selected being as nearly alike as possible. After planting the boxes were each copiously watered with pure water and placed in a cool and partially shaded greenhouse. One box was covered with a wire netting, as fine as could be procured, so as to exclude insects; the other was left uncovered. By about the middle of May, two months after planting, the plants had begun to grow freely, and the "feeding" process was begun with the plants in the uncovered box. In this he was assisted by Mr. William Tait, one of his neighbors, a gentleman of leisure, and one who is well versed in many branches of natural science; between them the one hundred uncovered fly-trap plants were "fed" almost daily for three months with flies and other insects. In August, three months from the time the feeding began, the operation was stopped, and the most careful examination and comparison failed to show the slightest difference between the one hundred plants that had been "fed," and the one hundred (under the wire netting) that had not been "fed." Both lots had made a splendid growth, and were the admiration of scores of visitors. Mr. Henderson never omitted an opportunity to ask professional horticulturists for their opinion, and the verdict invariably was that both lots were identical, as near as could be. In this case the "feeding" certainly did not fatten. "It may be," Mr. Henderson remarks in the *Gardener's Monthly*, "that our American flies were not so nutritious as the English 'meat,' though certainly ours was the more natural food of the two; but, as corroborating the test of Mr. Darwin, it failed."

STUDIES FROM THE BRIGHTON AQUARIUM.

To wander at ease among the many strange and beautiful forms of life which animate the world of waters, watching the mysterious habits and doings of creatures as different as they well can be from those with which we are most familiar, is a pleasure and a profit which have been reserved for our own times, and which can be nowhere more conveniently or completely studied than at the Brighton Aquarium. In our engraving different subjects are indicated by numbers, as follows: 1. Electric ray fish. 2. Sea horses. 3. Fife fish. 4. Bear crabs. 5. Star fish. 6. Muscle. 7. Anemones.

Remarkable Mortality of Fish.

The extraordinary phenomenon displayed on the Florida coast, by which not only the coast waters, but as far out as 150 miles into the Gulf, have been rendered so poisonous as to kill the fish and create a pestilential stench in bays and harbors where the floating carcasses collect, should receive a thorough investigation. We have seen no other explanation of the poisoning than that it comes from inland waters—the everglades prominently—and penetrates the Gulf in strata of dark reddish water, which kills all the surface fish as soon as it reaches them, and even far beyond any apparent contact. This poisonous outflow is stated to have been nearly fatal to the fish trade between Florida and Havana—the smacks finding it almost impossible to select a route in which the fish in their wells are not destroyed by the poison. The Key West *Key* says: "The smack George Storrs, Capt Zeb Allen, attempted to run to the westward in hopes of escaping the deadly waters, and when 50 miles west of Tortugas, in 25 fathoms of water, lost its whole fare of fish in a very short time. He describes the poisoned water to the south and west of him as far as he could see." Fifty miles west of the Tortugas would make the locality indicated 150 west of Cape Florida, and not very far from mid-gulf.

STUDIES FROM THE TANKS OF THE BRIGHTON AQUARIUM.

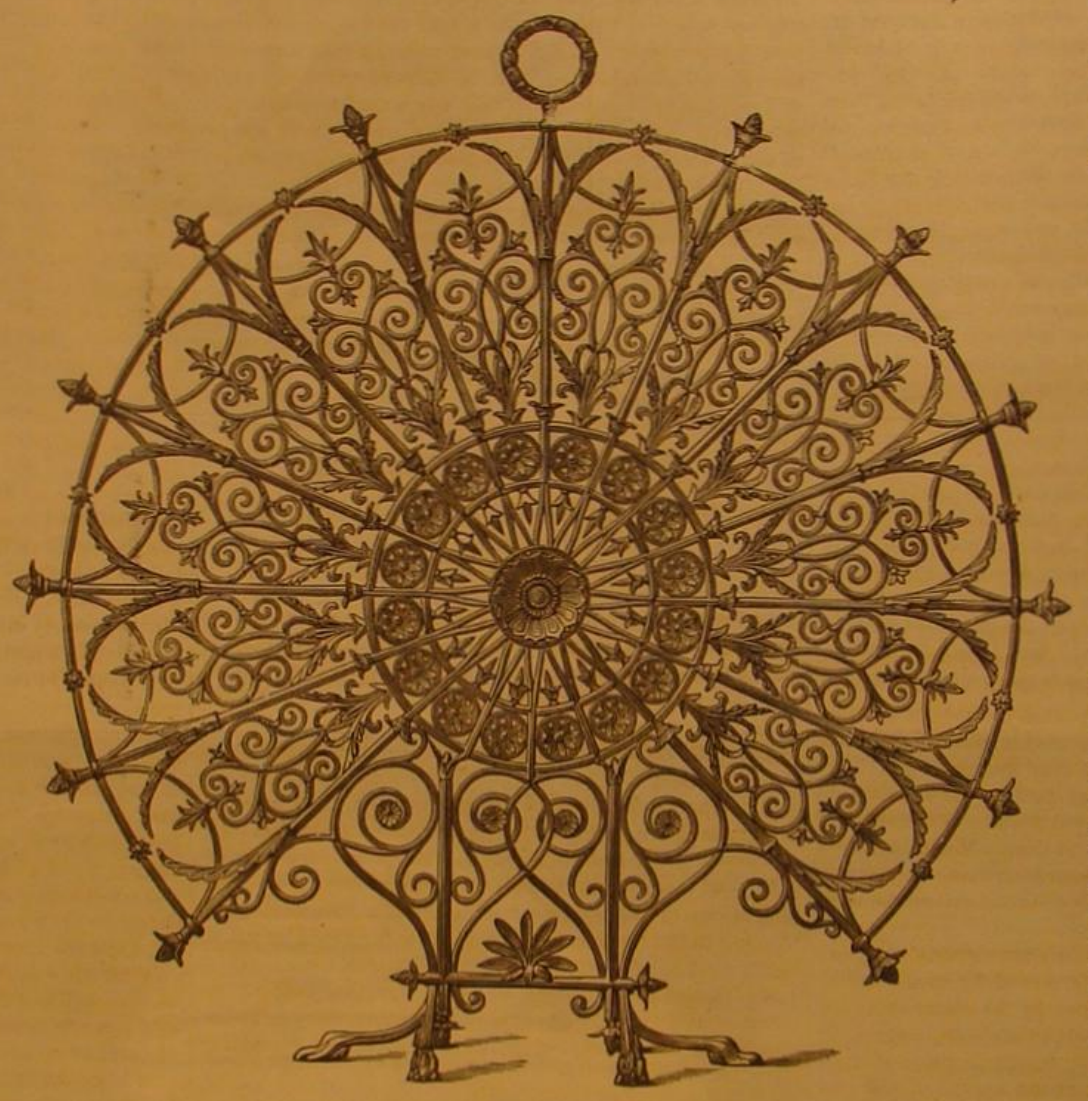
The Orange Trade in New York.

With the holidays come the oranges, and since the season promises to be an exceptional one, it is estimated that between now and New Year's 50,000,000 oranges will be sold in this city. Already the fruit departments of Fulton and Washington markets are glutted, and by one steamer due in port to-day 300,000 oranges, by another 3,000 barrels, or 1,000,000 oranges, and by another 350,000 in bulk are expected. The barrel stock, nearly all of which comes from the West Indies, and the case and box stock, mainly from Mediterranean ports, are consigned to shipping and commission houses, by whom they will be distributed among the trade. The stock in bulk, however, partly from the West Indies and partly from Florida, is sold in quantities from one barrel to 1,000 barrels at the docks, as potatoes and other home products are sold at the foot of Vesey and West Thirty-fourth streets. One whose inferences with reference to the local orange trade are drawn from an inspection of the business exhibits which dealers put forth to tempt the small buyer has but a superficial and erroneous notion of the risks which encumber it. To say that the fruit is perishable, as the term is usually understood, is an inadequate expression of the extent of that risk. There is no product so perishable. Of about two hundred million oranges received here last season—from September until March—nearly eighty-three millions perished, or 40 per cent of those received from the Mediterranean ports and 46 per cent of those received from the West Indies. The loss on a cargo of 200,000 oranges from Dominica was 159,600, or 79 per cent; on eleven cargoes from Mayaguez, comprising 2,654,590 oranges, 1,495,120, or 56 per cent, and on a cargo of 230,000 from Ocho Rios, 210,000, or 91 per cent. In many cases the amounts received from the sales of cargoes were insufficient to pay the charters of the vessels. Until within three or four years the trade was conducted mainly by importers, but they soon learned the lesson which the figures just given convey, and many of them were ruined in the learning. Of about fifty then engaged in the business in the city only three remain, nearly all the others having become commission merchants only. No better opportunity to appreciate the trade, stripped of its glamour, could be had than by boarding to-day or to-morrow the sailing vessel which will be moored at some of the docks near Burling slip, with stock in bulk, the vessel having on the way from the West Indies encountered two tornadoes, which are especially disastrous to the preservation of the fruit. The stock, when sold, will be carried to store rooms or cellars, out of sight, and there sorted after the approved fashion best known to the trade, by a process so highly scientific, that the best that is saved and the worst, after the usual polishing and drying, would never be recognized as having originally belonged to the same lot. Stock received in bulk is generally considered inferior in quality to that received in barrels, boxes, or cases, although it is no more perishable. At present, there is a furor over Florida fruit, which is rarely received in bulk. Ever ready to accommodate the public taste, small dealers have provided themselves abundantly with paper labels, and it is almost impossible for a retail buyer to find any other kind of fruit. John Marsh, who sells for Darrell & Co., importers of the Mandeville (Jamaica) stem cut oranges—a large, solid, bright colored fruit—and who has a large trade among the Fulton and Washington market dealers, says that the best imported fruit is labeled as coming from Florida to meet the popular demand. The receipts of this season have thus far been much larger than they were at this time last year, although the West India trade has suffered from violent storms, and is likely to fall short of the average yearly importation.

"I was offered a few days ago," said a large dealer yesterday, "the use of two of the best estates in Jamaica, where the fruit may be had in any quantities for the gathering, but I wouldn't hear of the offer. By accepting it I could deliver the best oranges in the world in New York for less than $5 a barrel. The best sell for $10 a barrel—from 320 to 340 in a barrel. When I was younger in the business I thought I could make money in that way. I stood on the wharf for three months and lost $10,000 on account of the waste by rot. That is why I didn't accept last week's offer."—*New York World.*

BRONZE LATTICE OR FIRE GUARD.

The accompanying engraving represents an elegant bronze lattice or fire guard, designed by H. Claus, and manufactured by Messrs. D. Hollenbach & Son, of Vienna.



BRONZE LATTICE OR FIRE GUARD.

The Last Eruption of Mount Vesuvius.

A sketch of the crater of Mount Vesuvius, as it appeared during the recent eruption, has been sent to us by our esteemed correspondent, A. Ricco, Professor at the University of Naples, who visited the crater on the 10th of November last.

"The view on the crater," he says, "is extremely beautiful and imposing. The crater has undergone considerable changes since the eruption of 1872. It now presents the form of a large amphitheater of about 1,200 feet in diameter and 100 to 150 feet deep. The bottom is formed of lava which has only superficially hardened. In some places the crust is hard and thick enough to allow walking over it, at other places it is yet quite soft. The surface is full of cracks and holes, from which dense masses of smoke are constantly issuing. The lava on the sides of the crater is soft and so plastic that it readily receives impressions from coins, etc. In the center of the crater rises a small cone, about fifty or sixty feet high; it is covered with incrustations containing many shells and different species of mosses. Looking through the cracks in the side of the cone and floor the incandescent lava may be seen, the aspect resembling a labyrinth of fiery paths, running over the bottom of the crater in all directions. At short intervals the mouth on the summit of the cone sends forth a gigantic column of smoke and fire, which is plainly visible from the city of Naples, miles distant. Near the base of the cone a second mouth has been formed, from which lava and smoke constantly issue.

"As the inclined position of the crater tends to send the lava and smoke constantly in one direction, the crater may at present be visited with comparatively little danger."

Look to Your Fireplaces.

From what occurred the other day in Boston, according to the *Daily Advertiser*, it is wise for residents of new houses that they should keep close watch of the fireplaces during their first trial. The fire in the Roberts mansion on Beacon Hill, which was about three years in building, and had the immediate supervision of an architect, is an item of grave astonishment not only to the underwriters, but to the owner. Two days previously a fire was started in one of the open grates for the first time, and not burning freely was dumped upon the hearth. From that moment there was a smell of smoke in the apartment, when, as above noted, it was discovered that the hearthstone rested upon a beam which ran directly across the fireplace. About three feet of this beam was burned off. Three other Boston fires from open grates are noted within a fortnight. A South End resident had an attractive soapstone fireplace, and, purchasing a pair of andirons, started an old-fashioned wood fire, to find that his fireplace was only a ventilation, and his blaze burning in behind the plastering up through his house. Another case similar was the Marlborough street fire in October, where a single course of brick for a hearth resting upon the beams was no protection, and a marble slab for a hearth lying upon the under floor being overheated set the floor afire.

Iron Wood Screws, etc.

No recovery can be reported as yet, says the *Ironmonger*, in this important and once flourishing branch, which continues very quiet under the combined influences of over-production, American and French competition, and the depression of the building trades.

The introduction here in 1854 of patent self-acting machinery from the United States, continues the same English paper, has increased the local production probably fivefold, and it is not to be wondered at, therefore, that in times of dull trade like the present the industry should be in a somewhat suffering state. Westphalian wire, which is being imported by thousands of tons yearly, is fast superseding English wire for screw making purposes.

The Birmingham Screw Company, who produce in ordinary times some 60 to 70 tons weekly, find the Westphalian wire, or English wire drawn from Westphalian rods, equal, if not superior, for screw making purposes, to any article in the market, and at considerably less cost than native iron. The great difficulty English screw makers have to contend with just now is the French and American competition. Messrs. Jappy Frères have now got a virtual monopoly of the French and Italian markets—thanks, in some measure, to protective tariffs; and as the German screw makers are also very active, there is not much opening for English screws in the continental markets. The Americans, however, are at present our most formidable competitors, not only in Canada and the colonies, but in this country, where, there is some reason to believe, they are selling under cost price.

Since the recent auction sales of screws, which were professedly intended to relieve stocks, but which were manipulated in such a way as to enhance the market value of those stocks by bogus purchasers at high prices, the American screw makers have altered their discounts so as to advance prices, on the net, about 12½ per cent, and as this advance gives them the required profit on their home sales, they can afford to send their surplus stocks into this and other markets at something under cost price. This is understood to be the policy of the American Screw Company, who make a specialty of the "taper" bodied screw, and manufacture some 4,000 varieties, and this will explain the low prices at which American screws are being delivered now in Liverpool. A new variety of screw, now being offered to English manufacturers, has been newly adopted by Jappy Frères for France. Its peculiarity consists in this, that the bottom of the groove, or slit, in the head of the screw, instead of being straight and level, rises in the center to an apex nearly flush with the surface of the screw. This necessitates, of course, the employment of a special form of driver with V-shaped edge to fit the bottom of the slit. The object is to strengthen the head of the screw, which is sometimes so much weakened by the slit as to break off under the pressure of the driver, but the proposed remedy is generally regarded here as worse than the evil, and it is not likely to be adopted.

Cost of the Yellow Fever.

Loss of life by yellow fever in the South last year is estimated at about 15,000 persons, and of money and trade at from $175,000,000 to $200,000,000—as great as the loss from the Chicago fire. But some good is likely to come out of this calamity. It is thought that henceforth quarantine regulations will be more thoroughly established than they have ever been. Apart from death and human suffering, negligence is the worst kind of political economy. Expenditure of one-twentieth part of what the fever has cost might have prevented it altogether.

The Catalpa.

Professor Burrill, of the Illinois Industrial University, says that from experiments performed at that institution, the catalpa is found to be one of the cheapest and earliest trees to grow, and one of the most rapidly growing of our forest trees, native or introduced. Its growth has been surpassed only by the white willow and soft maple, among the various trees tested in the last eight years. It has outgrown the American elm, white ash, European larch, Osage orange and black walnut, on the same ground, and under the same treatment. It is not attacked by any insect. The young trees were set two feet by four, cut back and cultivated like corn for three years, and plowed one of the two succeeding years. This was good management. The trees are now large enough for half to be thinned out. The average height is more than sixteen feet; they are straight and erect.

ELECTRIC ILLUMINATION.

BY JOHN TROWBRIDGE.

In the subject of electric illumination America is far behind Europe at present, unless there may be some great invention about to issue, with the seal of the Patent Office, which shall give her the lead. This inferiority is not alone in the number and variety of the lamps before the public, but also in the forms of dynamo-electric machines. On the continent of Europe we find several forms of the Siemens-Halske machines; the Gramme machine and its different species, of which Schuckert's is a notable type; the new Gramme alternating machine, which is almost indispensable in the regular consumption of carbons used in electric lighting, and the Lontin machine. The horse power seems to be less per light with the use of the foreign machines than with the American, if we can judge from the measurements made public; and less velocity is required to run the machines, which is a great desideratum. America has not given to the world a regulator which is as efficient as the Serrin lamp. The foreign carbons are better than those of American make, and the process of electroplating them with copper or other metals, in order to prevent their heating so far below the point of burning, has long been known in France. The Brush lamp and the Wallace lamp are the prominent lamps before the American public, and answer very well for purposes of general illumination. There are not more than a dozen establishments in America which are lighted by electricity, while there are hundreds on the continent.

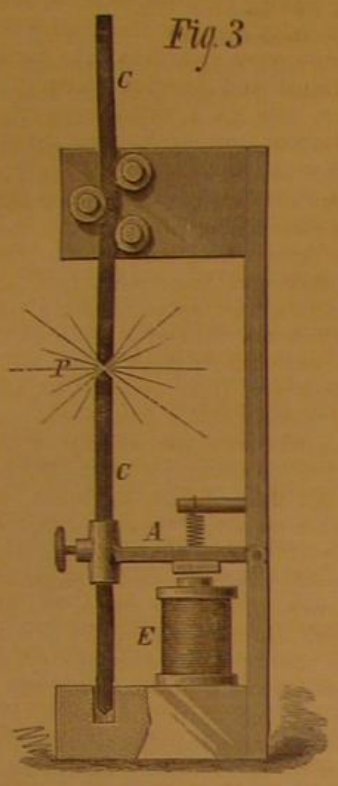


Fig. 3

Lighting by incandescence has not hitherto been successful either by the use of carbons in receivers exhausted with air or filled with nitrogen, or with platinum or iridium wire, or platinized asbestos. The carbons disintegrate or crack after a time, and the metals fuse. Both of the above methods—that by carbons and that by incandescent wire—have been tried in Europe and have been proved to be more expensive than the use of gas.

The great attention that is being paid to the so-called divisibility of the electric light is evidenced by the number of new lamps that appear from time to time. Messrs. Siemens and Halske, the owners of the Siemens dynamo-electric machine, have patented eight forms of lamps; among the most noteworthy are the following:

Fig. 1 represents a form in which the carbons, C C, are separated by the rod, R, which is moved by means of the lower arm, A, which is set in action by the electro-magnet, E. When the current passes through the electro-magnet, E, and the carbons, C C, the rod, R, which is made of a refractory substance, thrusts the carbons apart. If the current should decrease in strength, the carbons fall together again, and the current is not broken by any similar lamp on the circuit failing to perform its function.

In Fig. 2 one carbon is set in oscillation or vibration by means of the lever arm, which is terminated by an iron cylinder which forms the movable core of the electro-magnet, E. This carbon has to vibrate merely 32 times a second to cause the appearance of a steady light at the point, P. This lamp also admits of many lights in the same circuit.

Fig. 3 represents another form of the same idea. The upper carbon falls gradually upon the lower one, which is set into vibration by means of the lever arm, A, which is set in action by the electro-magnet, E. The lower carbon moves so quickly that the upper carbon, which is forced down merely by its own weight, cannot sympathize with it, and a small voltaic arc is therefore produced at P. The fluctuations of this arc are so rapid that they are said to produce no apparent alternation in the light. This lamp has also been invented in this country by Professor Thurston, of Philadelphia.

With the lamps above described a continuous circuit can be maintained even if one lamp should, from any cause, be extinguished, which is not the case when the Jablochkoff candle is used; for the poorly conducting medium employed in the latter prevents the re-establishment of the current when the light is extinguished. It does not appear, however, that these vibratory lamps have been put to practical tests.

A Substitute for Pens and Ink.

A German named Schwanhäuser has invented a sort of pencil which he calls a "Universal Tintenstift," which possesses all the advantages of both ink and pencils, but is quite unlike the aniline marking pencils once introduced into New York. It is deep black without containing any graphite, can be copied by a press just as copying ink can, yet does not fade in sunlight as aniline inks do. The method of preparing the mass is as follows:

Ten pounds of the best logwood is boiled repeatedly with 100 pounds of water, and the decoction evaporated down to 100 pounds. This liquid is heated to boiling in a porcelain dish, and nitrate of chromium added in small quantities until the bronze precipitate that forms at first dissolves again with a deep blue-black color. It is then evaporated on a water bath to the consistency of an extract, and finely elutriated fat clay mixed in, so that there is 1 part of clay to 3 or 3½ parts of extract. A little gum tragacanth may be added according to the hardness desired.

It is very necessary to observe the right proportion of chromium salt to logwood extract, for an excess makes it write badly, while too little changes the solubility of the black compound. No other salt of chromium is suited to the preparation of this mass, as they are all crystalline, and on drying the crystals make it brittle.

The nitrate of chromium is prepared as follows: Dissolve 20 pounds chrome alum in 20 pounds of boiling water, and add slowly to this solution enough carbonate of soda, also in solution, to precipitate all the chromium as hydrated sesquioxide. After this bluish-green precipitate has settled the liquid is poured off and the precipitate washed until it is free from sulphates of soda and potash, as found by testing the wash water with acidified chloride of barium solution. The precipitate is brought upon a filter, and pure hot nitric acid, diluted with an equal part of water, put on slowly, so that upon boiling a long time a small excess of the oxide still remains undissolved. In this way a perfectly saturated solution of nitrate of chromium is obtained free from excess of acid, which would be very injurious to the logwood extract, producing a dirty red color.

Another advantage of using the nitrate is that no basic salts are formed when excess of acid is present, as in the case of most other chromium salts. These basic salts would precipitate a greater part of the coloring matter from the logwood extract.

It is claimed that it dries quickly, so that blotting paper or sand are unnecessary.

The written ink is indifferent toward caustic alkalies; dilute nitric acid colors it reddish without diminishing its intensity. It is not affected by oxalic acid, which destroys ordinary iron inks. The pieces cut off in sharpening the pencil can be thrown into water and used as ink with a common pen.

New Inventions.

An improvement in Water Gauges for Steam Boilers has been patented by Mr. Erastus B. Kunkle, of Fort Wayne, Ind. This invention consists in scrapers or cleaners formed upon the valve stem of the water cock, to free the cock from scale. The valve has a vacuum chamber at the outer end of the water cock, to prevent the escape of hot water around the valve stem.

Mr. John D. William, of Rising Sun, Ind., has patented a Burglar Alarm, which is an improvement upon that form of burglar and fire alarm in which a clock mechanism is set going and made to ring a bell from the movement of a tripping device, which is released when one of a number of cords running to the various parts of a house is burned by fire or disengaged by the entrance of a burglar.

Mr. Robert W. Tavener, of West Bay City, Mich., has patented an improved Lubricator or Oil Cup, designed to be attached to the steam chest of a locomotive, and depending

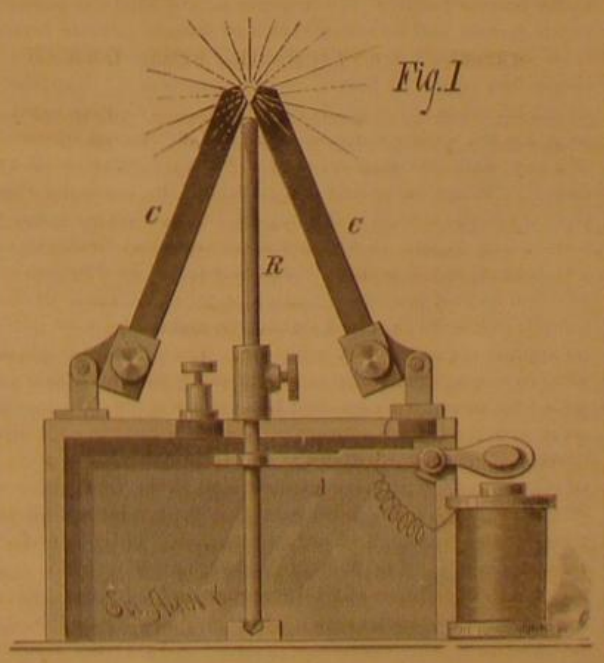


Fig. 1

for its automatic feed or operation upon the intermittent injection of steam into it. The cup is provided with valves for admitting steam and permitting the exit of the oil, and also for facilitating the discharge of sediment.

Mr. Wilson E. Facer, of Cleveland, Ohio, has devised an improved Electric Gas Lighting Apparatus, which, by the simple opening and closing of an electric current, turns on and lights the gas or shuts it off. It is designed principally for lighting street lamps, but is capable of application to other purposes.

A Curious Surgical Operation.

The success of the experimental researches of Odlier, Patterson, and others, in regard to the transplanting of various organic tissues, lately led to a remarkable experiment in practical surgery. The case is reported at length in a recent number of the *Lancet*. A marine engineer had broken both bones of the left forearm, a little above the wrist. The arm was kept in splints for some weeks, but the bones refused to unite. Eight months elapsed before the man reached land, and then he entered the Glasgow infirmary for treatment. Three separate operations of setting the bones were performed, and all failed to secure a union. A year and a half after the accident the man returned to hospital to have an amputation performed, the hand and lower part of the arm being useless. Although amputation was unanimously recommended by the surgeons, Dr. Patterson was granted permission to try any plan he chose to save the limb, and accordingly planned the following operation:

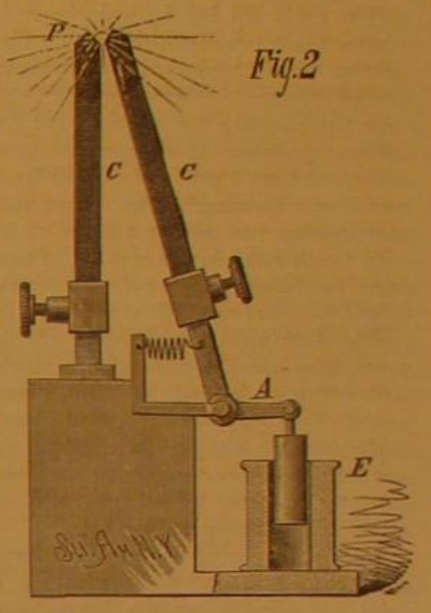


Fig. 2

"The patient was, on the 14th of September placed under the influence of chloroform, while at the same time a retriever dog was being anæsthetized. Cutting down upon the ends of the fractured bone, and removing the fibrous band which alone formed the bond of union, the rounded points were removed by the saw, and a hole drilled obliquely through each squared end. This process was repeated on both sides of the arm, when it was found that an interspace of about ¾ of an inch existed between the two fragments. In the meantime, one of the senior students, and a very clever manipulator, had exposed the humerus of the quadruped completely denuded of every tissue except the periosteum. The length of the bone was accurately measured (¾ of an inch), while from half an inch beyond the end of the necessary length the periosteal covering was rapidly but carefully dissected, the bone sawn through, a hole drilled in either end obliquely, as in the bone in the arm, where it was at once placed and fitted accurately. Wires having been passed through the holes, the bones were firmly tied together. The wound was stitched with silver wire, the bone sutures coming out at each end of the incision. The entire operation was conducted under the carbolic acid spray. The arm was put up in gauze, and held in two rectangular splints.

"After the operation there was a slight tendency to sickness, which was relieved by ice. On the 15th the wound was dressed, and one or two of the stitches removed, as there were signs of tension and a slight blush around the sutures. Tincture of opium (25 minims) was given to induce sleep.

"By the 3d of November a union had taken place, and the wires were removed on the 28th of the same month. The fracture then had all the appearance of being firmly united, and the patient was dismissed, with orders to return weekly for dressing and examination. On leaving the hospital boracic lint was used as dressing. One small wound remained open for twelve months, when the dog's bone, reduced to about half its size, came away, after which the wound healed completely. Shortly after this the patient resumed his former occupation, at which he is still engaged. He remains in perfect health, and retains a very useful arm."

Dr. Patterson says that he had some hope that the strange bone might have found a new home in the man's arm; failing that, he was sure it would secure perfect alignment of and steadiness in the ulnar fragments. Should a similar case occur he would adopt the same process, still hoping that the two bones might become one.

Effects of Food upon the Bones.

Experiments made by Lehmann upon young animals showed that food containing an insufficient amount of phosphates not only affects the formation of the skeleton, but has an essential influence upon its separate parts. A young pig was fed 126 days upon potatoes alone, and it had, as a result of this insufficient food, *rachitis* (rickets, or softening of the bone). Other pigs, from the same litter, fed upon potatoes, leached-out meat, meal, and additional phosphates, for the same length of time, had a normal skeleton. Yet even in these animals there was a difference according to the kind of phosphate added. Two that were fed on phosphate of potash had porous bones, specifically lighter than the others, which were fed upon phosphate and carbonate of lime.

GOOD SAUSAGES.—The following is a time-honored recipe of excellence which, at this season of the year, may be found useful: For 30 lbs., of meat, chopped, add ½ lb. fine salt, 2½ ozs. of pepper, and 2 teacups of powdered sage, sifted.

THE MANUFACTURE OF SOFT FELT HATS.

Before the general introduction of machinery into the trade, the various processes involved in making hats, from the forming of the bodies to the trimming and lining of the finished article, were performed exclusively by manual labor Then, the manufacture of a hat was a slow and tedious operation, requiring a large amount of expensive, skilled labor, thus making a good fur hat a luxury entirely out of the reach of the laboring classes. Now, by the use of efficient machinery, the process is short and the cost reduced to a small percentage of that previously charged for the handmade article.

The finest quality of felt is made from the fur of small soft haired animals, especially the Russian hare or cony, the fur of which is imported into this country in immense quantities It is shaved close to the pelt in order that the hair may be as long as possible, and shipped to the hat formers in small bundles of a few pounds weight each.

The quality of felt desired being determined upon, various grades of fur are thrown together and passed through a "mixer" as it is technically called. The fur is fed into this machine by an attendant, and is brought in contact with a toothed cylinder, revolving rapidly, which tosses it into a large box covering the machine, and thoroughly mixes the different qualities. It still contains, however, a great many impurities, bits of pelt, and matted fur, which are to be removed by "blowing." The "blowers" are contained in a long wooden case having a cover of fine wire netting, in order to allow the dust to escape. The mixed fur is fed between two rollers upon a cylindrical picker, which, making several thousand revolutions a minute, throws the heavy impurities down upon a screen and sends the light fur up in the cover, from which it falls upon a moving apron only to be delivered to another pair of rollers, when the operation is repeated. Each case contains several blowers, and when the fur finally emerges, it is perfectly uniform and exceedingly light and soft. It is now ready to be made into hat bodies, and is carefully separated by weighing into equal amounts, each of which is sufficient for one hat.

The forming machines consist of a large sheet copper cone, two feet long, with a hemispherical top, pierced full of small holes, and standing upon a slowly revolving circular table. This cone is covered by a hinged case of the same shape, but with an open top and of such size as to leave a space between it and the cone. The fur, falling through the opening, is sucked tightly down upon the cone by a powerful exhaust far under the revolving table. The case is thrown open, cloths wrapped around the felt body, and a tight fitting perforated tin case placed over the cone. The whole thing is now immersed for about two minutes in a tank of boiling water, which "felts" the fur sufficiently to allow the body to be stripped off and wrung out, after which it is folded and dried. At this stage the "form" is a long funnel shaped bag, thin and very slightly tenacious. These are delivered to the hat manufacturers, who turn out the finished article.

The first process in these establishments is to felt the bodies by manipulation, which shrinks the felt one half, doubles its thickness and makes it tough and resisting. Six men stand around a hexagonal table called a "battery," rolling and working the bodies until they have acquired the proper dimensions, frequently immersing them in a bath of boiling water set in the middle of the table. They are then placed in a vat of weak vitriol, which draws the fibers of hair together and makes the felt compact. After remaining some time in this bath, they are dried and the thin rough edges trimmed off.

That part which is to form the brim of the hat must now be stiffened. This is done by dipping it carefully into a solution of shellac and soda, afterward passing through a pair of wooden rollers which remove the superfluous liquid. While in this moist condition the body is machine blocked, which gives the general shape of the hat. The blocking machines consist of a frame holding a set of radial arms over a movable upright, which is capped by a circle of radiating pieces and worked by a treadle. The body being placed upon this block, is pressed into the upper mould, the operator changing its position until it is of the proper shape. Separate machines are used for blocking the crown and brim.

They are now colored by immersing for a short time in a vat of hot dye and then washed thoroughly in cold water. After being dried, each body is fitted tightly upon a felt covered block, which is then placed upon a slowly revolving spindle. The attendant fits a cone of fine sand paper upon a tapering plug, sets it in rapid revolution and presses it upon the hat. This process, called "pouncing," removes the projecting ends and irregularities of the hair and gives the belt a smooth, even appearance. In this operation as in blocking the body and brim are "pounced" separately, the machines differing slightly in construction The hats are now taken by the finishers, who block them and give the perfect shape and smoothness of felt by ironing and hard pouncing. The linings and trimmings are sewed on by girls, and the hats are ready for market.

England Taking a Hint.

The *British Trade Journal* thinks "the late Paris Exhibition has developed some startling proofs of the ability of Continental and American rivals to produce articles equal to and in some cases surpassing those produced by this country, notwithstanding even that such manufactures have been regarded as our own specialties, and have hitherto been thought to be unsurpassable. Our manufacturers have brought back with them the knowledge that we have no insignificant rivals. Both master and workmen have been too prone to consider that 'a parcel of foreigners' could never turn out anything even approaching English goods; but our eyes are being rapidly opened, and if the lesson is taken to heart the Paris Exhibition may partly be credited with having taught us to respect the workmanship of other nations."

New Agricultural Inventions.

Messrs. Thomas J. Lindsay, David A. Lindsay, and William J. Miner, of Windfall, Indiana, have invented an improved combined Seed Drill and Corn Planter for drilling seed or planting corn in two or more rows at once. The machine may be used for drilling or for planting in hills at will, without changing the parts.

Mr. Curtis H. Warrington, of West Chester, Pa., has devised an improved Machine for Marking Land, which is so constructed that it may be readily adjusted to make the marks at any desired distance apart, which will allow the plows to be readily raised from the ground for convenience in turning around and in passing from place to place.

Mr. David Englar, Jr., of Avondale, Md., has devised an improved Guano Distributer, which consists in a cam-grooved cylinder, located and revolving in the hopper of the machine, and a clearer and discharge regulator, which project up through the bottom of the hopper, and are reciprocated horizontally as they follow the cam groove. The guano is removed from the cam groove by means of the clearer, and falls into the tube or spout, which conducts it into the furrow in rear of the hoe or shovel.

Mr. Washington H. Tucker, of Stone Fort, Ill., has devised an improved Trough for Feeding Hogs with any desired kind of feed, and which is so constructed as to prevent the hogs from wasting their food, from getting into the trough with their feet, or interfering with each other while eating.

Mr. David F. Hacker, of Kempton, Ind., has patented an improved Horse Hay Rake, which is automatic in its action, the teeth being raised by the wheels through a movable ratchet sleeve placed on the axle.

An improvement in the class of Force-feed Seeders and Planters having a gauge or regulator for increasing or diminishing the flow of seed at will, has been patented by Mr. Alonzo Runyan, of Catawba, O. In this machine the regulator can be easily set to any desired amount of feed, and it always indicates the amount of seed the wheel is delivering.

An improvement in Hay Elevators has been patented by Mr. Joseph W. Higgs, of Sharon, Pa. The object of this invention is to furnish a device for moving hay from the wagon to the mow in the barns. It is simple in construction, convenient and reliable.

Machinery.

The never-ending invention of mechanical and other contrivances for minimizing manual labor leads to the supposition that, by-and-by, the latter will be dispensed with altogether, and that human existence will become a state of sinecurism. If this consummation were ever to be obtained, however, it is pretty certain that life would become unendurable, and that mankind would soon cease to exist altogether. We have no apprehensions, says an English writer in the *Foreman Engineer and Draughtsman*, as to the arrival of either of the contingencies in question. Machinery will ever be the handmaid of humanity, but never its destroyer, and every real improvement made therein being only a new application of the forces of Nature, must be advantageous to the human family. No machine of any kind can possibly create power, and no combination of wheels, pinions, levers, belts, or cranks, however ingeniously arranged, will raise a single foot pound of power, or even one ounce. Suppose a watch be taken by way of illustration. In order to set it in action the spring must be bent and contracted by means of a key, and this imparts power from the muscles of the fingers. When the spring has given off the muscular force put into it the wheels and hands of the timekeeper come to a standstill. Again, in winding up an eight day clock you lift a weight of, say, 6 pounds, through 4 feet. In doing so you perform 24 foot pounds of muscular power. These 24 foot pounds will serve the clock eight days, and unless more power be applied the machinery will stop. The same principle applies to mechanical contrivances of every kind, whether impelled by steam or by sentient bone and muscle. In fact all work is derived from sources of Nature, which in turn have derived their present existence and form from the workings of Nature, or, to be more explicit and exact, from the heat of the sun, which has developed and is developing all the natural laws by which we are surrounded. There is no fear, then, of our getting beyond Nature, nor of machinery of any kind ever adding one iota to the stock of power, latent or active, in Nature's arcana. We may modify and adapt, but we can neither create nor destroy, and may rest assured, therefore, that all discoveries in science and in mechanism will tend eventually to the good of mankind and the glory of the Creator of all things.

New Metals.

In a communication to the Paris Académie des Sciences, read on the 14th of October, M. Delafontaine announced the discovery of the oxide of another new metal, to which he has given the name of Philippium (Pp), in honor of M. Philippe Plantamour, of Geneva, a friend and pupil of Berzelius. M. Delafontaine describes the new element as forming a fourth member of the yttria group of earths. It is yellow, and assuming provisionally that the philippia obtained is in the state of protoxide, its equivalent would be 90 and 95. Its concentrated solution examined with the spectroscope showed a rather broad and very intense magnificent characteristic absorption band in the indigo.

On the 28th of the same month the same gentleman made known to the Academy another new metal, which he calls Decipium, found like yttrium and its cogeners in the samarskite and gadolinite from the United States. At present very little is known about decipium, but its oxide is white, while, as before remarked, that of philippium is yellow. In giving the chemical equivalents of some of these new metals of the same group, such as yttrium, terpium, philippium, and decipium, M. Dumas remarked that chemists find themselves in the presence of new bodies whose series offer some gaps, but if researches are continued we shall soon have more precise and complete data.

Is Science Benevolent?

Faraday had an idea, it is said, that it would be well if the secret of the decomposition of water were not discovered, as the power so gained might not be wisely used; and though the story may be nonsense, any power that, requiring skill and self-restraint for its use, was yet placed in the hands of all men would probably not be beneficial—would certainly not tend to that elevation in comfort which the popular mind permanently expects from science. Imagine the power of firing water discovered, made public from excellent motives, as in a patriotic war, and so becoming the property of a world in which one man in a thousand is probably a crypto-lunatic, anxious, above all things, for a supreme sensation. A discovery, quite possible, of the means of dissolving brick or stone within a definite area into pulp would materially interfere with the security of all property, as would for a time the realization of the Middle Age alchemists' dream. All these discoveries would, of course, to do mischief, require the aid of human malignity, in a consciously malignant state, but others are quite conceivable over which will would have no control. Suppose, for example, Sir G. Airey were to discover that a change had occurred in space, which within, say, a century or two would affect our universe, and inevitably draw the world out of its orbit, thereby pulverizing it to atoms; the effect of that discovery, fatal as it would be to foresight, to patriotism, to that long series of good impulses which have for their unconscious motor the belief that the human race will last, could be nothing but evil. Half the motives to energy and to self-restraint would disappear at once, while the temptation to use up the world, its forests, coal mines, and resources generally, would be enormously exaggerated. Humanity would realize its mortality, and make the best—that is, the worst—of its time. Not one of these suggestions, however, or many other much better ones which might be offered, will come in the least home to the minds of men taught by a few years' experience that science is kind, that knowledge is beneficial, and that every victory over the forces of nature tends to the comfort of man.—*The Spectator.*

The Volatile Oil of Hops.

If steam is passed through hops it carries away a substance which, when condensed, forms an oil that swims on water and has been called hop oil. According to Kühnemann, this oil is not a simple hydrocarbon, but a mixture of a hydrocarbon with several other compounds of oxygen, hydrogen, and carbon. If the so-called hop oil is treated with metallic sodium, the sodium dissolves in the oil without any great evolution of heat, and a substance is produced which is for the greater part soluble in absolute alcohol. If the oil is made from hops that have been treated with sulphur, a strong odor of sulphureted hydrogen is evolved upon the addition of phosphoric or other acids, and can be proved to be such by its reaction with lead test papers. By this reaction sulphured hops can easily be detected. Further researches have shown that this hop oil is a very complicated mixture of a hydrocarbon with oxygen oils. The specific gravity and boiling point of this hydrocarbon is still uncertain, depending upon the purity. The oxygenized bodies separated by sodium have the properties both of alcohols and acids. The product obtained by distillation in vapor of water varies in mixture and composition according to the quality and age of the hops very greatly. Kühnemann is engaged in determining the boiling point, vapor density, and specific gravity of the oxygenized compounds, after which he will make an ultimate analysis to determine their formulas.—*Poly. Notizblatt.*

Toad Poisoning.

The following singular account of the action of toad poisoning on the human body, is reported in the last number of the London *Chemist:*

A child of six years old followed a large toad on a hot summer's day, throwing stones at it. Suddenly he felt that the animal had spurted some moisture into his eye. There suddenly set in a slight pain and spasmodic twitching of the slightly injected eye, but two hours after coma, jumping sight, desire to bite, a dread of food and drink, constipation, abundant urine, great agitation manifested themselves, followed on the sixth day by sickness, apathy, and a kind of stupor, but with a regular pulse. Some days later, having become comparatively quiet, the boy left his bed; his eyes are injected, the skin dry, the pulse free from fever. He howls and behaves himself like a madman, sinks into imbecility and speechlessness, from which condition he never rallies.

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.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Jarvis Patent Boiler Setting, same principle as the Siemens process for making steel; burns screenings without blower, and all kinds of waste fuel. A. F. Upton, Agent, 48 Congress St., Boston, Mass.

Valves and Hydrants, warranted to give perfect satisfaction. Chapman Valve Manuf. Co., Boston, Mass.

New York, December 25, 1878. To the patrons of Lubricene: In wishing you the compliments of the season, we believe the most acceptable offering we can make will be lower prices for the coming year. The unprecedented success which has attended the introduction and sale of Lubricene, together with our increased facilities for manufacturing, warrants us in reducing the price, on the 1st January, 1879, to 30c. per lb. on quantities over 100 lbs., and 35c. per lb. on less quantities. We shall also be prepared to furnish Machinery and Cylinder Oils, Gear Grease, etc., at lowest market prices. Thankful for favors of past years, and soliciting a continuance of same, we remain, yours respectfully, R. J. Chard, 134 Maiden Lane.

Wanted.—Partner with $15,000 to $25,000, to take one third to one half interest in an established Mill Machinery and Engine Works located in Central Ohio. Tools, patterns, buildings, and location first-class. A good opening for a good man. Address, with full name and references, Ohio Manufacturer, Box 1059, Mt. Vernon, O.

Wanted.—A Foreman for an Iron Foundry, experienced in fine machinery castings, with references as to energy and ability. Apply to Lock Box 795, Worcester, Mass.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

The Lambertville Iron Works, Lambertville, N. J., build superior Engines and Boilers at bottom prices.

Empire Gum Core Packing, Soap Stone Packing, Piston Packing; all kinds. Greene, Tweed & Co., 18 Park Place, N. Y.

1,000 2d hand machines for sale. Send stamp for descriptive price list. Forsaith & Co., Manchester, N. H.

Bevins & Co.'s Hydraulic Elevator. Great power, simplicity, safety, economy, durability. 94 Liberty St. N.Y.

Hydraulic Elevators for private houses, hotels, and public buildings. Burdon Iron Works, Brooklyn, N. Y.

Galland & Co.'s improved Hydraulic Elevators. Office 206 Broadway, N.Y., (Evening Post Building, room 22.)

Iron, Brass, and Steel Wire. Needle pointed English Steel Wire, for all purposes. W. Crabb, Newark, N. J.

For Fire or Power Pumps, address the Gould's Manf. Co., Seneca Falls, N. Y., or 15 Park Pl., N. Y. city.

Brush Electric Light.—20 lights from one machine. Latest & best light. Telegraph Supply Co., Cleveland, O.

The Hancock Inspirator received a gold medal at Paris, as being the best boiler feeder ever made, and the Old Colony Railroad (who have twenty-three machines in constant use) have just given it their unqualified indorsement, as the cheapest and most effective feeder ever used on their locomotives. Those interested are referred to their letter of recommendation, which may be found in our advertising columns.

J. C. Hoadley, Consulting Engineer and Mechanical and Scientific Expert, Lawrence, Mass.

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are to be sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

For the best advertising at lowest prices in Scientific, Mechanical, and other Newspapers, write to E. N. Freshman & Bros., Advertising Agents, 186 W. 4th St., Cin., O.

H. Prentiss & Co., 14 Dey St., N. Y., Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

Rubber Hose, Suction Hose, Steam Hose, and Linen Hose; all sizes. Greene, Tweed & Co., 18 Park Pl., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Nickel Plating.—Wenzel's Patent Perforated Carbon Box Anode for holding Grain Nickel. A. C. Wenzel, 114 Center St., New York City.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the SCIENTIFIC AMERICAN Export Edition. This paper has a very large foreign circulation.

Two fine Astronomical Telescopes, 3 in. and 7 in., by first-class English maker, cheap. I. Ramsden, Phila.

Gold Chronometer Watch, by first-class English maker: cost $260, price $135; latest patented improvements. I. Ramsden, 21 Christian St., Philadelphia, Pa.

Hand Fire Engines, Lift and Force Pumps, for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N.Y., and 73 Liberty St., N. Y. city, U. S.A.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N. H.

Women's Hospital 49th St. and 4th Ave., New York, March 6, 1877. H. W. Johns Manufacturing Company, 87 Maiden Lane, New York. Sir:—The Hair Felt Covering, with Asbestos Lining, which you put on the steam pipes and boiler domes of the Women's Hospital, and the Asbestos Cement Felting on the three hot water boilers, are giving great satisfaction, and the result is a great saving of fuel. The temperature of the engine and fire-rooms is very much reduced, so much so, that in cold weather we are rather cold. The saving of coal is 33 1-8 per cent by actual measurement. The Cement Covering is put on in a superior manner, and is the neatest boiler or pipe covering I have yet seen. Respectfully, Duncan McIntyre, Engineer.

Punching Presses, Drop Hammers, and Dies for working Metals, etc. The Stiles & Parker Press Co., Middletown, Conn.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

24 x 48 in. Wright's Automatic Engine, with 16 foot band wheel, 30 in. face, for sale. Price low. Atlas Works, Indianapolis, Ind.

Inventors' Models. John Ruthven, Cincinnati, O.

The Lawrence Engine is the best. See ad. page 29.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Special Planers for Jointing and Surfacing, Band and Scroll Saws, Universal Wood-workers, etc., manufactured by Bentel, Margedant & Co., Hamilton, Ohio.

Boston Blower Co., Boston, Mass. Blowers, Exhaust Fans, Hot Blast Apparatus. All parts interchangeable; material and workmanship warranted the best. Write for particulars.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in Scientific American of this week.

Diamond Self-clamp Paper Cutter and Bookbinders' Machinery. Howard Iron Works, Buffalo, N. Y.

Mellen, Williams & Co., 57 Kilby St., Boston, Mass. Wiegand Sectional Steam Boiler. Ætna Rocking Grate Bar.

Fine Taps and Dies for Jewelers, Dentists, and Machinists, in cases. Pratt & Whitney Co., Hartford, Conn.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

Sir Henry Halford says Vanity Fair Smoking Tobacco has no equal. Received highest award at Paris, 1878.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St. Wm. Sellers & Co.

The SCIENTIFIC AMERICAN Export Edition is published monthly, about the 15th of each month. Every number comprises most of the plates of the four preceding weekly numbers of the SCIENTIFIC AMERICAN, with other appropriate contents, business announcements, etc. It forms a large and splendid periodical of nearly one hundred quarto pages, each number illustrated with about one hundred engravings. It is a complete record of American progress in the arts.

Notes & Queries

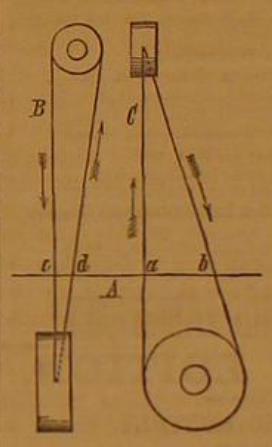
(1) F. H. asks: 1. Does painting the trunk or stem of fruit or shade trees with coal tar harm them? A. Daubing the bark with tar will often kill or seriously injure the tree. It is a common practice, however, to bind the lower part of the trunk, from 10 to 12 inches below the surface of the ground to 3 or 4 feet above, with well dried, tarred paper, to prevent the encroachments of mice and insects. 2. How, and on what part of the grapevine, is grafting or budding done, and which is the easiest and best, also the best time therefor? A. The grapevine may be grafted in the cleft manner if treated as follows: cut the scions during the winter or early spring, keeping them partially buried in a cool damp cellar till wanted. As soon as the leaves of the old vine or stock are fully expanded, and all danger of bleeding is past, cut it off smoothly below the surface of the ground, and split the stock and insert one or two scions in the usual manner, binding the cleft well together if it does not close firmly. Draw the soil carefully over the whole, leaving two or three buds of the scion above the surface. If the root of the stock is a strong native grape, the graft will frequently grow 10 or 15 feet during the first season and yield a fair crop the second year. The vine may also be grafted with good success at the usual season if grafted below the ground, but above ground it should not be attempted, on account of bleeding, until the leaves are nearly expanded. 3. Is it permitted for any person in the United States to make for his own use (strictly), without paying taxes thereon, whisky, wine, or beer, in the same way that we make our own coffee or tea? A. Yes. 4. What is a good book, pamphlet, or paper, treating on insects? A. One of the best works on this subject is "A Treatise on Insects Injurious to Vegetation," by T. W. Harris.

(2) J. R. C. writes: I want to rework stale butter on a large scale, to remove the bad odor and give it a desirable or natural color, if in so doing I will not be under the necessity of using anything injurious to health. A. The following mode of treating rancid butter has been recommended: The butter is first well agitated with hot water, whereby the salt is extracted. On standing it soon separates from the water, when it is again agitated for some time with an equal volume of fresh hot water and a few ounces to the pound of fresh animal charcoal in coarse powder and free from dust. It is freed from charcoal by straining through a fine cloth while still hot, and from the water by the difference in specific gravity. The butter when cold is well washed with fresh milk to which a little sulphite of lime has been added, and then reworked, salted, and colored with a small quantity of annatto. As the latter is not infrequently adulterated with iron oxide and vermilion, it is well to test it for these before using it in butter.

(3) C. D. asks: 1. What is the significance of the picture, which appears in most almanacs, of a man surrounded by the constellations and signs of the zodiac, and lines drawn from the signs to different members of his body? A. It has no significance now. In the days of astrology the several parts of the human body were thought to be influenced by or under the control of the portions of the zodiac designated by the signs with which the members are connected. This with special reference to life, death, health, and disease. 2. What is the best non-conductor of sound? A. A vacuum.

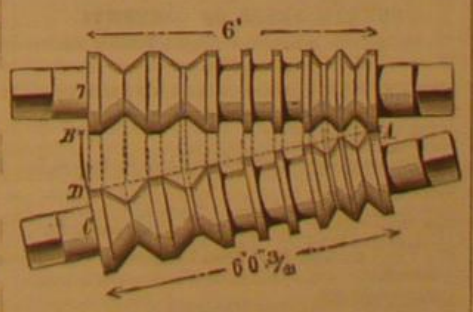
(4) D. V. writes: 1. I have a quantity of chemical writing fluid; have had it two years and it has faded. How can I make it darker? A. You may try the addition of small quantities of tannic acid or extract of nutgalls, and logwood extract. 2. I am in a country place apart from machine shops. How can I draw copper wire No. 22 finer and make my own tools? A. Take a well annealed piece of good tool steel ⅛ inch thick, drill in it several holes of the size of the smallest wire to be drawn, make them all tapering, and enlarge with a reamer so that the holes will vary regularly from the size of No. 22 wire down to that of the smallest wire to be drawn. Harden the plate, polish the holes, reduce the size of the end of the wire, and draw it through the several holes in succession, greasing it before each drawing, and annealing it whenever it becomes stiff. 3. I have made a pair of telephones, mouthpiece as per your engravings, diaphragm of very thin tin. My neighbor wants me to put it up for his use between house and store. Shall I do it, that is, am I infringing on any patent by so doing? A. See "Rights of Investigators" p. 128, volume 39, of the SCIENTIFIC AMERICAN.

(5) A. W. D. asks how to lay out and cut belt holes for a quarter turn belt, said belt to run from one shaft through floor on to another shaft, at right angles with the first, both supposed to be level. A. To make holes through the floors for the belts, lay out on the floor with chalk line and train two views of the pulley, or by scale on paper as shown in the engraving. B is the belt running in the direction of the arrow on the lower pulley, and C is the belt running in the opposite direction. Drop a plumb line representing the perpendiculars, B and C, and draw diagonals governed by the diameters of the pulleys, marking the distances, *a b*, and *c d*, on the floor; now drop a plumb line from each side of the center of face of upper pulley to the floor, and from the point, *c*, thus found, lay off the distance, *a b*, in a line parallel with the upper shaft, and from the point, *a*, in the distance, *c d*, parallel with the lower shaft. These points indicate the places where the holes should be cut.



(6) W. C. H., Jr., asks: 1. How far will a telephone like that described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 142, p. 2260, Fig. 4, carry? A. With a good line, 20 miles. 2. What amount of No. 38 covered wire will give the best results? A. ¾ ounce. 3. How can I make a cheap and simple electric lamp, one or two burners? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 149.

(7) J. A. C. writes: The following method of laying off the sweep for a pair of rolling mill rolls may be of interest to your readers, the object being to give the proper proportion of shrinkage to each member of the roll pattern. The exact configuration of the roll when finished is laid off on a piece of flat wood, and if the working part of the roll is 6 feet long, as in the sketch, the shrinkage, being usually ⅛ of an inch to a foot, would amount to ¾ of an inch in all; this being the case, a pair of trams are set to 6 feet and ¾ of an inch, and one leg placed at A, and the other at B, and the arc of a circle, B D, described. From the point where this arc intersects a line drawn down from F to C, a line is drawn to A, making the line, D A, which may represent the edge of the sweep to be made. Similarly with the line, F C, all the other lines which give shape to the roll are brought down until they intersect the line, D A, and on this line are erected the various members of the roll. Now, it follows that if the distance, D A, is the amount of the shrinkage longer than the true length of the finished roll, namely, 6 feet, then every intersection of the line, D A, will be proportionally wider apart on the sweep than on the roll itself; consequently the roll swept up by such a template or sweep will, when cast, be the exact length from each distinctive point to the other, as well as the exact length over all.



(8) C. H. H. asks: 1. How shall I fix a short length—½ inch—of platinum wire between the ends of my battery wires? I wish to heat it. A. Wind it two or three times around each wire, or split the ends of the battery wires, and after inserting the platinum, press the ends together. 2. How many ½ pint bichromate of potash (bottle) batteries will be necessary to heat such a piece of platinum wire? A. If you use a Grenet battery, and a fine platinum, one cell will answer. 3. How can I insulate a brass ring, so that a current can be sent through it without loss to an electro-magnet? A. Glass, sealing wax, rubber, ivory, and hard wood are good insulators. 4. Would it be possible to run a dynamo-electric machine for electric light, by bringing the current from the light back to an engine like Edison's "Harmonic" engine? A. No.

(9) G. H. I. asks: Would heat or sound pass through a vacuum, that is, assuming a perfect vacuum? A. Heat would, sound would not.

(10) E. O. C.—For a definition of sound see p. 347, vol. 29, reply to F. H. P.

(11) M. A. G. asks: 1. What is the meaning of the word anthracite? A. Literally a burning coal stone. 2. Is anthracite coal found in any other place but Pennsylvania? A. Anthracite is found in Pennsylvania, Rhode Island, and South Wales. It is used for the production of iron chiefly in Pennsylvania, Scotland, and Wales. 3. Where was iron first made with anthracite coal, and who was patentee of the process? A. In 1838 and 1839 Thomas made the first experiment on melting iron with anthracite in Pittsville, Pa.

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

C. E. B.—It is a shale containing much iron sulphide and a little organic matter.—C. A. R.—No. 1 contains hornblende and tourmaline. No. 2 was not received.—C. & H.—It is a dolerite or trap rock, of little value.—S. L. C.—It is an impure chrysocolla—a silicate of copper. It contains about 9·5 per cent of copper—no silver or gold.

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November 12, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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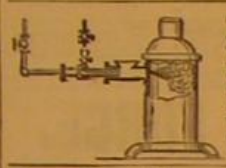

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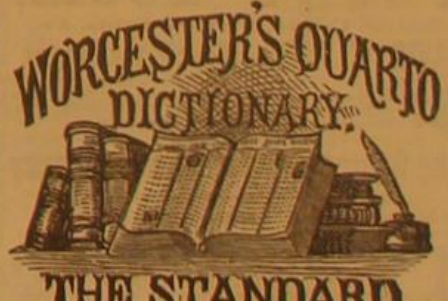

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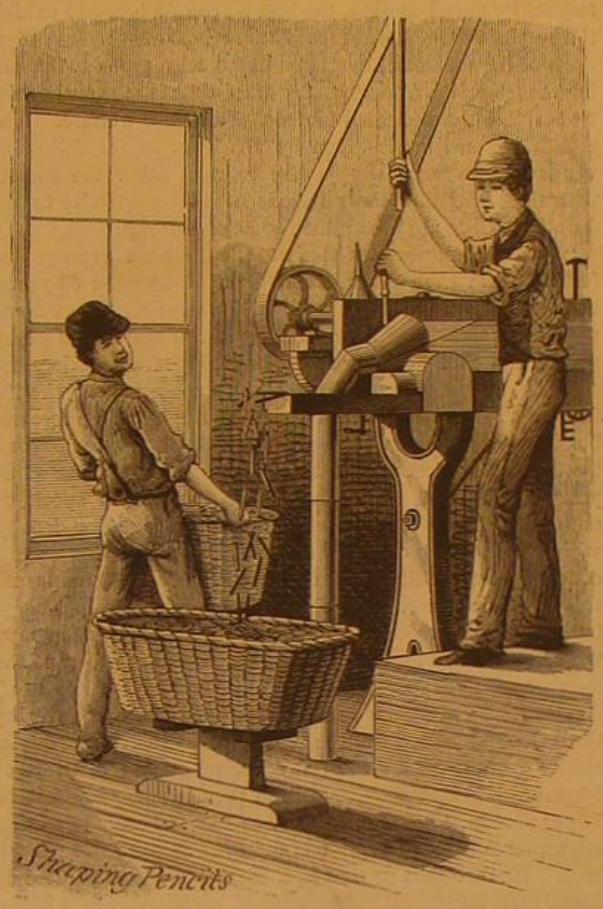
The Adulteration of Soft Soap.

The *Manufacturers' Review* translates from the French of M. Emile Picard the following note on the adulteration of soft soaps:

"One hundred parts of fatty matter, combined with soda or potash, yield 230 to 235 parts of pure soft soap, containing 33·14 per cent of water. When certain adulterants are added in quantities too small to affect the appearance of the soap, 100 parts of grease will yield 320 to 340 parts of what would be a good commercial article, containing 33 to 38 per cent of water. The same quantity of grease can be made to produce 380 parts of soap, containing as much as 52 per cent of water. The adulterants generally used are clay, resin, fecula, and silicate of soda. All are added to increase the yield of soap, and the proportion of water it can contain. Clay is the most harmless of these adulterants. It is partly dissolved by the alkali, but makes the soap opaque, and is easily detected by its insolubility in water. It increases the amount of water required to bring the soap to the proper consistence, but is not otherwise harmful. It is less and less employed every day. Resin combines with alkali, but the resulting compound 'possesses none of the emollient qualities of fats.' It retains large quantities of water, but alters the emollient and detergent power of the soap, and makes it more caustic and corrosive. Soaps adulterated with resin only are clear, brilliant and transparent; more soluble in water than pure soap. They nearly always retain a slight odor of resin which is most noticeable when the soap is warmed. Their color is often redder than usual. They attack the skin, and make linen yellow. Fecula is very harmful, especially when combined with silicate of soda. It is generally employed with three or four times its weight of lye, water, or silicate of soda. Soap made with it contains an excess of alkali, and a very large quantity of water. It is more or less opaque, as the proportion of starch is large or small; it is easily soluble in water; it is much affected by changes of temperature; and its detergent power is much lessened by the large proportion of water it contains. The latter fault is partly concealed by making it excessively alkaline; it is then corrosive, and attacks and destroys the skin, coloring matters, and woolen and silken goods. Analysis reveals the presence of the decomposition products of the latter in the water in which they have been washed. Silicate of soda with fecula is far the most injurious adulterant of soap, and it is also the one most usually employed.



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Almost all commercial soaps contain it. Silicate of soda in small quantity does not alter the appearance of the soap; but it is decomposed when used, and silica is deposited in the fiber of the flax or cotton, and cannot be removed, rapidly destroying the tissues. Silk and wool are also attacked, and made more liable to be destroyed by alkalies. Water in which silk and wool have been washed with this soap contains considerable quantities of sulphur and ammonia resulting from the decomposition of the material. According to Dr. Vohl, linen and cotton cloths thus treated look, under the microscope, like worn fabrics—the fiber destroyed and the surface covered with a nap. Franklin said good bargains are sometimes ruinous. This is particularly true of soaps. Low-priced samples are never cheap; a larger quantity must be used to cleanse an equal amount, and fabrics are far more rapidly destroyed."

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The British Army in Afghanistan. The Military Elephants. A British Elephant Battery. Mouth of the Khyber Pass. 3 illustrations.—The Development of the Garpike.

OVER-DENSITY OF POPULATION IN CITIES.

The great and growing question as to the dangers, both to life and health, that result from an overcrowding of the population in large cities, has lately received a new treatment at the hands of the learned Dr. Parr, by the labors of whom the subject has been reduced to a science of almost mathematical exactness. In a paper entitled "Density or Proximity of Population, its Advantages and Disadvantages," recently presented to the Congress at Cheltenham, England, by this excellent authority, the statistics shown are somewhat startling, and put forth in such a way as to prove exceedingly interesting and instructive. Dr. Parr's principle is this: "Observe the effects of the population-density; as a rule, the greater this density the shorter the duration of life; and this life-duration is seen to follow a ratio appreciable by simple arithmetic."

That man by his very nature is gregarious in his habits, and that, following the dictates of his nature, it is his wont to congregate in dense communities, is a fact so well known, and one that has been so often commented upon, as to appear trite in its repetition. We cannot, perhaps, expect to accomplish much in the way of changing his habits in this respect by moral suasion, the best we can do being to exhibit the results that modern science has arrived at in its investigations of the subject of overcrowding, not so much to the sufferers themselves from this state of things, as to the authorities whom they have elected to look after their welfare. The gist of the matter is given by Dr. Parr in the following words: "The nearer people live to each other the shorter their lives are," and the relations of this proximity to the duration of life are ascertained to be as follows:

"In round numbers, where we stand on an average 400 feet off from each other, we live on an average 50 years; where we are 300 feet off, we live 40 years; where we come within 60 feet of each other, we live but 30 years; and where we are but 20 feet off, we live but 25 years. It does not seem likely that by extending our interspace beyond the 400 feet we could prolong the average of life beyond 50 years; but it is very clear that if we contract the interspace beyond the limit of 20 feet we must rapidly reduce the mean of 25 years to 20, to 15, to 10, and before long, so to speak, to nothing. That is to say, there is a certain population-density with which, in the ordinary circumstances attending such a condition, human life could not be sustained at all; and from this melancholy zero there rises a scale of progression, obeying, of course, a recondite, but intelligible mathematical law, whereby we may measure off in a moment, according to the number of lives per acre, the number of years of life." Again, from Dr. Parr's actual figures we learn that "during the decennial period from 1861 to 1870 inclusive, the death-rate of certain of the most favorably situated districts of England, taken at per 1,000 of the population, proved to be 17 per annum, 16, and even so low as 15; whereas in certain other places it stood at 31, 33, and even 39 per 1,000 per annum. He then tells us that in those cases where 16 died in 1,000, each individual had to himself, on an average, 4 acres: where 15 died, each had 3 acres; whereas where 31 died, each had only one tenth part of an acre on an average; and where 39 died, each had only one one-hundredth part of an acre. The writer then goes on to show that, as regards the intermediate cases, the regularity of the rule is sufficiently precise." It further appears that the densest and most unwholesome of the districts in England is Liverpool, where a square mile holds no less than 63,823 human beings—an average of about one hundredth of an acre to each, or equivalent to a space of 12 by 12 feet. Thus it may be readily seen that if the men, women, and children of the lower order were to be placed on a surface of level country, each person being 12 feet from the next, and if the dirt, destitution, intemperance, and disease, coupled, of course, with the toil of this class, were conditions present in full force, 39 out of 1,000, or say 1 out of 25, must die annually. In other words, the average duration of human life must be as low as 25 years.

Such are some of the more important of the interesting facts given us by Dr. Parr in his valuable paper. The *Architect*, to which we are indebted for an abstract of these conclusions, remarks very truly that "no doubt the local circumstances of any particular community must always exercise a considerable influence on the death rate. It is scarcely necessary to say that it is not so much the crowd that kills, as it is the conditions under which the crowd accumulates; the conditions of soil and climate, of the contamination of air and water, of the disposal of refuse, of food supply, of the consumption of strong drinks, and of social character and habits in various ways, whether in labor or in idleness." While there is no doubt that such conditions as these exercise a large influence on mortality in large cities, there is also no doubt that the death rates in such communities are pretty certain indices of the perfection or imperfection of municipal arrangements in regard to sanitary matters.

Without pretending to state the cause, we may call attention, in connection with this subject, to the following fact: From the figures lately published by the German Imperial Statistic Office, giving the mortality per 1,000 inhabitants in the chief cities of the world, we learn that the death rate in the city of New York is about one third greater than that of London, and a fraction greater than that of Liverpool, which, as Dr. Parr has shown, is the most unfavorable district in England.

PATENTS IN NEW SOUTH WALES.

A bill to amend the laws relating to patents has been introduced in the Parliament of New South Wales. It provides for the establishment of a patent office, the appointment of a "Patents Officer," and the issuing of patents for inventions, and the publication of the patent specifications. Any person may obtain a patent for his invention, giving him an exclusive property therein, provided the invention has not been in public use in New South Wales for more than one year, or has not been patented in any other country more than one year. But if any one in New South Wales shall have begun to manufacture an article before the patent is granted, such person may continue to manufacture and sell such article notwithstanding the patent. The life of a patent is to be five, ten, or fifteen years, at the option of the patentee, the respective fees being $25, $50, and $75. The Government retains the privilege of using any patented invention on paying to the patentee such sum as the Patents Officer may decide to be a reasonable compensation therefor. Patents are assignable, wholly or in part, the assignment to be registered in the Patent Office. In case of infringements, the Supreme Court adjudges damages and costs.

SUN SPOTS AND COMMERCIAL CRISES.

To the numerous explanations that have hitherto been given by various writers on commercial topics, to account for the present depressed state of trade, there has recently been added another—this time from the pen of Prof. W. Stanley Jevons, who, in a late number of *Nature*, treats the matter at some length from a scientific standpoint.

The fact has long attracted attention that commercial crises, like the one through which we are passing, are marked by a certain periodicity in their occurrence, and they have been associated, not unreasonably, to a certain extent with a deficiency of crops, and such deficiencies again have in recent years been supposed to be in some way connected with the "sun spot period."

Professor Jevons, in his present paper, endeavors to establish a direct relation between the latter periods and times of trade depression; and, although his studies have not as yet allowed him to fix the exact nature of the connection, the data that he furnishes exhibit at least some curious coincidences. After some preliminary accounts of what has been done in this field of research, both by himself and others, in former years, Professor Jevons says: "It is impossible in this place to state properly the facts which I possess; I can only briefly mention what I hope to establish by future more thorough inquiry. . . . Deferring, however, for the present, any minuter inquiry, I permit myself to assume that there were, about the years 1742 and 1752, fluctuations of trade which connect the undoubted decennial series of 1711, 1721, and 1732 with that commencing again in the most unquestionable manner in 1763. Thus the whole series of decennial crises may be stated as follows: 1701 (?), 1711, 1721, 1731–32, 1742 (?), 1752 (?), 1763, 1772–3, 1783, 1793, 1804–5 (?), 1815, 1825, 1836–9 (1837 in the United States), 1847, 1857, 1866, 1878. A series of this sort is not, like a chain, as weak as its weakest part; on the contrary, the strong parts add strength to the weak parts. In spite, therefore, of the doubtful existence of some of the crises, as marked in the list, I can entertain no doubt whatever that the principal commercial crises do fall into a series having an average period of about 10·446 years. Moreover, the almost perfect coincidence of this period with Mr. J. A. Broun's estimate of the sun spot period—10·45 years—is by itself strong evidence that the phenomena are casually connected."

Hyde, Clarke, Wilson, and Danson all argued, 30 or 40 years ago, that commercial fluctuations must be governed by physical causes; but the difficulty that has beset the theory is that hitherto no one has been able to detect a clear periodic variation in the price of corn. Sir William Herschel endeavored to do this at the beginning of the present century in his inquiry as to the economic effects of the sun spots; but his facts are too meager to justify any certain inference. Professor Jevons confesses that as yet his own inquiries have been equally without result on this point. "The fact is," he says, "I believe that cereal crops, as grown and gathered in Europe, depend for their success upon very complicated conditions, so that the solar influence is disguised. But it does not follow that other crops in other latitudes may not manifest the decennial period. Dr. Schuster has already pointed out in *Nature* a coincidence between good vintages and minima of sun spots, which can hardly be due to accident. "Now, if we may assume Dr. Hunter's famine theory to be true, there is little difficulty in explaining the remarkable series of periodic crises which I have pointed out." The author goes on to show that the trade of Western Europe has always been strongly affected by communication with the Indies, several crises being distinctly traceable to this cause; thus the crisis of 1878 is clearly connected with the recent famines in India and China, and these famines are confidently attributed to solar influence. He states, then, that it is his present belief that to trade with India, China, and other parts of the tropical and semi-tropical regions, must be attributed the principal fluctuations of European commerce, although the decennial fluctuations ought not to be wholly laid to the account of Indian trade; it being quite possible that tropical Africa, America, the West Indies, and even the Levant are affected by the same meteorological influences which occasion the famines in India. Thus it is the nations which trade most largely with those parts of the world, and which give long credits to their customers, which suffer most from these crises. Professor Jevons sees nothing in his theory inconsistent with the fact that crises and panics arise from other than meteorological causes; but when such do happen, they

seldom, if ever, have the intensity, profundity, and wide extension of the true decennial crises.

The conclusion which the author draws from his speculation is that "if there is any truth in all these sun spot speculations, there must be a periodic variation in the sun's rays, of which the sun spots are a mere sign, and perhaps an unsatisfactory one. It is possible that the real variations are more regular than the sun spot variations, and thus may perhaps be explained the curious fact that the decennial crises recur more regularly on the whole than the maxima and minima of sun spots."

To determine this mooted question, then, he suggests the importance of at once undertaking direct observations upon the varying power and character of the sun's rays; and to this end solar observatories should be established in every country where the sun can be observed most free from atmospheric opacity. If from such observations it be found, as will probably be the case, that the sun does vary, "the time will come when the most important news for the commercial world contained in the *Times* will be cablegrams concerning the solar power." And he adds that certainly an empire upon which the sun never sets cannot wisely neglect to keep a watch on that great fountain of energy, since "from it we derive our strength and our weakness, our success and our failures, our elation in commercial mania, and our despondency and ruin in commercial collapse."

PROGRESS OF THE SWEDISH ARCTIC EXPEDITION.

There is a strong probability that the Swedish Exploring Expedition, under Professor Nordenskjöld, has by this time proved the existence of an available northern passage from the Atlantic to the Pacific. In 1876 and 1877, Professor Nordenskjöld succeeded in reaching the mouths of the Siberian rivers Obi and Yenisei by way of the Kara Sea, a feat never before accomplished, thus establishing a new commercial road to the regions which those streams water. During the past summer, the expedition which sailed from Hammerfest, Norway, in July, successfully traversed the Kara Sea in the forepart of August, and arrived at Dickson's port, at the mouth of the Yenisei, on the 6th. Four days later the expedition, comprising two small but strong steamers, the Lena and the Vega, began the exploration of the hitherto untried sea to the north and east. By August 20, the northernmost point of Asia was passed, and in a week more the mouth of the Lena was safely reached. Here the steamers parted company, the Lena to ascend the river to Yakutsk, the Vega to continue the exploration of the Siberian coast, hoping within a few months to reach Japan by the way of Behring Strait. The greater part of the coast from the Lena to Behring Strait has already been explored by sailing vessels, so that the probability of the successful passage of the Vega is very great. Should it prove feasible to navigate those seas even during a few months of each summer, the commercial advantage of the new route between Europe and Eastern Asia and Western America will be considerable. Besides, it would open up to trade the northern half of the vast continent of Asia, by way of the great rivers Obi, Yenisei, and Lena.

Professor Nordenskjöld has already shown that trading vessels carrying profitable cargoes can reach the north of the Yenisei in August and September, and return with marketable freight before the Kara Sea is closed by ice. Should the entire route by way of the Arctic Sea prove practicable, the summer voyage from Europe to the East would be shortened about one fourth; but that advantage would be offset by the disadvantage of being closed by ice ten months in the year.

In any case the new Siberian regions opened up are likely to prove of great benefit to Europe, both in furnishing large supplies of food stuffs and raw materials, and in offering a market for manufactures. Siberia has made enormous progress in material development during recent years, and improved trade connections would give a great impetus to the new settlements. Fortunately American manufactures are highly esteemed in Siberia; and if a proper effort is made a large share of the new trade may fall to us. On the other hand Siberia is likely to become a serious rival to us as a producer of breadstuffs. Vast regions there are admirably suited for the cultivation of grain; and they will make themselves felt in the markets of the world as soon as means are provided for transporting the crops cheaply.

THE TRADEMARKS QUANDARY.

The attempts to better the law of trademarks by statutes have evidently muddled the subject. A Maryland judge has pronounced the law of Congress unquestionably constitutional; and jurists will generally agree that, if it is so, it has superseded State laws. But a Wisconsin judge is just as clear that the National law is a nullity; and one consequence of this decision, if sustained, would be that State laws are revived. Meanwhile the manufacturer cannot know under which law to act.

Before either law was passed courts of equity had built up a somewhat vague yet efficient system for perfecting the peculiar labels, unique designs, characteristic names, and fancy catchwords adopted by various manufacturers and dealers. Every producer of an article generally known to be good sets a value on the trademark with which it has become associated in the public mind, and will resist the employment of it by his competitors. The courts have sustained these claims; not so much, however, in the view that a trademark is property, as upon the ground of protecting the public from imposition. Any man may make and sell cologne or cocoa oil, pencils or piano-fortes, shawls or shirts; but if he sells them under the names and characteristic labels of old and distinguished dealers, the public are liable to be deceived. For the sake of the public the courts will stop such imitations by injunction, and if doing so also protects a meritorious manufacturer in the slowly-acquired reputation of his wares, so much the better. This was the old equity doctrine of trademarks. But it was a long and difficult inquiry, in many of these cases, which of the rivals was first in the use of the disputed name or emblem. To relieve this difficulty, to supply proof of the original ownership and use, is a leading object of the trademark statutes. Such statutes have been passed in England, by the Legislature of New York, and by Congress. They enable a dealer when he first adopts a trademark to register it as his own; and having done this, he can at any time appeal to the public record to establish his priority of design. Conversely, any one proposing to adopt a trademark can ascertain from the record whether the same design has been appropriated.

Our people have little concern with the English law; it is the confusion between State and National laws which needs remedy. The first National law appeared in 1870, as one chapter in a newly enacted revision of all the laws pertaining to patents and copyrights. This juxtaposition of subjects gave the impression that the law rests upon the power of Congress to secure to authors and inventors the exclusive right to their respective writings and discoveries. And now the objection is made that a trademark is not a writing or a discovery, and its designer is neither an author nor an inventor. Therefore the law is unconstitutional.

The objection is forcible, but an answer is offered that trademarks pertain to commerce, and that Congress has power to regulate commerce. Opponents of the law reply that it is commerce among the States which Congress may regulate, while trademarks belong primarily to domestic commerce, which Congress cannot control. Friends of the law contend that the National Government may make treaties, and treaties may properly stipulate for mutual protection of trademarks of subjects of one government within the dominions of another, and therefore Congress may pass a general trademark law as incidental to enforcement of treaties. And so the discussion slowly proceeds, with the effect of creating the dilemma that claims founded on either law may, at any moment, be adjudged invalid. For the power of Congress, if it exists, is exclusive; if it is disproved, then and then only are State laws operative. The New York *Tribune*, from which we select the above, concludes with everybody else interested in the matter, that the subject deserves early and final determination.

HOW TO UTILIZE OLD FRUIT CANS.

Perhaps one of the most appropriate uses of an old fruit can that can be devised is to make it contribute to the growth of new fruit to fill new cans. This is done in the following manner: The can is pierced with one or more pin holes, and then sunk in the earth near the roots of the strawberry or tomato or other plants. The pin holes are to be of such size that when the can is filled with water the fluid can only escape into the ground very slowly. Thus a quart can, properly arranged, will extend its irrigation to the plant through a period of several days; the can is then refilled. Practical trials of this method of irrigation leave no doubt of its success. Plants thus watered flourish and yield the most bounteous returns throughout the longest droughts. In all warm localities, where water is scarce, the planting of old fruit cans, as here indicated, will be found profitable as a regular gardening operation.

SENATE BILL 300.—SECTION 2.

In all discussions of patent rights with reference to Mr. Wadleigh's bill for the amendment of the patent law, it is needful to bear in mind the broad principle that Congress is empowered by the Constitution to grant to inventors the "exclusive" right to the manufacture and sale of the article or process patented. The right is limited in time, but it cannot be limited in scope. In other words Congress has no power to come between the patentee and his invention, to say what he shall do with it. Whether this provision of the Constitution is wise or not is beside the question. In our opinion it is eminently wise; but wise or foolish, there it stands, and can be got rid of only by an amendment of the Constitution, not by any change in the wording of the patent law.

The fatal objection to Section 2 of Mr. Wadleigh's bill is that it undertakes to limit the scope of the patentee's right. It provides that if the patentee chooses for any reason to share his right with A and B, giving them a license to use his invention or discovery, C, D, and all the rest of the alphabet may come in and enjoy the privilege on the same terms. Still worse, if the patentee elects to retain the entire control of his invention, his purpose may be thwarted, the penalty for the infringement being a license fee "determined from all the evidence in the case."

The purpose of the American patent law is to encourage the advancement of the useful arts through invention and discovery. Its object is to induce men to study and experiment and invent; and it seeks to accomplish that object by the hope held out to the inventor that by the enjoyment of the exclusive right to the manufacture and sale of a patented invention he will stand a better chance of gaining a fortune than would be otherwise possible. Once secured a patented invention is property, to be respected as other property is. The Constitution provides that during the life of the patent the owner of it shall be free from dictation or interference; so long, of course, as he uses it without direct injury to himself or others. In other words, his right is as exclusive as his right to a horse or a gun, or a house that he has reared or bought or made.

What would be thought of the wisdom of a legislative body which should enact a law to the effect that in case A lends his horse to B, for friendship or hire, any other man might use the horse on the same terms? Or in case A should decline to lend his horse, B's unauthorized use of the animal would be punishable only by the payment of the customary license fee of the livery stable? Similarly if A allows B to plant a potato patch in the corner of his farm, the whole farm shall be laid open to invasion on the same terms? Or if C wants to occupy a room in D's house he shall be allowed to do so on payment of such rental as some one else shall decide to be sufficient?

Is there any less absurdity or injustice in making parallel provisions with respect to invasions of patent rights?

As a rule it may be said that the work of inventing a novel and useful device is less arduous and costly than the work of introducing it. As a rule, too, the inventor is very apt to be without the means needful to develop and introduce an invention so as to make it pecuniarily profitable. Accordingly very favorable terms may well be offered to the first to take hold of and work up a new invention. The risks are great, and the promise of ultimate profit should be correspondingly great. Would any cautious business man be willing to assume such risk if he knew that when the profitableness of the invention came to be successfully demonstrated, any one else could step in and use the perfected invention at no greater risk than the payment of a license fee?

The great trouble with the framers of devices for facilitating the invasion of patent rights, like this second section of Mr. Wadleigh's bill, arises from their proneness to forget the grand purpose of the American patent system—the advancement of the useful arts by the encouragement of invention—and the not less vital point that the only means for the attainment of that end contemplated by the framers of the Constitution was the recognition of the inventor's exclusive right to the control of his invention or discovery during the period for which the patent should be granted.

It would no doubt be very pleasing to such as are or desire to be infringers upon patent rights, to have the inventor's exclusive right laid open to invasion. But the patent law was not framed to meet the wants of infringers, and Congress has no constitutional power to alter it in their favor.

BOILER FEEDERS FOR LOCOMOTIVES, ETC.

Among the improved appliances in this line proven by practical tests to possess superior merit, the Hancock Inspirator may be especially mentioned. The company's business announcement will be found in our advertising columns. The performances of this apparatus are in some respects remarkable. E. Howard & Co., the well known watch and clock makers, have one in use which they say draws the water from a driven well, some 75 feet distant, and a perpendicular lift of 20 feet, and also forces the water, when needed, 70 feet up into a tank at the top of the building.

For locomotives they are especially useful. Mr. James K. Taylor, master mechanic of the Old Colony Railway, states that every one of twenty-three of these feeders, now in use on the locomotives of the above company, is giving great satisfaction. Not one has had to be taken off for repairs. They supply all the water required by the engines, are found more reliable and economical than any pumps, which latter they do not hesitate to remove. They are more positive in working, less liable to clog, have greater range than any other device, and require less attention from the engineer in working them. Practical indorsements of this sort are worthy of the highest consideration.

An Economical Engine.

A compound condensing pumping engine, erected for the Buffalo (N. Y.) High Service Water Works, by the Holly Manufacturing Company, of Lockport, N. Y., recently tested under the supervision of Professor Greene, President of the Troy Polytechnic Institute, developed a duty of 80,489,638 foot pounds per 100 lbs. of coal. Following are the elements of the test:

High pressure cylinder, 1, diameter, inches	25·
Low pressure cylinders, 3, diameter, inches	25·
Double-acting pump cylinders, 4, diameter, in.	15·5
Length of stroke of each cylinder, inches	33·
Total number of revolutions	25,650
Duration of test	20h. 15m.
Revolutions per minute	21·12
Piston speed per minute, in feet	106·16
Pressure on water gauge, in pounds	46·76
Pressure from reservoir supply, to be deducted in pounds	5·58
Actual water pressure, or load on the pump, in lbs.	41·18
Coal consumed, no deductions, pounds	5,400
Steam pressure, pounds	61·5
Vacuum, inches	26·5
Temperature of injection water to air pumps, degrees, Fah.	48·
Temperature of water in hot well, degrees, Fah.	92·
Temperature of feed water to boilers, deg., Fah.	170·
Air pumps, two single acting, diameter, 24 in. stroke, 30 in.	
Suction and discharge pipes, diameter, 24 in.	
Fly wheel, diameter, 12 ft. 4 in.; weight, 7 tons.	
Duty in foot pounds, per 100 pounds of coal	80,489,638

This engine is similar to that described in the SCIENTIFIC AMERICAN, vol. XXXIX., p. 95, and in SUPPLEMENT No. 140.

A Mammoth Farm.

A correspondent of the Troy *Times*, traveling in Dakota, writes from Fargo, a town, he says, now only eight years old, containing 6,000 inhabitants, describing the cultivated farm of William Dalrymple, containing an undivided estate of 50,000 acres, extending 12 miles along the fertile bottom lands of a most beautiful river, and then back into the interior 11 miles more, the whole covering an area of over 30 square miles.

Of this, 20,000 acres were last year sown in wheat, which has yielded 250,000 bushels as reward for the husbandman's toil. The soil of this Red River farm is peculiarly rich, and adapted to the production of just the cereal cultivated. The upper surface is an alluvial deposit of great fertility, under which is a deposit of marl, containing in large quantities the phosphates and silicates needed in the formation of the berry and the stalk of wheat.

Of course it would be impossible to operate such a farm from one headquarters, so the land is apportioned into subdivisions of 2,000 acres each, every one of which is presided over by a superintendent, who is under the direction and orders of the owner. Each chief overseer has a nice house, in most cases handsomely fitted up, and finished, in several instances, in most excellent taste. Near the superintendent's house is the hands' boarding-house, where all the harvesters board. Back of these buildings are located the granaries and stables, and, a little further removed, the machine shops, engine rooms, and windmills. All the buildings follow a plain but quite attractive style of architecture, and answer every purpose intended. Each subdivision has the same set of buildings, and is operated in quite the same way.

To run the farm it requires the services of 450 men and over 300 horses and mules; to keep the accounts, 3 bookkeepers and 2 cashiers are kept constantly busy. Water is pumped by windmills several miles back into the interior from the river. 75 Wood's reapers and binders are used in the harvest, and pile up yellow sheaves at the rate of 1,000 acres per day. During the entire harvest season last year they were retarded only one half day by inclement weather. The grain is separated from the straw by 18 steam thrashers, which puts it in the bins at the rate of 1,000 bushels per day.

STRAUB'S SCIENTIFIC GRAIN MILL.

We give herewith engravings representing in different views a mill for grinding grain, middlings, minerals, and

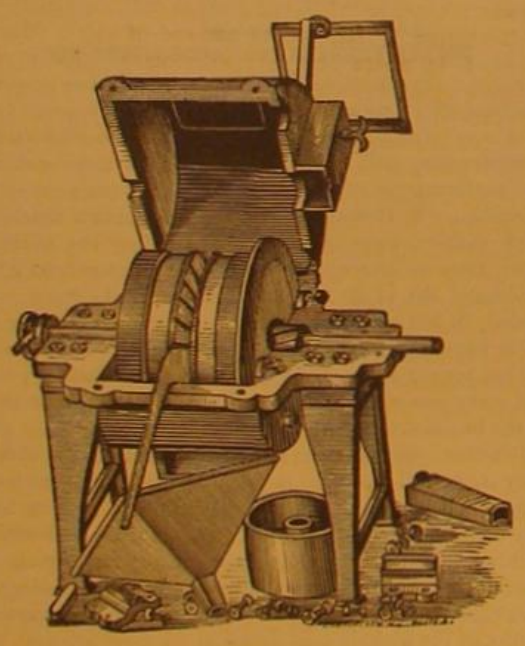


Fig. 2.—STRAUB'S MILL OPEN.

paint, which is known as Straub's Scientific Grain Mill. It is claimed by the manufacturers of this mill that burr stones revolving in a vertical plane are more effective than horizontal stones of double the diameter, running very light and steady and grinding faster and cooler than ordinary stones. The principal requirements in a mill of this character are to have the parts accurately fitted and rigidly held in position; to have a ready means of taking up wear, and to have it so simple that it can be readily understood and managed by any one likely to require such a mill. The manufacturers of the scientific grain mill claim to have met these requirements. Fig. 1 is a perspective view of the mill, giving a good idea of its external appearance. Fig. 2 shows the mill opened, with the bar between the stones which is employed to lift them from the casing and place them in position for dressing, as shown in Fig. 3.

This mill has a silent feed and is adapted for grinding wheat flour; regrinding middlings; grinding corn, oats, and feed; and it may be used for grinding minerals, gold quartz, rock, slate rock, fire brick, dyewood, bone, cochineal, foundry facing, and whatever can be ground by French burr stones. It is especially adapted to farm and plantation use, as the smaller size may be driven by hand or horse power.

Further particulars may be obtained by addressing the manufacturers, Messrs. A. W. Straub & Co., 2231 Wood street, Philadelphia, Pa.

[*Continued from first page.*)

conductor of heat and electricity, the purest carbon known next to the diamond, and is capable, the manufacturers claim, of being divided finer than any other known substance. Its proper color is that of a darker shade of fractured steel. Its best known use is for pencils, and the next is, perhaps, for crucibles and refractory mixtures, and then as a conducting coating for galvano-plastics. Its unchangeable character

THE RAILROAD, WITH BUNDLES OF PENCILS.

and smoothness have attracted much attention to it as a lubricator. The use of graphite for lubricating is not new. It was used for that purpose more than 200 years ago; but the want of a pure article prevented its adoption to a large extent. Within the past few years the Dixon Company have taken the matter up in earnest, and have succeeded in producing graphite of purity and free from grit, at a price that must bring it very largely into use for lubricating. Its well known properties have caused many persons to mix it with oil or grease or apply it dry to journals, and their disappointment has caused them to condemn the article, the graphite being of inferior quality. The brand of graphite prepared by the Dixon Company, known as the "Perfect Lubricator," has cured, it is stated, the step of a mill of heating when every other tried means had failed.

A grease is now being prepared by the company, for use in mills and for railroads, steamboats, cylinders, gearing, bearings, slideways, etc. The company has named the article "Dixon's Everlasting Graphite Grease." For this grade of graphite the company was awarded the gold medal at the Paris Exhibition of 1878.

The most interesting mechanical processes in the Dixon Works are to be found in the Pencil Department, which is illustrated on our first page, the large engraving showing the several operations of making the leads, gluing the pencil strips, and bundling the pencils. The smaller cut shows the machine for shaping the pencils. The graphite is divided as finely as mechanical means will permit, and is then floated through several tubs or vats, placed one above the other; the coarsest of the particles will settle in the first vat, the next coarsest in the next vat, and so on till the finest have lodged in the last, or lower vat.

A very smooth, blue clay is dissolved in the upper vat, and floated in the same manner, the finest being gathered into the lowest vat. The finest clay and the finest graphite are mixed together for the finest pencils. The proportion of clay determines the grade of hardness of the pencil when finished, the more clay the harder the "lead." After the materials are mixed together the plastic mass is placed in a "well." A screw press follower presses the material out through a hole in the bottom of the well, when it coils up like a thread under the machine, so that it may be handled like a skein of yarn.

It is then straightened out in lengths, dried, placed in a crucible, and submitted to a high heat and baked like earthenware for some hours. The "leads" are then streng enough to be handled like knitting needles. The cedar boards are sawed into suitable lengths and of a width for six pencils. They are run through a machine that planes and grooves them on one side, nimble fingers place the leads, the two halves or boards are glued together, and they are ready for the shaping machine. The little blocks enter at one side of the machine, and the pencils fall into a basket at the other side at the rate of 216 per minute. An ingenious contrivance counts them. On leaving the shaping machine the pencils are about as perfect as woodwork can be made. They pass thence into the finishing room, where they are varnished and finished in any desired color, stamped with the title and grade and packed in boxes for sale. Eighty-six thousand pencils per day are now passing through the works, made throughout by machinery, and claimed to be more perfect than is possible by hand labor.

The Dixon Company not only produced its own machinery for the manufacture of the pencils, but maintained the idea of originality by adopting a system of stamps for the different grades. The whole system of pencil manufacture is, in the Dixon Company's works, original and interesting. The machines are mainly automatic, but very simple. The finest grades of pencils for artists and draughtsmen are manufactured by this firm. The company are the only pencil manufacturers, we believe, that were awarded a gold medal at the Paris Exhibition.

A Canadian Gold Mine.

Dr. Laflamme, of the University of Laval, Quebec, favors us with a photograph, natural size, of a nugget of pure gold,

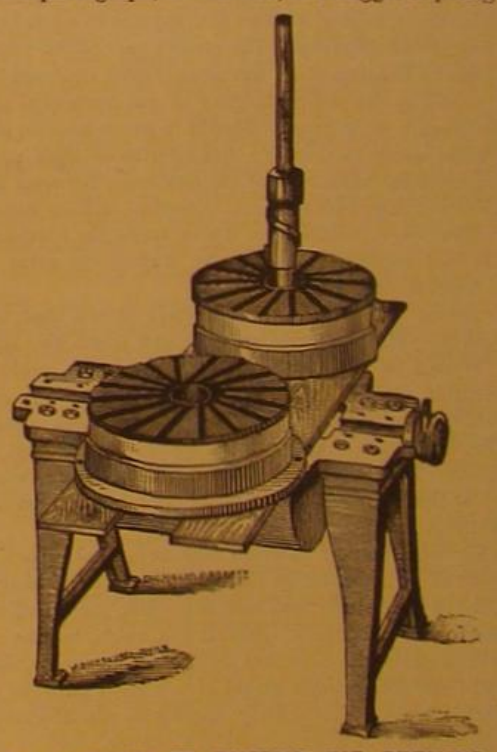


Fig. 3.—STONES IN POSITION FOR DRESSING.

weighing 38 ounces, lately found in the gold mine worked by Messrs. L. Saintrouge & Co., in Beauce County, near Quebec. The mines are said to be very rich, two weeks' work having furnished 150 ounces of gold; number of men employed not stated. The means employed, however, are described as of the most primitive character. The gold is found in bowlder clay underlying glacial drift, also in quartz accompanying the clay, but not in large quantities.

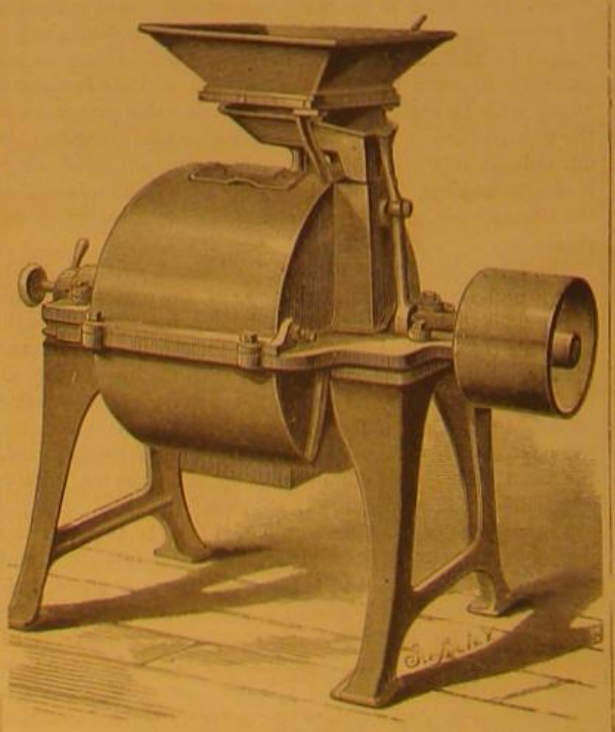


Fig. 1.—STRAUB'S SCIENTIFIC GRAIN MILL.

Recent Engineering Inventions.

An improvement in Methods of Connecting Sputs to Boilers has been patented by Mr. John Trageser, of New York city. This invention consists in a sput formed with an annular recess or cavity around its body, into which recess the edge of the opening in the boiler is calked and the joint afterward brazed

Mr. George Elliott, of New York city, (P. O. Box 2326), has patented an improved Paddle Wheel, the paddles of which are so constructed as to diminish the velocity of the middle portion of the current of water set in motion by the paddles, in order that the remaining portion of the said water may be made efficient, and the combined action of the different parts of the paddles upon the water may be more effective for the propulsion of the boat. The paddles are made in the form of rectangular parallelograms, and have elliptical apertures through the middle.

THE COLUMBIA BICYCLE.

The bicycle furor which pervaded this country and Europe a few years ago has subsided into a solid interest in this means of locomotion, which is much more noticeable in England than in this country, although the bicycle is now very popular here, and is daily becoming more so. It has arrived at great perfection, and is constructed more scientifically than formerly It is of great practical utility as well as a rational means of amusement. It is, in fact, an ever-saddled horse that eats nothing and requires no care.

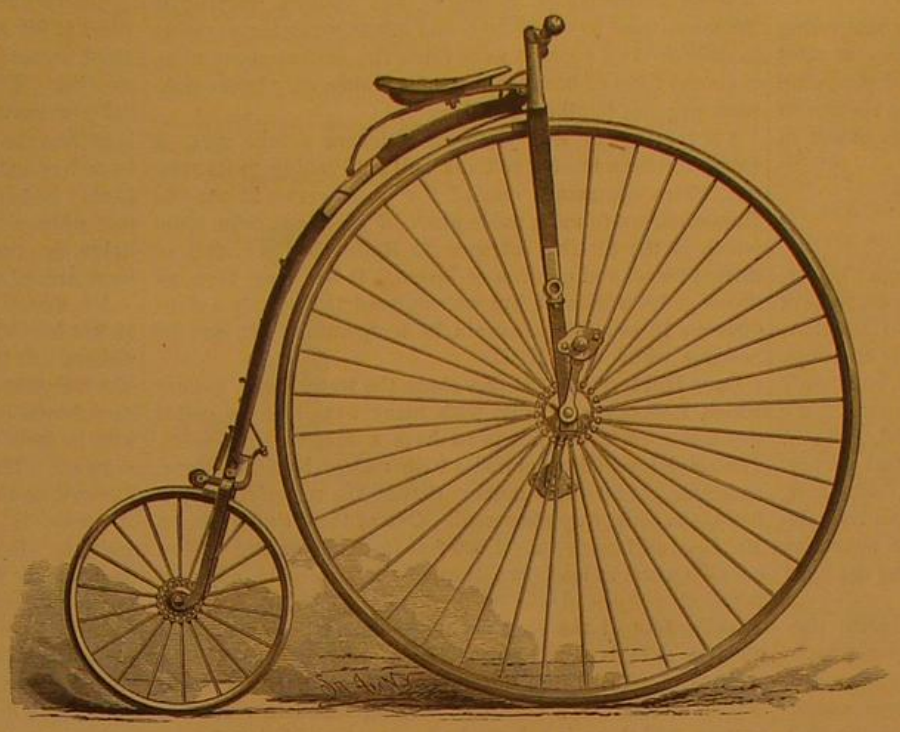
Undoubtedly the most perfect bicycle now made is the "Columbia," manufactured by the Pope Manufacturing Company, of 87 Summer street, Boston, Mass. This machine, which is shown in our engraving, has a steering head which is one solid forging. The backbones, which are made of steel, are large, light, strong, and rigid. The spring is attached by a joint to a small plate sliding on the backbone. The wheels are of the spider pattern, with steel V shaped fellies, with forged steel hubs, hardened in bearing parts. The back wheel and pedals run on coned bearings, one being adjustable, and are made so as to prevent the admission of dust and dirt. The front wheel bearings are conical and well hardened, and fitted with coned fastenings of India rubber, 1 inch on the front and ¾ inch diameter on the back wheel.

In the modern bicycle the seat is placed almost directly over the center of the front wheel, by which means a much larger wheel can be ridden, thus gaining in speed and making the act of propelling it more like walking, instead of pushing with the feet as in the velocipede, which is tiresome and injurious to the rider. Although our bicyclists have had very little experience compared with English riders, yet some long distances worth mentioning have been made. On November 27, 1877, Mr. A. D. Chandler rode from Leominster to Boston, a distance of 40 miles, in 4 hours. May, 1878, Russell Sharp and John Storer, from Boston to Newport, R. I., 72 miles, in 13 hours, including stoppages. Actual riding time, 10½ hours. August, 1878, H. E. Parkhurst rode from Clinton to Boston, 44 miles, in 5½ hours, without a stop, making the distance from South Framingham to Boston, 20½ miles, in 2 hours. Has also ridden from Boston to Natick and return, without a dismount, 36 miles in 3½ hours. October, 15, 1878, E. W. Pope and F. S. Jaquith rode in the suburbs of Boston, 77 miles in 11 hours, including stops. After having ridden 60 miles they made the distance from Wellesley to Newton, over 7 miles, in 38 minutes. October 19, 1878, G. R. Agassiz, on the Chestnut Hill road, traveled one mile in 3 minutes 21½ seconds, winning the Boston Bicycle Club Gold Medal. E. Costen and F. Smythe, September 2, 1876, on a turnpike road, made 205 miles in 22 hours.

We give a record of some professional and amateur bicycle runs made in England:

Quickest professional times—October 2, 1876, J. Keen, Molineaux Grounds, made 1 mile in 2 min. 56 1-5 secs. Same party, December 8, 1876, Lillie Bridge, made 10 miles in 33 minutes. Same rider, on same date and place, 20 miles in 1 hour 5 min. 34 sec. The same, October 9, 1876, Lillie Bridge, 50 miles in 3 hours 6 min. 45 sec. October 19, 1874, D. Stanton, Lillie Bridge, 106 miles in 7 hours 58 min. 54 sec. The same, March, 1878, Agricultural Hall, London, 1,000 miles in 6 days.

Quickest amateur times—T. T. East, Lillie Bridge, 1 mile in 2 min. 56 sec. September 11, 1875, W. Tylerson, Lillie Bridge, 10 miles in 34 min. 40¾ sec. May 15, 1876, Hon. I. K. Falconer, Cambridge University Grounds, 50 miles in 3 hours 20 min. 37 sec. June 10, 1878, F. E. Appleyard, turnpike road, Bath to London, 100 miles, in 7 hours 18 min. 55 sec. Stanley Thorpe, turnpike road from London to York, 105½ miles, in 23½ hours.



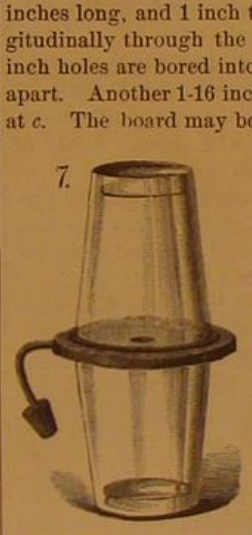
THE COLUMBIA BICYCLE.

EASILY MADE PHYSICAL APPARATUS.

BY GEO. M. HOPKINS.

But for the glass in the doors which imprison the physical apparatus in many of our institutions of learning, students would have little idea of the form or construction of the instruments, so many of which are now made for illustrating scientific principles, but which, alas! are doomed to eternal rest. Through fear of accident; through lack of confidence in their own ability to properly conduct experiments; or through indisposition to perform more than the absolutely necessary work, teachers too often ignore practical demonstration and permit students to rely on knowledge conveyed by text books, many of which are full of errors, while others lack that clearness, thoroughness, and conciseness which are necessary to a ready comprehension of the principles taught; in fact they are generally full of instruction on every point excepting the very one upon which instruction is most needed. There is scarcely a principle in physics that may not be easily demonstrated by experiment, and in the majority of cases the apparatus may be extemporized. To the young, one of the most interesting and instructive instruments is the air pump, as with it much that is daily seen and experienced may be explained.

The engraving shows in perspective in Fig. 1, and in section in Fig. 2, an air pump which may be readily made. The base, A, is a perfectly plain board, 8 inches wide, 15 inches long, and 1 inch thick. A 3-8 inch hole is bored longitudinally through the center, and near one end, two 1-16 inch holes are bored into the longitudinal hole at *a*, 3-4 inch apart. Another 1-16 inch hole is made at *b*, and another one at *c*. The board may be of any well seasoned wood that is not liable to warp. After boring it should receive several coats of good alcoholic shellac varnish on all sides and in the holes. When the last coat is applied a 6 inch disk, J, of elastic packing rubber, having a small central aperture, and which has previously received a coat of the same kind of varnish, is placed varnish side down upon the board with its central aperture coincident with the hole, *c*, in the board, and it is kept in position under slight pressure until the varnish dries, which will take a considerable time (a day or so), being confined between the two surfaces. To the base, A, two wooden standards, B, are secured, each 6 1-2 inches high and about 2 inches wide at the narrower end and 1-2 inch thick. They are two inches apart and are connected at the top by a cross piece, C. The base, A, standards, B, and cross piece, C, should be fastened together with long screws. The pump barrel, D, is a piece of glass tubing 1 1 2 inches internal diameter, and 6 inches long. A piece which is as nearly true and straight as possible should be selected. It may be cut from a long piece by turning it in a heated loop of heavy iron wire, which half encircles the tube. The tube should be turned back and forth at first until it begins to crack, when it should be turned slowly in one direction until it cracks entirely around. If the ends need to be squared up they may be readily ground upon an ordinary grindstone, or by moving it with a gyratory motion upon a slab of glass having on its surface some coarse emery and water. A piece of mandrel drawn brass tube will answer as a barrel equally as well as the glass tube.



7.

The lower end of the pump barrel rests upon a soft rubber disk, E, and a ring of the same material is placed between the cross piece, C, and the upper end of the barrel. The rubber disk, E, has an oblong aperture, also a small circular one, as seen in Fig. 5. The oblong aperture is placed over the right hand hole at *a;* the small aperture over the left hand hole.

A disk, F, Fig. 4, of hard rubber, brass, or other suitable material, having its edge grooved, and having two small apertures (1-16 inch) which coincide with the holes at *a*, is covered on its under side with oiled silk, which is drawn over its edges and fastened by a stout thread wound in the groove. Two slits are cut in the oiled silk, one upon each side of the right hand hole, making a valve which works in the little chamber formed by the oblong hole in the packing disk, E; the oiled silk is removed around the left hand hole. The upper valve, which is shown in Fig. 3, consists of a strip of oiled silk, which covers the left hand hole and is fastened by a thread around the edges of the disk, as in the other case.

The disk, F, is placed upon the packing disk, E, and secured by four small screws that pass through both into the base.

The piston, H, consists of two disks of wood, which have been soaked in melted paraffin to prevent them from absorbing moisture. The lower one nearly fills the barrel; the upper one is small enough to receive between it and the barrel a leather packing, which is turned upward in the same manner as the packing of an ordinary cistern pump. The piston is fastened to the end of the wooden piston rod, I, by means of a long wood screw. The piston rod passes upward through a hole in the cross piece, C, and is provided with a suitable handle.

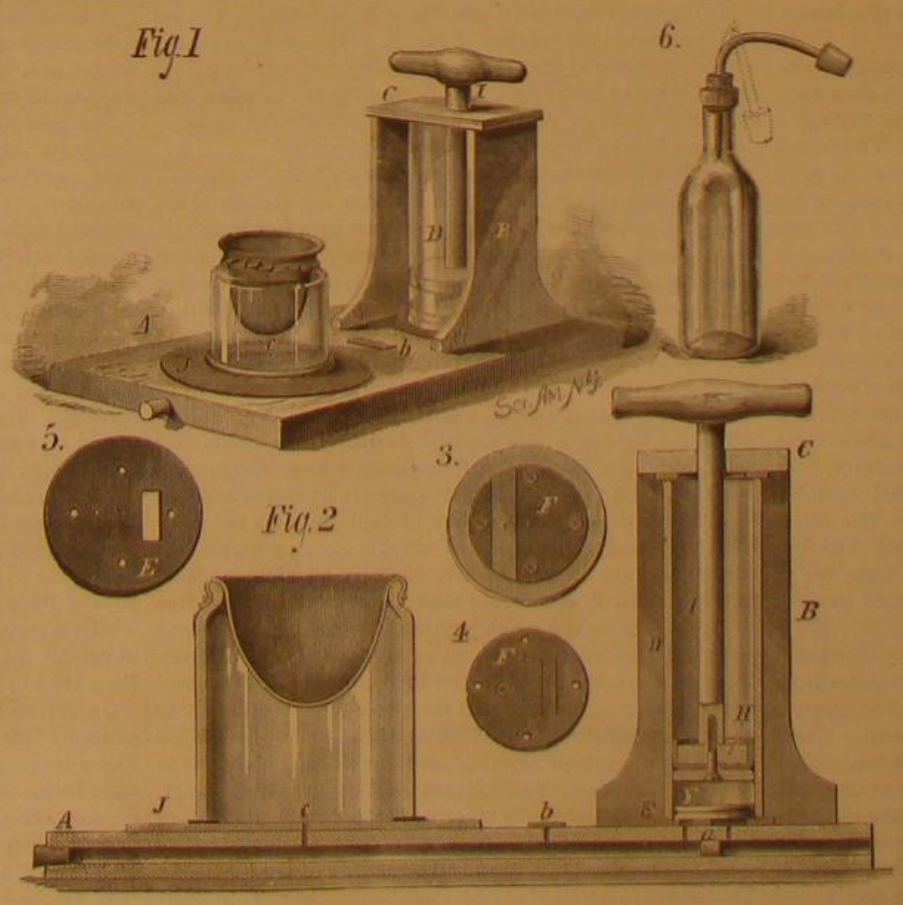
A rubber stopper is forced into the longitudinal hole in the bed to a point between the two holes at *a*, and another rubber stopper closes the opposite end of the hole. An oiled silk or flexible rubber flap or valve covers the hole, *b*. The piston should be greased with lard. By adding to the piston a second packing turned downward the pump may be used for the compression of air.

Any of the experiments performed with other air pumps may be repeated with this. A bottomless glass jar is shown in the present case upon the soft rubber disk, J. It has a thin piece of elastic rubber stretched over its mouth, and tied when the air is exhausted. External air pressure forces the elastic rubber downward. By substituting a piece of bladder for the rubber, it will burst with a loud report. By placing the hand over the mouth of the jar and exhausting the air, the fact that the air has weight will at once be realized.

A strong common fruit jar may be used as a receiver, and to insure a perfect joint with the rubber disk, a packing ring of very soft rubber may be interposed between the mouth of the jar and the rubber disk, J, and in any case the rubber disk and whatever is placed on it should be greased with lard to make a joint.

The fountain in vacuo requires no expensive apparatus. All that is needed is a small tube or jet, which may be either of metal or glass, a piece of stiff rubber tubing, and two good corks or rubber stoppers. One of the corks is inserted in the bottle and the jet is inserted in the cork, the rubber tube is slipped over the outer end of the jet tube and is fitted to a hole in the second cork, as seen in Fig. 6.

To exhaust the air from the bottle stop the hole, *c*, insert the cork that is on the end of the rubber tube in place of the stopper in the end of the bed. Work the pump, and when the air is exhausted bind the rubber tube, as indicated by the dotted lines, so as to close it; raise the valve from the hole, *b*, to admit air to the passage in the bed, and remove the cork on the rubber tube from the hole in the bed, and dip it in a vessel of water, at the same time allowing the rubber tube to straighten out.



A SIMPLE AIR PUMP.

To illustrate the principle of the Magdeburg hemispheres, make a ring of wood a little larger than a tumbler top, soak it in melted paraffin, attach to each side a packing ring of very soft rubber, fasten in one edge a piece of rubber tubing, which communicates with the interior of the ring; place on each side of the ring a tumbler with its mouth in contact with the packing ring; exhaust the air as in the case of the fountain bottle, and prevent its re-entrance by bending the tube short. The tumblers will press so firmly upon the ring that it will be difficult, if not impossible, to separate them from it.

It is not necessary to enumerate here the many interesting experiments that may be made with an air pump, as most of them are well known. If the construction of the pump has been made so simple as to enable the young readers of the SCIENTIFIC AMERICAN to construct one, the object of this article will have been attained.

THE LURAY CAVERN

BY H. C. HOVEY.

The marvels of this cave, lately opened in Page County, Va., have been made widely known through the columns of the New York *Herald*. Especial credit is due to Major A. J. Brand and J. J. Collins, C.E., for their graphic accounts, which have less of fancy and more of truth than commonly characterize the reports of enthusiastic explorers. We confess, however, that at first we were skeptical, and that our doubts have only been removed by an actual survey. And now, having gone through every avenue, hall, gulf, and gallery, and enjoying excellent opportunities for comparison with other caves elsewhere, we add our testimony that Luray Cavern may be safely counted among the chief wonders of the world.

The object now arrived at is to classify and explain phenomena, rather than to describe what is merely grotesque or beautiful, unless the ends of science may be thus promoted. Many of the things to be considered are so novel and ornate that any statements of their peculiarities, however coolly made, must seem florid and overdrawn to persons not familiar with cave scenery.

A cursory glance at the geology of the region will aid us in handling our subject. The official surveys are meager, and we had to rely chiefly upon such observations as could be made along the line of railroad from Harper's Ferry to New Market, where alternate beds of slate and limestone, displaced by volcanic upheavals, dip at an angle of 30° eastward into the Shenandoah valley. Crossing the lofty Massanutten range once by stage and the second time on foot, for the purpose of closer inspection, we saw impressive signs of the stupendous forces that have modified the original strata, lifting them vertically, and sometimes even inverting them. Amid all this rugged violence the general symmetry of periods is preserved; rising from Silurian limestones, through sub-carboniferous rocks, to thin deposits of coal said to lie on the highest peaks, and then descending through the same formations down the eastern slope.

This synclinal arrangement brings to view again in Page County the Lewisburg limestone (Formation II. of Rogers' Survey), which Fontaine locates between the Vespertine strata underneath and the Umbral series above. In this blue limestone, of the lower carboniferous period, many caves are found, the most noted of which, hitherto, has been the unique and attractive Weyer's Cave, about 1,600 yards long, and whose features were well described a few years ago, by Porte Crayon, in *Harper's Magazine*. It is in this same formation, indeed, as it appears with various modifications in different parts of the globe, that the most remarkable caverns in existence have been discovered; so that it is often spoken of by geological writers as the cavernous limestone. But in Virginia it has its peculiarities.

Volcanic action has been so powerful and recent, comparatively speaking, that masses of igneous rock are actually thrust through the sedimentary rocks, so that there is a dike of trap within a mile of Weyer's Cave. The veined condition of the limestone in Page County is due to such disturbances, by which it has been cleft into countless fissures, that were afterward filled by calc spar and silicates, with occasional streaks of the oxides of iron, manganese, and other metals and minerals, that play an important part in coloring the hard carbonates deposited on the walls of the underlying caverns. The loose rocks scattered on the surface are chiefly calcareous, often silicified, with occasional groups of quartz crystals and bowlders in the beds of streams.

The limestone in place is very compact and fine-grained, breaking with sharp edges. The color varies from light brown to deep blue, or even black, streaked, however, with fibers and veins of milk-white spar. Weathered surfaces are almost always stained with the oxide of iron. The analysis of five different specimens, from Luray and vicinity, showed an excess of carbonate of lime with from ten to forty per cent of the carbonate of magnesia, and even in one instance amounting to dolomite.

The valley of Luray is fertile, watered by the Hawksbill Creek, a tributary of the Shenandoah, and 150 miles from the sea coast. It is embosomed between the Massanutten range on the west and the Blue Ridge on the east. These ridges lie in vast folds and wrinkles, the fissures being often filled with metallic ores. Elevations found in the valley are, of course, such masses as had coherency enough to resist the wear of retreating waters by which gaps were opened in the mountain chains. Yet, as might be supposed, the lower hills are often pierced by the action of such mighty floods; and it is hardly necessary to refer any of the changes observed in these tunnels and hollows to the operation of volcanic forces. Water is as energetic as fire.

These geological conditions, thus hurriedly described, are favorable to rather deep and extensive excavations, marked by picturesque diversities and stalactitic ornamentation, but limited by the rapidly succeeding undulations of the surface and rifts dividing the strata.

There is no possibility of finding such immense domes, long avenues, and navigable rivers as characterize Mammoth Cave and others found in the vast, undisturbed, and homogeneous limestones of Kentucky and Indiana, varying in thickness from 50 to 500 feet, and oftentimes lying so nearly in their original position as to cause the surface above to assume the form of broad table lands, broken only by the sink-holes peculiar to all cave regions.

For more than fifty years an eminence a mile west of Luray has been known as Cave Hill. Climbing to its summit, which commands one of the finest views in the Old Dominion, we found a noble grove of pines and oaks, amid which is the pit-like entrance to Ruffner's Cave, full of drifted leaves and perilous of access. It has long been an object of local interest, but we explored it for only a short distance in order to ascertain its temperature, 60°, and its bearing, which is N. N. E.

Cave Hill is about 200 feet above the water level, toward which it slopes gradually, with many oval hollows called sink holes, each of which must have a subterranean outlet. Their axis invariably coincides with that of Ruffner's Cave, confirming the popular opinion that all the underlying cavities are in some way connected. One of these sink-holes on Mr. Brodus' land is fully 1,000 feet in diameter and 50 feet deep. Others at least two thirds as large are in adjacent fields.

At the foot of the long declivity, and at the distance of about a mile, is a pond near Blackford's furnace, fed by what is regarded as an unfathomable spring. A 50 pound weight attached to a cord 80 feet long failed to reach the bottom, and there is a legend of a wagon with four horses and the driver being swallowed down in this aqueous abyss without a vestige remaining. Doubtless it is really very deep, extending down to the level of Hawksbill Creek, and the volume of water it constantly pours forth is probably the drainage of all the cavities in the hill.

There is a small sink-hole about 70 feet lower than the summit and 320 paces N. E. from the mouth of the old cave. The crevice in the bottom of it was long since filled with stones and the space was overgrown with briers. Study of the topography led Messrs. Campbell and Stebbins to remove these obstructions, and dig through into what is now known to all the world as the Luray Cavern. That was done on the 13th of August, 1878. They only explored about 200 feet to a muddy pool, which they had there no means of crossing; and accordingly they returned to the surface, filled up the pit again, kept their secret, and bought 30 acres, including both the new orifice and Ruffner's Cave. Having thus gained possession by the double title of discovery and purchase, they proceeded with commendable enterprise to open their underground territory and make it accessible to the public.

Bridges have been thrown across pools and chasms that lie athwart the path; plank walks and tan bark have been laid down wherever needed on the main line; a large room at the further end has been floored; chandeliers are hung at several suitable points; railings guard the more dangerous places, and a building over the entrance is in process of erection for offices, dressingrooms, a cabinet, a dining hall, and other conveniences. Although but a portion of the cave is yet on exhibition, it has been visited by about 800 persons.

Mr. Stebbins was busied with these improvements, and we gladly accepted the services of Mr. A. J. Campbell as guide, whom we followed through every gallery and winding way, except three or four rooms now flooded by recent rains, and even into these we peered by the aid of fireworks, so as to get some idea of their dimensions and attractions.

Previous to our visit the cavern had never been illuminated by any better means than common lamps and candles in tin reflectors, or perhaps in a single instance by a few little tableaux-spirals. Anticipating this deficiency we had supplied ourselves beforehand with several pounds of the best quality of chemicals for making red and blue fires; and also with a large coil of magnesium ribbon, which we used very freely, as it burns with an intense white light, and emits no odor nor smoke, the sole product of combustion being wreaths of the pure oxide of the metal quickly falling to the ground.

The atmosphere within the cave is free from all hurtful gases, although Mr. Campbell has usually taken the precaution to lower a lighted candle into any pit he was to explore, in order to detect the presence of foul air. On the other hand we perceived no excess of oxygen, such as surcharges the atmosphere in caves where there is an abundance of saltpeter actively combining with lime and emitting free oxygen. The air is not exhilarating; it is merely wholesome and good to breathe everywhere, even in the deepest recesses. It sustains combustion well; but light seems to lack its usual power, owing to the fact that the atmosphere is optically as well as chemically pure. That is, there are no motes, or spores, or discernible atoms of any sort floating about, as in the sunbeams, each of which has its duty to perform in reflecting rays of light. In other words, cave chambers need a more powerful illumination to produce a given effect than would be required in a dark hall or church of the same size. This serves to explain the fact that the most honest observers nearly always have exaggerated estimates of cave distances. In one instance a room said to be 100 feet long, dwindled to 60 on measurement. Less extreme cases are common, and the cause of illusion having been pointed out, the necessity is evident of relying on the tape line rather than the eye; and where this is impracticable estimates should be cautiously made and from different positions.

The temperature observations made in all parts of the cave show an atmospheric range from 54° to 63°, averaging about 58°, which is 2° above that of Mammoth Cave, as fixed by repeated experiments made last summer. The temperature of the various bodies of water was about 54°. The mercury stood at 50° at the entrance. Hence there was a draught inward instead of outward, as would be the case in warm weather. The fact of fluctuations in the currents of air, in different parts of the cave, prove the existence of other openings than the one now known; and this ventilation aids us to understand the delightful purity of the cave atmosphere. It may be laid down as a rule in underground exploration, that wherever the draught changes, as indicated by wavering lights, an opening is near, either to the upper air or to some large arm of the cave.

A stairway of solid masonry leads down to the Vestibule, 30 feet below, where are stands and benches for the use of visitors. It is lighted by a chandelier hanging from the tip of a stalactite. It is a place of preparation. Putting on stout boots, overalls, and caps, and taking the tin reflector with its three candles provided for every visitor, we are ready to go on. The compass shows our path to lie due west. The eye, as soon as it has accommodated itself to the change of scene, is at once attracted by figures grotesque and majestic. Seldom does a cave have so fine an ante-chamber. On our right is the adit, now closed, through which the first explorers forced their passage. On the left is Specimen Avenue, from which the proprietors get most of the mementos tourists are allowed to take away. Next to it is Stebbins Avenue, which we leave, as we also do other side avenues, to be examined after we have followed out the main line.

Only ten paces in front of us is Washington's Pillar, broader at the base than at the top, a stalagmitic mass rising 25 feet from floor to roof, with a long diameter of 30 feet and a short one of 14. Its sides are fluted and jointed. The material is pure white carbonate of lime, fine grained, but not equal in quality to many to be found further within. A basin filled by trickling rills from the roof lies alongside the pillar. Against the opposite wall are rounded masses reminding one of the glyptodon and other monsters exhibited in museums.

Between a petrified cascade and a fossil garden we descend 18 steps to a lower floor, the roof retaining its altitude and supported by long slender shafts of alabaster. Brown buffaloes seem to hang from the roof, which on inspection were found to be spongoidal in appearance and blackened by the oxide of iron. They are really the network of silicious veins running through the limestone and remaining after the latter has been dissolved by acidulated water that would not affect silex. The floor was once lower than it now is, having been filled in by debris and washings from without. Fringed galleries mark the upper tier.

Next is the muddy lake already referred to as having put an end to the first exploring trip. On the second it was crossed in a small boat, and now it is bridged. It lies in a chasm from 12 to 30 feet wide and 75 in length. Midway there is a natural arch 4 feet wide and 8 high, through which the bridge is built.

The fish market is beyond this lake, getting its name from a row of folded stalactites, wet and shining, quite like a long string of black bass and catfish.

A hundred feet further on the way is obstructed, but with a small orifice through which a passage might be forced that would only lead to a point that is already accessible from another direction.

Our path now turns at right angles, up a flight of 25 steps, due north, to a floor on a level with the Vestibule. The roof is at this point nearly bare of ornaments. The floor is a bank of chalky substance, no doubt the product of disintegrated carbonates. The distance from floor to roof is only about 5 feet. But the width of these galleries is immense. We dispersed lights here and there in order to get some idea of their extent, and judged it to be 200 feet in one direction and 500 in another. The dimensions will more probably exceed than fall short of this estimate. Rambling to and fro we found many water-worn stalactites and columns half eaten through. This was plainly once a spacious hall, though now nearly obliterated by calcareous deposits and debris. It has been named the Elfin Ramble.

Trenches have been dug on the line of travel to enable persons to walk erect who prefer doing so to roving around as we delighted to do, spying out the secrets of the gnomes. Following one of these trenches we find ourselves on the edge of Pluto's Chasm, 500 feet long, 40 wide, and 70 deep, with a corresponding rift above, varying from 30 to 70 feet in height; making a total distance from top to bottom of from 100 to 140 feet.

Opposite where we stand is an alabaster formation surprisingly like a body of falling water suddenly congealed. There are many such objects in the cavern, and for want of some better term they are styled frozen or petrified cascades. On each side of this one are openings leading to a large room, to be reached perhaps at a future day by a bridge, but now by a circuitous route. The chasm is curved and its chord runs nearly S. W. to N. E. The compass was so affected by magnetic influences as not to be perfectly reliable; but

we are satisfied of the approximate accuracy of the bearings, and Mr. Campbell assures us of their general correctness.

Following the brink of Pluto's Chasm toward the northern end we find its character changed and its bare and gloomy walls hung by fine stalactitic drapery. By burning red fire and magnesium we gained some idea of its grandeur and beauty, both above and below.

Threading our way still further amid very old and decayed pillars, we climb to a balcony inclosed by clustering columns of more modern date, and overhanging a dark and forbidding pool far below. Within this lovely balcony, which, as a compliment to the SCIENTIFIC AMERICAN, the cave owners have named for your correspondent, there are rich marvels of nature's loom. Sixteen alabaster scarfs hang side by side, of exquisite color and texture. Three are snow white; thirteen are striated like rich bands of agate, showing every imaginable shade of brown, and all are translucent. The shape of each is that of one wing of a narrow lambrequin, one edge being straight and the other meeting it by an undulating curve. The stripes follow the curve in each detail. The scarf most admired resembles a white crêpe shawl, both in size and in its graceful, wavy folds, excelling the most artistic creation of the sculptor's chisel. Down the edge of each piece of drapery trickles a tiny rill, glistening like silver in the lamplight. This is the ever-plying shuttle that weaves the fairy fabric.

(To be Continued.)

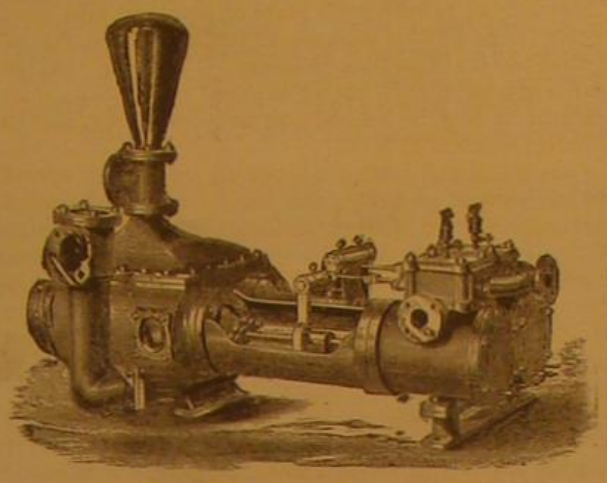
General Daniel Craig McCallum.

The necrology of 1878 contains few names of men who had served their day and country more worthily, in peace and in war, than Major-General D. C. McCallum, who died at his residence in Brooklyn, N. Y., December 27.

General McCallum was born in Scotland in January, 1815. Soon after his parents came to this country and settled in Rochester, N. Y., where young McCallum was bred to the trade of the carpenter. His attention was early directed to bridge building, at which he was notably successful. In 1851 he invented and patented the McCallum arch truss bridge, so widely introduced throughout the country. In 1855 he was appointed general superintendent of the New York and Erie Railway, but left the position two years later to superintend the construction of bridges of his design, chiefly on new roads in the West. At the same time he served as consulting engineer in the department of bridge construction for the Atlantic and Great Western Railway. When the war broke out he was called upon to serve his adopted country in connection with the transportation service, being assigned to the Department of the West, with the rank of colonel. In 1864 he was appointed general manager of all the military railroads of the United States, with the brevet rank of brigadier-general, in which capacity his splendid abilities in handling troops and supplies prepared the way for many important victories in the field. His final report on the military roads of the country, made in 1866, showed that he had had under his supervision 2,105 miles of railway, of which he had constructed 641 miles, with upward of 26 miles of bridges. On these roads there had been employed 419 locomotives and a large number of cars. The expenditure of the Government on this branch of the service exceeded $42,000,000. In June, 1865, General McCallum was mustered out of service with the brevet rank of major-general; and with the exception of a short service as inspector of the Union Pacific Railroad, has since lived for the most part in retirement. To the last General McCallum was proud of having carried the tin dinner pail of the mechanic, and of having made his way in life by hard and honest work.

DUPLEX STEAM PUMPING ENGINES.

The hydraulic works at South Brooklyn, N. Y., owned by Henry R. Worthington, the well known constructor of steam pumping machinery, are among the most extensive and complete of their class in this country. The buildings are nearly quadrangular in figure and cover an area of about 10,000 square feet, or about two city blocks. They consist, principally, of a large foundry, blacksmith, pattern, erecting and machine shops that are stocked with superior machine tools, many of which were designed and constructed for special purposes in the construction of steam pumps. At this establishment water works engines, condensing and non-condensing, of the largest size; air and circulating pumps for marine engines; stationary steam fire engines; boiler-feed pumps; pumps for hydraulic pressure, and others especially adapted for oil pipe lines; water and oil meters; hydraulic cranes and hoisting machinery, etc., are constructed. Some of the larger steam pumping engines made at these works have already been described in this journal. The engraving now given represents one of the smaller description of pumps known as a duplex steam pump adapted to boiler feeding and other purposes where the service is of ordinary character. Pumps of this type have two double-acting plungers. The water valves are made of either rubber or metal. The diameter of steam cylinders ranges from 4½ to 20 inches, and that of the water plungers from 2¾ to 15 inches. The stroke varies from 4 to 15 inches. One of the most important features of the Worthington duplex steam pumping engines is the peculiar arrangement of the valve motion, which prevents all noise or concussive action. For this reason the pumps are highly suitable for hospitals, hotels, and public buildings. By reference to the engraving it will be seen that two steam pumps are placed side by side, and so combined as to act reciprocally upon the steam valves of each other. The one piston acts to give steam to the other, after which it finishes its own stroke, and waits for its valve to be acted upon before it can renew its motion. This pause allows all the water valves to seat quietly, and removes everything like harshness of motion. As one or the other of the steam valves must be always open, there can be no center or dead point. The pump is, therefore, always ready to start when steam is admitted, and is managed by the simple opening and shutting of a valve. The manufacturers state that special care has been taken to have all the parts easily accessible for inspection or repairs. All the moving parts are made to gauge, and therefore can be readily renewed.



DUPLEX STEAM PUMPING ENGINES.

The makers of this pump have adopted an excellent system of manufacture, and employ a large number of special tools, which, together with the increasing demand for their pumps, enables them to make their prices in accordance with the times.

The offices of Henry R. Worthington's Hydraulic Works are at 239 Broadway, New York, and 83 Water street, Boston, Mass.

THE CLIPPER INJECTOR.

Manufacturers of the different forms of injectors have each endeavored to accomplish some particular result—one, to feed the largest amount of water; another, to secure in one instrument a large maximum and small minimum capacity; another gives prominence to lifting power; and still others to simplicity of construction and facility of adjustment.

FIG. 1.—THE CLIPPER INJECTOR.

The inventor of the injector shown in the accompanying engravings claims to have accomplished in one instrument all that is desirable in the perfect feeding of boilers, and states that it works at high or low pressure of steam; lifts the water, or receives it from tank or hydrant; can be regulated, without reference to steam or water valves, to feed from about one half to the full capacity; is not affected by jarring or jolting, as on a locomotive; cannot get clogged by anything entering with the water; cannot be sprung when the attachments are made; and it can be readily taken apart. The parts being made interchangeable are easily replaced, should it from any cause become necessary.

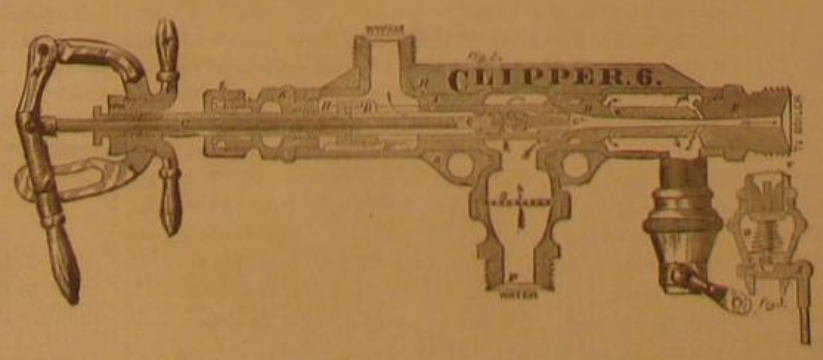


FIG. 2.—LONGITUDINAL SECTION OF INJECTOR.

The inventor says that every injector should be capable of drawing water whether it is overheated or not, without altering the adjustment. The Clipper being constructed in this way may be set so that it will feed either the maximum or minimum quantity. It is provided with a device which effectually prevents the entrance of foreign substances which might clog and impede the action of the instrument, and it is capable of working under either high or low pressure, is readily started and regulated, and is exceedingly simple and complete. The several parts are described as follows, reference being made to Fig. 2:

A is the shell, or body; B, the steam tube; C, jet, or lifting tube; D, main, or water tube; H, swivel, kept from turning by fin H'; K, bonnet, by unscrewing which, tubes, B and C, are removed; M and M', revolving lever and handle, to regulate water and steam; N', extra revolving handle, used to regulate water when room is insufficient to receive lever, M'; O, overflow holes; O', holes to assist in lifting and starting; Q, strainer, preventing anything from entering too large to go through injector; R, ribs to prevent springing or bending shell, A; W, overflow valve and spring. In Fig. 3 is shown a longitudinal section of overflow, turned one fourth round to show construction. X is the lever and revolving pin to set overflow valve when using injector to heat water in tank. A check valve is provided in connection with the swivel at the feeding end of the injector.

The injector is started by drawing the steam tube, B, back by revolving the lever and handle, M M', which turn the tube, B The steam is fully turned on, and when it blows out at the overflow, the lever, M', is pushed forward and the water valve is opened. When the water appears at the overflow the lever, M', is pulled back and the tube, B, is moved forward slowly until no water appears at the overflow. The injector will then feed the maximum amount. It may as easily be set to feed the minimum. After adjusting in this manner it can be started without moving the lever, M'.

For further information address J. D. Lynde, patentee and manufacturer, 405 North 8th St., Philadelphia, Pa.

New Inventions.

Mr. Samuel Whitnum, of Greenpoint, N. Y., has patented a Novel Fire Shovel, having its handle and blade made in two separate pieces and connected together by a simple and strong fastening.

Mr. William Smith, of Carmi, Ill., has patented an improved Fly Trap which has an alarm mechanism in connection with a bait holder and wire gauze cone or other form of prison receptacle for flies. The alarm mechanism is operated intermittently, but at regular intervals it frightens the flies that have collected around the bait, when they ascend and pass into the prison chamber, from which they cannot escape.

Mr. Elias G. Sternberg, of Depauville, N. Y., has patented an improved Ventilator consisting of one or more perforated pipes, extending along and secured to the ceiling of a room, and provided with an outlet pipe, extending into and up through the chimney.

An improved Connector for Battery Carbons has been patented by Mr. Adam C. Kreis, of New York city. The object of this invention is to provide a connector for the carbons of batteries with the copper disks or strips that will prevent the rapid destruction of the metal attachments, which are subject to corrosion by the exciting fluid in the batteries.

Mr. Joseph H. König, of Mason City, W. Va., has patented a Process of Recovering Chloride of Sodium from its admixture with impurities in crude brine, which consists in precipitating the chloride of barium by sulphuric acid, filtering out the precipitate, then precipitating the calcium and iron together as a subcarbonate by the addition of sal soda, and afterward separating the clear liquor and crystallizing the pure salt out of solution from the bromide of magnesium.

Mr. Napoleon B. Heafer, of Bloomington, Ill., has patented an improved Kiln for burning tile, brick, pottery, or any other clay wares. It is so constructed that the heat passes directly through the wares in its upward course, and thus produces better results than it would if separated from them by a fire wall or bag, as is usual in a down draught kiln.

An improved Gas Light Extinguisher has been patented by Messrs. Philipp Brand and Edward J. King, of Jacksonville, Ill. The object of this invention is to improve the construction of the gas light extinguisher for which Letters Patent No. 206,926 were granted to the same inventors August 13, 1878, to make it simpler in construction and less expensive in manufacture, while being equally sensitive to variations in the gas pressure.

Mr. Ebenezer Miller, of Fredericton, N. B., Canada, has devised an improved Shifting Rail for carriage tops, which can readily be attached to and detached from the body of the carriage when the top is not needed. It consists of a rail provided with lugs having upper and lower lips, between which the flange or rim of the seat is clamped by thumb screws.

Mr. Henry E. Griffin, of Olympia, Washington Ter., has devised an improved Door Hinge that may be put on at a saving of screws without difficulty even by inexperienced hands, forming a cheap, neat, and strong support for the door.

Messrs. Thomas W. Platt and Arthur M. Orwig, of Windfall, Ind., has devised an improved Lifting Jack or Press Power, which is capable of exerting an immense power. It is simple and compact, and it may be used in a vertical, inclined, or horizontal position, as may be desired.

RECENT INVENTIONS.

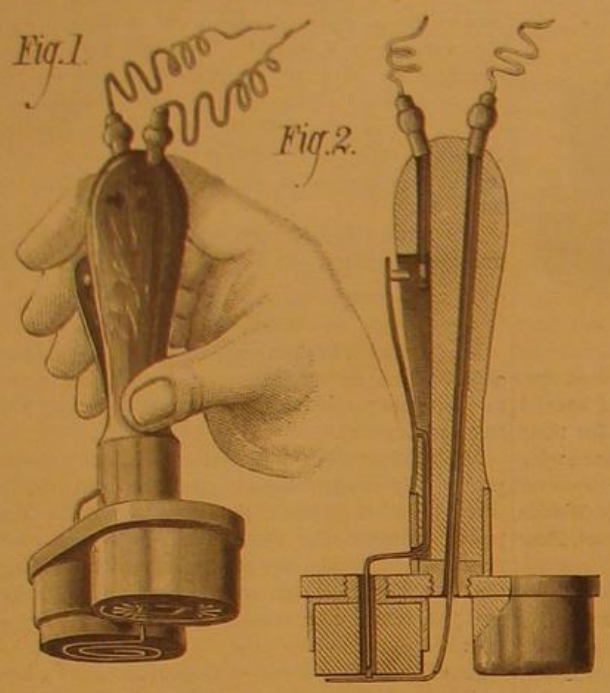
The several figures in the accompanying engraving scarcely need explanation, as the main features of the devices are shown. Figs. 1 and 2 represent a stamp canceler having on the face of one of the dies a coil of platinum wire that is heated by the passage of an electrical current. There is a key in the handle which completes the electric circuit when the instrument is grasped in the hand.

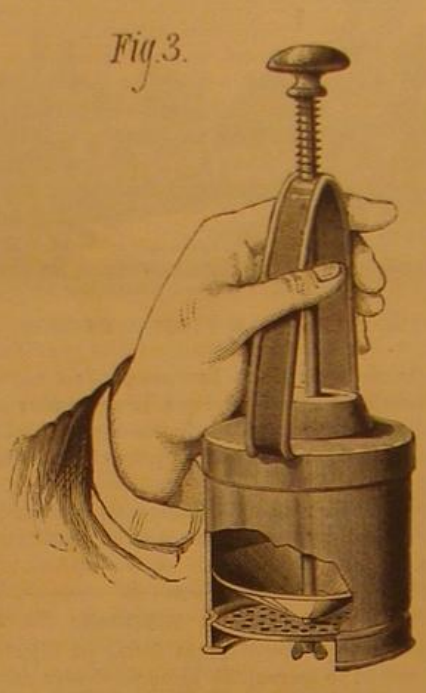
Fig. 3 represents a simple device for dusting ashes, plaster, guano, Paris green, or other pulverized substances upon plants. The substance is placed in the receptacle and passes through the aperture in the middle of the conical bottom. The sieve seen at the lower end of the receptacle is moved up and down by the handle attached to the vertical rod, when the material feeds slowly through the hole in the bottom, and is evenly distributed by the sieve.

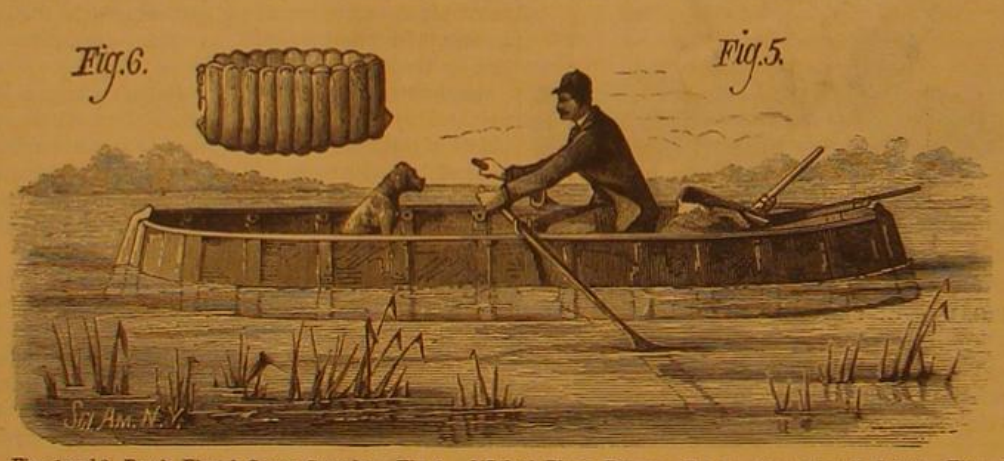
The shoemaker's lamp shown in Fig. 4 explains itself. It is designed for heating the implements used in smoothing and burnishing the edges of the soles of boots and shoes.

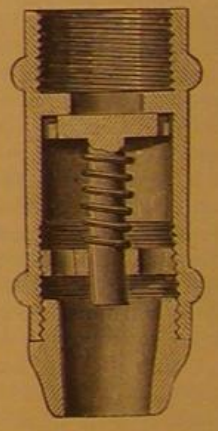
Fig. 5 represents a boat which is capable of being folded very compactly, as shown in Fig. 6. The body, or covering, consists of a skin of flexible waterproof material. The frame work is arranged so that it may be readily extended for use or folded for transportation.

Fig. 7 shows in perspective and Fig. 8 in section a water regulator, which is designed to control the flow of water from any particular outlet, so that water may be drawn simultaneously from several outlets in the same building. This is particularly useful where the pressure or supply of water is insufficient to carry it to a higher outlet when the lower one is open. The resistance offered by the spring-acted disk may be varied by screwing up the disk upon which the spring rests.









Figs. 1 and 2. Dow's Electric Stamp Canceler.—Fig. 3. O'Brien's Plant Duster.—Fig. 4. Rosentjerna's Lamp.—Figs. 5 and 6. Osgood's Folding Boat.—Figs. 7 and 8. Hutchinson's Water Regulator.

A FEW NOVELTIES.

The Telephone in Philadelphia.

The Philadelphia Local Telegraph Company has perfected an arrangement putting their clients in the various parts of the city into immediate telephonic connection. This is done by means of an ingenious telephonic switch board recently devised. As described by a local paper, the front of the apparatus consists of a walnut frame and bright strips of brass, punctured with holes, into which wires are fitted to make the necessary connections. Behind this all the wires converging in the office concentrate. The board just put in operation accommodates no less than 400 different lines, which have an aggregate length of 1,000 miles, thus placing each firm or individual having telephonic connection with the main office in direct communication with 399 other persons scattered over the city. Should an individual at the Baldwin works desire to converse with a person at Cramp's shipyard, he ascertains from a printed card the number or call of the Kensington ship-builders. As an instance, if the number of the Cramp telephone is 12, the speaker at Baldwin's touches a spring attached to his instrument to designate the number, and immediately a bell at the central office rings out the signal, and simultaneously a little tablet on the switch board drops and reveals the name of Baldwin & Co. An attendant sees at a glance that some one at Baldwin's desires to talk with No. 12, and, finding this to be the box at the Cramp yards, connects the wires of the two places, either by means of the pins referred to or by joining them to a rod fixed in the back of the switch board. Now, the man at Baldwin's practically has his mouth to the ear of the person at Cramp's, and can talk to him about the weather, or the price of steamships, or order some machinery, or invite him to dinner, as he chooses. If he wants some article which the shipbuilder cannot supply, they may recommend him to one of the other 398 establishments connected with the telephone exchange, and, by going through the same simple process, he can order coal at Port Richmond, call for cars at Washington Street wharf, send for a man at Manayunk, and, in fact, can talk with a dozen individuals in as many distant points in less than that number of minutes. The instrument is so arranged that any number of persons can talk on as many subjects at the same time, from different points, without experiencing the difficulty that occurred at the building of the Tower of Babel.

Telephone circuits, working substantially similar to the above, are now in operation in the principal cities of the United States.

Correspondence.

A Fast Little Steam Yacht.

To the Editor of the Scientific American:

I have noticed several articles in your valuable paper in relation to steam yachts, and send you the following, hoping that you will give it room:

Last winter two boys, William and John, sons of Daniel Kelly, aged 17 and 19 years, both of them readers of the SCIENTIFIC AMERICAN, commenced work on a steam yacht, and although then at work in the shops of the Chicago and Michigan Lake Shore Railroad, they worked nights, and toward spring the work was nearly completed. John, the younger of the boys, now gave his whole time to the boat, and in April she was ready for business. She is named the Susie Watson, and is 25 feet keel, 28 feet 6 inches over all, 6 feet beam, built of oak 1 inch thick, on oak frames 1¼ inch by 1½ inch. She has an upright boiler 24 inches in diameter, 52 inches high, with 90 one inch flues; her engine is 4½ by 6; her wheel is 28 inches, 40 to 42 pitch, and with 100 pounds steam makes 300 turns per minute; she is capable of running 11 miles an hour, and has room for about 20 passengers. She has been used as a ferry on Muskegon Lake during the season, and from April 1st to December 8th made an average of 80 miles per day. This entire boat, including boiler and engine, was constructed by these boys, who are now building a much larger one for next season.

W. C. WOLVERTON.

Muskegon, Mich., December 30, 1878.

Useful and Mischievous Birds.

The State Entomologist of Illinois gives the following classification of native American birds, with regard to their capacities for use or mischief:

To be Preserved and Fostered.—Blue birds, titmice (chickadees), warblers (small warbling birds found on trees and in gardens), kinglets (ruby-crowned and golden-crowned wrens), nuthatches and creepers (black, white, and brown), wrens, martins (swallows), vireos (greenlets), tanagers, finches, song sparrow, chipping sparrow, field sparrow, clay-colored sparrow, black throated bunting, indigo bird, cardinal grosbeak, ground robin (chewink), black birds (crow, bobolinks, meadow lark, and others), all the fly-catchers (including king birds and the peewee), cuckoos, nighthawks (goat suckers and whip-poor-wills), swifts (chimney swallows), all the wood-peckers except the yellow-billed—*Sphyropicus varius*—(known in Central and Northern Illinois as the sap-sucker), and, perhaps, also the large red-headed wood-pecker—*Melaurerpes erythrocephalus*, plovers, prairie snipe (prairie plover), quail.

To be Destroyed.—Cedar bird, Baltimore oriole (hanging bird), larger owls, hawks, and the yellow-billed wood-pecker (sap-sucker of Central and Northern Illinois). This species is distinguished from the other small wood-peckers by its pale yellowish breast, a large patch of black upon the upper part of the breast; the throat of the male is a bright red, and that of the female is white; the adults, both male and female, have the top of the head also red.

Doubtful.—The following are birds whose habits are not sufficiently known to justify full recommendation, and whose habits are sometimes beneficial and sometimes injurious:

Thrushes—including the common robin, cat bird, mocking bird, brown thrasher, wood thrush, tawny thrush, and hermit thrush. Shrikes—including the great northern shrike and white rumpled shrike (butcher bird), Savanna bunting, crow, blue-jay, red-headed wood-pecker, saw-whet owl, screech owl, horned lark, orchard oriole, and pigeons.

Sulphur for Diphtheria.

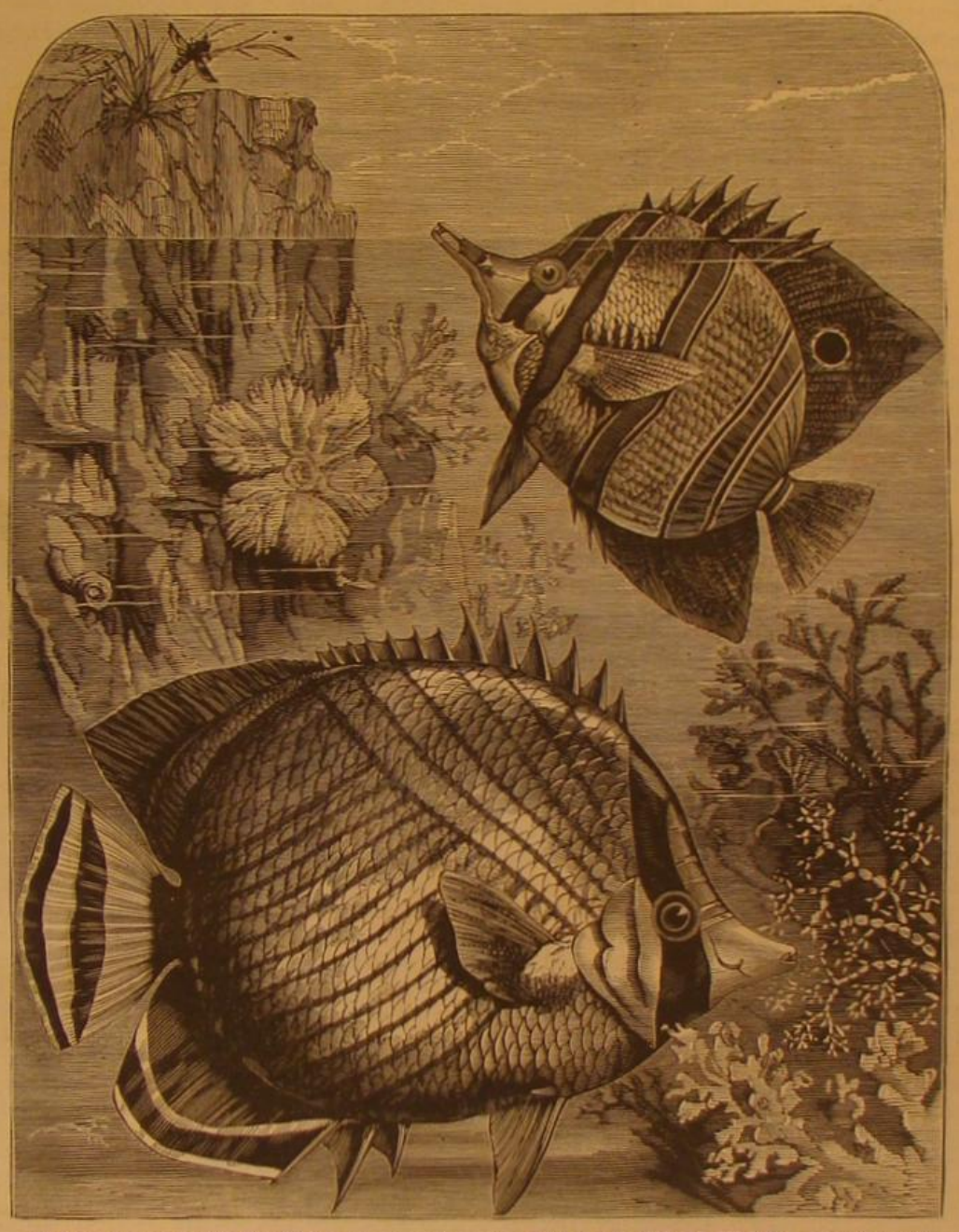
Mr. John S. Wiles, a surgeon of Thorncombe, Dorset, writes to the London *Times* that after two cases of malignant diphtheria out of some nine or ten he had been called to attend had proved fatal, the mother of a sick child showed him an extract from an American paper concerning a practitioner who used sulphur to cure the disease. Accordingly he used milk of sulphur for infants and flowers of sulphur for older children and adults, brought to a creamy consistence with glycerine; dose—a teaspoonful or more, according to age, three or four times a day, swallowed slowly, and application of the same to the nostrils with a sponge. Result: he did not lose a case there or elsewhere, and he succeeded in saving life when the affection had almost blocked the throat.

THE CHÆTODON.

The wandering chætodon is an example of a very large genus, comprising about seventy species, all of which are striking from their shape and color. Some of them are almost circular or disk like in the general contour of their figure, and the arrangement of their markings is very conspicuous. The muzzle is moderate in length, and the scales are rather large in proportion to the dimensions of the body. It is common on the southern coasts in summer and the beginning of autumn, but seems unable to endure the cold, and passes into deeper water at the first indications of winter.

The wandering chætodon is a native of the waters extending from the Red Sea to Polynesia, and is one of the common fishes of the Ceylonese coasts. The ground color of the body is golden yellow, on which a number of purplish brown lines are drawn, as shown in the engraving. This fish rarely exceeds one foot in length.

The curiously elongated muzzle of the beaked chætodon is used as a gun or bow, a drop of water taking the place of the arrow or bullet. This fish feeds largely on flies and other insects, but is not forced to depend on the accidental fall of its prey into the water. If it sees a fly or other insect resting on a twig or grass blade that overhangs the water, it approaches very gently the greater part of its body submerged, and its nose just showing itself above the surface, the point directed toward its victim; suddenly it shoots a drop of water at the fly with such accuracy of aim that the unsuspecting insect is knocked off its perch and is snapped up by the fish as soon as it touches the water.



WANDERING CHÆTODON (lower figure).—BEAKED CHÆTODON (upper figure).

A Disagreeable Discovery.

The *Commercial Bulletin*, referring to Professor Baird's astounding assertion as to the fecundity of the eel, thinks that, considering the reckless and indecent manner in which eels have lately been imposing upon manufacturing corporations—by getting into their water wheels, clogging up their machinery, and often enforcing a shut-down of the entire establishment for half a day or more at a time—manufacturers will not be pleased to hear that a well known fish culturist has discovered the number of eggs contained in a single female eel to be 9,000,000. When Professor Baird announced to the American Piscicultural Association in February last that he had, within the six weeks previous, received eels with ripe ovaries, it started a ripple of excitement in the room, which in a few days reached every naturalist in the land, and awakened new interest in the old question of the mode by which this mysterious fish perpetuated its race, one which had baffled all inquirers since man first sought to penetrate the secrets of creation, and which has almost by common consent been relegated to the category of "things which no fellow can find out." In commenting on this discovery, writers have ransacked history from Aristotle down, and have given all the theories which have been entertained by people who framed them in order to hide their ignorance, and who had not the moral courage to confess that they did not know how the fish did breed. But since the statement made by Prof. Baird, last season, many persons have been on the lookout for the ovaries of the eel, and a New York fish dealer having recently shown them to the fishermen, dealers, and others, they all say: "Oh, yes, that is what we call 'eel fat,' it is always plenty at this time of the year." And now the wonder is that no one has discovered this before, for during all these long centuries, in which the question of the generation of eels has been an open one, the eggs have been in plain sight; in fact, right under the noses of the investigators.

It may be a source of gratification to naturalists that they have solved the difficult problem, but mill owners would be glad to have them thoroughly well assured of their facts before they make the discomforting assertion that every one of the malacopterygious serpents that have this year been tampering so maliciously with the water wheels is capable of returning next season, accompanied by nine million offspring.

Natural History Notes.

Vitality of Wheat.—The seeds of the wheat possess a vitality which resists intense cold. A sample of the wheat left by the Polaris, in 1871, in 81° 16′ north latitude, and exposed to a temperature varying from that of summer to that of winter in that position for five years, was sown last year by Dr. Schanburgh, of the Botanic Gardens and Government plantations, South Australia, and out of three hundred grains, sixty germinated and produced plants, three or four feet high, with ears containing thirty grains each.

Locusts in Mid Ocean.—*Psyche* records the fact that a swarm of locusts boarded the ship Harrisburg, of Boston, on the passage from Bordeaux to New Orleans, on the 2d of November, 1865, in latitude 25° 28′ north, longitude 41° 33′ west, making the nearest point of land 1,200 miles away. They came on board in a heavy rain squall, the clouds and ship's sails being full of them for two days, as certified to by the master of the vessel, E. G. Wiswell. This species appeared in Corfu, in Spain, and even in England. The Corfu swarm was composed of the variety with yellow colored hind wings, and therefore came from Northern Africa, where that form is found, while the Spanish and English swarms were of the rose colored variety, and must have originated in Senegal. The most interesting point of all, however, is the fact first pointed out by Stol, that all the other species of that group of the genus to which this species belongs are American; whence it is highly probable that *Acridium peregrinum* also is indigenous to America, from whence it has been recorded. Its occurrence in mid-ocean in such numbers is a clear indication that it originally flew from one continent to the other in sufficient numbers to establish a new home.

A Hairy Water Tortoise.—Mr. Frank Buckland, in *Land and Water*, describes a curious water tortoise from China that had been presented to him. It is a terrapin which apparently has hairs growing out from its back. These apparent hairs consist simply of some water grass, something like the weedy material growing in decaying woodwork and lock gates of rivers. Whether the growth is produced artificially by the Chinese, or whether it is natural, is not known. In the "Travels of a Pioneer of Commerce, in Pigtail and Petticoats," by T. T. Cooper (London, 1871), there is a plate of one of these tortoises from the lakes of Ha-su, above Hankow. These curious little animals were about two inches long, and covered on the back with a long confervoid growth resembling hair. The tortoise being a sacred emblem in China, the Chinese make pets of the hairy tortoise, which they keep in basins during the summer months, and bury in sand during the 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. The figure in Mr. Cooper's book looks like an oval door mat with a tortoise head sticking out. It is a well known fact that the backs of certain species of spider crabs become adorned with a luxuriant growth of algæ, which serve to conceal the defenseless animal from its enemies: may not the presence of these marine plants on the carapax of the tortoise serve a like purpose?

The Mahwa Tree.

Mr. E. Lockwood, who was for several years a magistrate in Monghyr, India, has described in the *Journal of the Linnæan Society* the economic uses of the mahwa tree, which he speaks of as "a fountain yielding food, wine, and oil" to the inhabitants of the country where it grows. This tree (the *Bassia latifolia* of botanists) grows in the plains and forests of Bengal, and attains a height of 40 to 50 feet, with numerous spreading branches, forming a close, shady, rounded crown. Standing on the Kharakpoor hills, 250 miles northwest of Calcutta, a hundred thousand of the trees are visible in the plains below. They might be mistaken for the mango, but while the mango is uncertain in its yield, the crop of the mahwa never fails. The part eaten are the flowers, which are sweet tasting and succulent, and fall in great profusion during March and April. The natives collect these, dry them, and store them as staple articles of food. Each tree yields two or three hundred weight of the corollas; so that the total yield in the Monghyr district alone, it is estimated, cannot fall short of 100,000 tons. The nourishment is good, for the Santhals, who use it largely, are plump and happy. The mahwa had its share in alleviating the Indian famine, and during the scarcity which prevailed at Behar (1873–4) the crop, which was unusually abundant, kept thousands of poor people from starvation. The flowers are still more useful for feeding cattle; and again the same recommendation may be advanced, that while the potato, maize, and barley are uncertain in their crop, there has never been a season when these edible corollas have been known to fail. Their keeping powers are excellent; a ton, dried and put into sacks, was exported, and, examined after two years' time, was found to be undamaged. The tree furnishes a hard and strong timber used for carriage wheels, etc. The seeds yield a greenish-yellow oil, used for burning in lamps, making soap, and for culinary purposes. The flowers, in addition to their use as food, are now largely employed in the distillation of a strong-smelling spirit, resembling whisky, and which is consumed in great quantities by the natives. This liquor, when fresh, proves very deleterious to Europeans. The mahwa is considered by the Bheels as essential to their very existence, and this fact is taken advantage of by the government in dealing with refractory tribes; it is only necessary to threaten the destruction of their mahwa trees to bring them to submission.

Some of the English papers believe that there is a possible commercial future for the economic products of this tree, especially for its oil, which is said to be worth $175 per ton in India.

The Supply of Boxwood.

Sir Joseph Hooker, in his last annual report on Kew Gardens, makes the following remarks on the supply of boxwood:

"For some years past the supply of this important wood has diminished in quantity and risen in price. It is derived from the forests of the Caucasus, Armenia, and the Caspian shores. The wood of the best quality comes from the Black Sea forests, and is principally shipped from the port of Poti. The produce of the Caspian forests, known in the trade as 'Persian wood,' until last year, was also exported through the Black Sea from Taganrog. This found its way, after the commencement of the war, *via* the Volga canal, to St. Petersburg. The produce of the Caspian forests is softer and inferior in quality to that of the Black Sea. It is a matter of interest to see whether one result of the war will be to open these Black Sea forests which the Russian Government has hitherto kept rigorously closed. The falling off of the supply has led, meanwhile, to various attempts to find substitutes for boxwood for many purposes. Messrs. Joseph Gardner & Sons, of Liverpool, have introduced, with some success, the American dogwood (*Cornus florida*) and persimmon (*Diospyros Virginiana*) for shuttle making, for which purpose box has hitherto been in great demand. The diminished supply has also drawn attention to the Himalayas as a source."

It seems, however, that the difficulty of transit from the mountains to the seaboard is found to be the great obstacle; and, in addition thereto, the possible supply appears to be much smaller than is furnished from existing sources. Mr. R. J. Scott has presented to the Kew Museums blocks prepared for wood engraving of hawthorn, which, he states, "is by far the best wood after box that he has had the opportunity of testing."

Relative Earnings of Capital and Labor.

The *Tribune's* Washington correspondent gives the following report of a statement on the relations of labor and capital recently made by Mr. Edward Atkinson, of Boston, before the Committee on Labor, of which Mr. Abram S. Hewitt is chairman:

Mr. Atkinson presented interesting statistics obtained by the researches of Mr. Carroll D. Wright, chief of the Massachusetts Statistical Bureau, and from the returns of the assessors of State taxes, which, taken together, furnish as to Massachusetts (the richest State in the Union), the basis for a pretty close approximation to the truth in regard to the annual product of labor and the value of accumulated property. In 1875 the amount of property returned was as follows, values being expressed in currency, gold at the time being worth $1.10 to $1.12:

Real estate	$1,311,000,000
Personal property	530,000,000
Savings bank deposits	238,000,000
Property of corporations taxed directly by the State	84,000,000
Property returned under the bank tax,	31,000,000
Total	$2,194,000,000

On account of property subjected to double assessment, as in the case of mortgages, Mr. Atkinson deducted $650,000,000 from the returned value of real estate, and on account of mortgages, notes, and other paper merely representing titles to property, he deducted $544,000,000 from the aggregate amount of personal property assessed for taxes. This left $1,000,000,000 as the net accumulation of the actual product of labor during the two centuries which have elapsed since the Massachusetts colony was founded.

He next considered the product of industry in the State for 1875, which he set down as follows:

Manufactures	$592,000,000
Fisheries	7,500,000
Agriculture and mining	43,500,000
Total annual product	$643,000,000

In this amount, however, there were numerous duplications. Thus to some extent the same cloth is reported once as in possession of the manufacturers and again as clothing on the shelves of the dealer. After all deductions on account of duplications, Mr. Atkinson set down the net annual product of the industry of Massachusetts at a maximum of $500,000,000 or a minimum of $300,000,000, and pointed out that the aggregate accumulation out of the labor of two centuries is equal to the annual product of only two, or, at most, a little over three years.

As a partial explanation of the extreme slowness of the process of accretion, Mr. Atkinson pointed out the destructive character of invention in its effect upon existing capital. As an illustration of this he mentioned a cotton mill which in 1838 produced a given amount with the labor of 226 men working 13 hours a day, and in 1878 produces the same amount with the labor of 90 men working 10 hours a day. It belongs to the same corporation, is represented by the same shares of stock, and to all appearances is the same mill now as in 1838, but within the forty years from that date it has been twice rebuilt from the foundation, while its machinery has been again and again replaced by improved devices, devices which have increased the productiveness of labor in the degree indicated by the figures just given. This destruction of capital to make way for new inventions, said Mr. Atkinson, is the law of progress, and it is to the increase of production thus brought about that the working classes must look for the improvement of their condition.

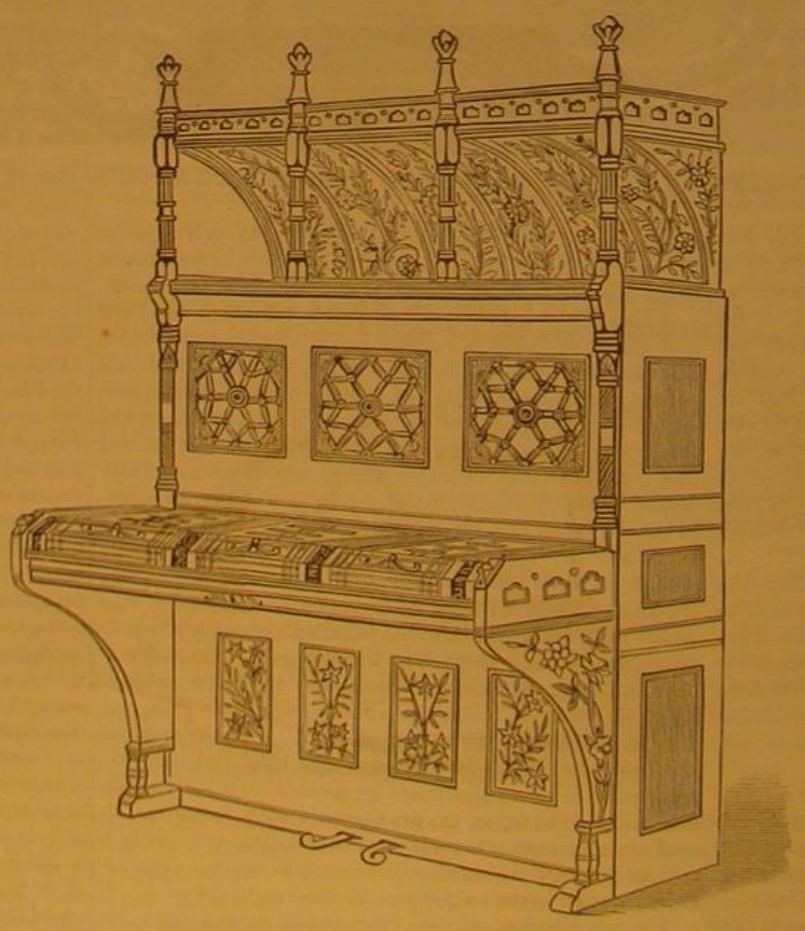
He next proceeded to show by statistics of distribution how small is the share of the annual product of industry that goes to capital, and how much smaller still is the percentage which capital can devote to luxurious uses. In a normal condition of trade, manufacturing capital may yield ten per cent. It cannot yield more, because any industry in which it yields that percentage draws so much capital into it that the profits are kept down by competition. For some years past it has yielded much less, and speaking for the cotton manufacture, it would not now be yielding anything at all except for the utilization of material formerly wasted and only saved now in consequence of services to which the wits of the manufacturers have been stimulated. Taking ten per cent as the yield of capital in ordinary times that amount has to be used to replace worn out machinery and machinery made useless by new inventions. It has also to repair building, pay insurance, and cover various other expenses, and in the aggregate the amount taken out for these several purposes reduces the ten per cent to six. Of this five per cent is used in the payment of domestic and other service employed by the capitalist and in the supply of the actual necessities of the capitalist and his family, leaving only one per cent that can possibly be devoted to the increase of capital or to luxurious indulgences.

To sum up, he declared as the result of his researches into the statistics of industry, that out of the entire annual product of industry in Massachusetts, from 95 to 98 per cent is distributed to labor, and all the remainder, except one per cent, goes to the maintenance and replacement of capital. It is out of this one per cent alone that capital can find anything to add to the percentage received by labor, and the only way in which the earnings of labor can be increased appreciably is through the increase in the efficiency of production which new mechanical inventions are continually producing.

Mr. Atkinson then went on to discuss the services which the capitalist renders to society in return for that one per cent which is the sole source of all the great fortunes made in manufactures or commerce. In reply to a question as to the present tendency of capitalists to invest in industrial enterprises, Mr. Atkinson said there is little inclination to do so, and that no improvement in this particular is to be anticipated as long as there remains any uncertainty in regard to the unit of value. He, however, anticipates a prosperous future for American industry. He disliked even to think of the difficulties in store for British industry and the distress likely to overtake the poorer classes of the British people, and he anticipated within the next five or ten years immigration from Great Britain to this country such as that which followed the Irish famine of 1846. In reply to a question from the chairman he expressed the opinion that English capital also would be transferred to this country in large amounts.

EARLY ENGLISH STYLE OF PIANO AT THE PARIS EXHIBITION.

The piano shown in the accompanying engraving is one of the exhibit of Messrs. Brinsmead, of London. It is a specimen of what this firm can do in the way of uniting beauty and novelty of exterior decoration with splendid musical effects. It is of the early English style, and is a full trichord upright iron grand, with a compass of seven octaves. It is fitted with the "perfect check repeater" action *sostenente* sounding board, and complete iron frame. The curved top part of the back is intended to act as a fenotone, collecting the sound and throwing it forward.



PIANO—EARLY ENGLISH STYLE.

Electricity in Silk Winding.

An inventor in this city claims to have perfected an electrical device which will materially reduce the cost of silk reeling, and so make the production of silk commercially profitable in this country. From their exceeding fineness the silk strands are liable to break while being unwound from the cocoons, necessitating close attention on the part of the person superintending the work. The strands of silk from four cocoons are usually run out on one reel to form a single thread, and one woman cannot do more than attend at most to two reels. It has been claimed by many interested in the silk trade that no machinery could be made delicate enough to watch this work automatically. The attention of the inventor was drawn to this subject two years ago, and he has lately perfected his application of the electric current to this work. By running the strands over carefully balanced wires, when one breaks the wire drops into mercury and closes a circuit which acts on an electric stop in the reel. The work is thus stayed until the strand is spliced and the circuit broken. In this way the electricity watches the strands, and the attendant has only to notice the reels and start them when they stop. In the old way not more than six pounds of silk could be wound in a week; by this invention it is claimed that forty pounds will be wound in the same time. The promoters of this invention hope by it to increase greatly the silk industry in this country. Owing to the cost of labor cocoons are not reeled in this country to any great extent. They are raised here—none better, it is claimed, can be found elsewhere—and exported for reeling, and then much of the raw silk is imported for manufacturing. A large amount will be saved if the cocoons can be cheaply wound off here. In the South, where the mulberry is common, it is believed that the culture of silk may rival that of cotton.

New Mechanical Inventions.

Mr. Richard H. Hill, of New Haven, Conn., has patented an improved Safety Attachment for Elevators, in which a governor is employed to throw out detents or pawls when the elevator attains an unusual speed in its descent.

An improved Railroad Track and Support has been patented by Mr. G. F. Folsom, of Boston Highlands, Mass. The object of this invention is to construct the road bed of railways so as to combine the elastic feature of wooden ties with the less perishable nature of iron. The wooden parts may be renewed without disturbing the solidity of the road bed.

Early History of the Electric Light.

A telegram from Washington, to the effect that Edison's application for a patent upon a divisible electric light had been rejected at the Patent Office, was published in the daily papers of November 21. The ground alleged for the refusal of the patent, says the *Operator*, was that Edison's invention was an infringement upon that of John W. Starr, of Cincinnati, who filed a caveat for a divisible light in 1845. [Edison's patent has since been allowed.]

Starr was a maker of philosophical instruments, and resided at Cincinnati. Had he lived he might have proved as much of a genius as Edison. He experimented on his invention, and went to England to complete it, Mr. King going as his agent, and two gentlemen, Judge J. W. McCorkle, late member of Congress from California, and Mr. P. P. Love, of Dayton, Ohio, furnished the money, about $3,000. Each was to have a fourth interest in the invention. Letters of introduction were given to King and Starr to the American banker in London, George Peabody, who, when the subject was fully explained to him, agreed to furnish all the capital that would be required to promote the project to a successful and practical use, provided that the same was approved and sanctioned by the best and most celebrated electricians in Europe. Professor Faraday was chosen.

In the meantime Starr and King returned to Manchester, where Starr built what he termed a tree, called "The United States." He had on it twenty-six branches or limbs, which he called by the names of the then twenty-six States of the Union. At the end of each limb he had an electric light, covered by a glass globe, on each of which was painted or inscribed the name of each State. Having thus completed his invention, he and King took it to London and exhibited it to the electricians at the Electrical Society, Professor Faraday being present. So perfect was his invention that the Professor pronounced it a perfect success.

After the exhibition was over King and Starr went home perfectly elated with the success, and after partaking of a very frugal meal they retired to bed. The next morning Starr, not making his appearance at the morning meal, was allowed to remain in bed, but as the day advanced and he did not make his appearance, King and the landlord went to his room, and not being able to awaken him, they burst open the door, and there found poor Starr dead in his bed. The excitement and overwork of the brain are supposed to have caused his death. From that day to this nothing further has been done with this Starr invention.

Starr filed a caveat in this country in 1845. His claim may be interesting enough to quote here:

"I claim the application of continuous metallic and carbon conductors intensely heated by the passage of a current of electricity to the purposes of illumination. I do not claim the method of lighting wires by electricity, which is well known, as I have already stated, but I claim the method of heating conductors so as to apply them to illumination, the current being regulated so as to obtain the highest degree of heat without fusing the conductor. I claim the method of obtaining an intermitting light for the use of lighthouses, in the manner set forth, and for signals. I claim the mode of submarine lighting by inclosing the apparatus in a suitable glass vessel, hermetically sealed, and also the mode of lighting places containing combustible or explosive compounds or materials, as set forth."

His application for a patent was rejected, however, in 1846, on the ground that the invention was not new, and that there was too much expense in producing the electric light. Mr. Edison says his invention is different from Starr's. He says he cannot patent the divisibility of the electric light, but he can patent the means that allows it. In other words, he can patent a lamp, or any device that will make this division. His application

for a patent for a lamp is already before the Commissioner, and is taking its regular course. According to the rules of the Patent Office nothing concerning it can be divulged. It is understood, however, that it is progressing favorably. Mr. Edison has already received seven patents bearing on the electric light, and has filed three caveats. Five more similar applications are now under way. He has had a man in the Astor Library searching the French and English patent records and scientific journals, from the earliest dates down to the past fortnight, and says nothing like his arrangements has been revealed.

Mr. Edison is making elaborate preparations to introduce and experiment with the electric light. He purposes to commence at Menlo Park with 2,000 lights, using telegraph poles with 15 lights on each arm. This experiment, including the cost of the buildings, engine, generating machines, and everything, is estimated at from $100,000 to $125,000.

SPREADING DIPHTHERIA BY KISSES.

From the report of the physicians in attendance upon the grand ducal family of Hesse-Darmstadt during the recent outbreak of diphtheria which resulted in the death of Princess Alice, the range of the disease appears to have been sharply limited. From November 6 to the 14th six of the family were attacked; on the 6th, Princess Victoria, aged 16; in the night from the 11th to the 12th Princess Alice, aged 6; on the 12th Princess Mary, aged 4; in the night from the 12th to the 13th, Princess Irene, aged 12; in the afternoon of the 13th, the Hereditary Grand Duke Ernst Ludwig, aged 10; and on the 14th, the Grand Duke himself. Of the entire family, the Grand Duchess (Princess Alice of Great Britain) and one daughter (Princess Elizabeth) only were spared at that outbreak of the disease. The Grand Duchess, however, was attacked afterward. Immediately after the first member of the family (Princess Victoria) had fallen ill she was seen by a physician and at once separated from all the others. The same caution was observed after the falling ill of the other princesses, but without preventing the outbreak of the disease in the rest of the family. In all cases there were large patches of false membrane on the tonsils, and in most of them swelling of the lymphatic glands in the angle of the jaw. All the patients recovered with the exception of Princess Mary, in whose case the disease from its very beginning had shown a very insidious character. No member of the household (in all 60 persons), no nurse, no physician was infected. It is, therefore, clear, the British *Medical Journal* asserts, that "all the cases were produced by direct infection, doubtless by kisses." The physicians ascribe the intensity and limited extension of the epidemic to three conditions: 1. To the intensity of the infection carried from outside, because the membrane in the case of the first patient (Princess Victoria) looked from their very appearance discolored and ecchymosed; 2, to the direct transference of the infectious matter by kisses; 3, to the condition of the mucous membrane of the tonsils and of the pharynx of the infected persons, all of them having suffered very frequently from acute and chronic affection of these parts.

The lesson to be derived from this not exceptional experience is very clear.

As every physician knows, it is no uncommon thing for adults to have diphtheria so mildly that it is mistaken for an ordinary sore throat resulting from cold; yet such a person can easily infect a child, and the child become a center of malignant infection. In view of the fatal prevalence of diphtheria, therefore, the kissing of a child upon the mouth by a person with a sore throat is hazardous, if not criminal; and scarcely less so is the practice of allowing children to kiss their ailing playmates. It would be wise to exercise great caution in this matter if not to discontinue the practice of kissing upon the mouth altogether.

New Agricultural Inventions.

An improved Load Binder has been patented by Mr. Henry A. Harris, of Katonah, N. Y. This is a simple and conveniently operated apparatus substituted for the pole and chains ordinarily employed for binding hay, straw, cut grain, or bales, bundles, etc., upon a rack or wagon body.

An improved Guano Distributer has been patented by Mr. James P. Lowell, of Purcellville, Va. The improvement relates particularly to the construction of the devices both for stirring the material in the hopper, and thus preventing its becoming aggregated in lumps, and also for causing its free and uniform discharge from the hopper.

Messrs. C. A. Sprague and John W. Clardy, of Weaver's Station, Ala., have patented a Cotton Chopper and Rake in which a vibrating hoe is employed to thin out the plants.

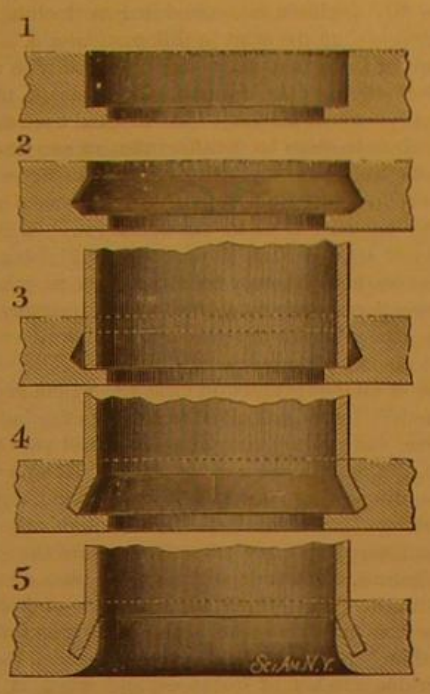
Mr. Aaron F. French, of Denison, Iowa, has patented an improved Harrow, the frame of which is fastened together by iron rods passed transversely into the ends and screwed into nuts or burrs let into the end beams. These rods serve also as draught bars, to which the whiffletrees are hooked.

An International Fish Show.

An international exhibition of the methods and products of sea and inland fisheries will be held at Berlin, Prussia, in April, 1880. Mr. R. B. Roosevelt urges the sending of exhibits from this country, confident that in several departments we could easily carry off the honors, though the Scandinavian states are far ahead of us in variety of methods of preserving fish.

A NEW METHOD OF SETTING BOILER TUBES.

We illustrate herewith a novel plan for setting tubes in steam boilers, which was recently patented by Mr. John E. Jerrold, of Meadville, Pa. The engraving exhibits the successive steps in the process of setting the tubes. Fig. 1 shows the tube sheet counterbored so as to leave an internal flange on the face side of the tube sheet. Fig. 2 shows the hole enlarged to receive the flared end of the tube. In Fig. 3 the end of the tube is in position to be flared, as shown in Fig. 4. In Fig. 5 the tube setting is shown complete, the internal flange of the tube sheet having been set down upon the flaring end of the tube.



JERROLD'S METHOD OF SETTING BOILER TUBES.

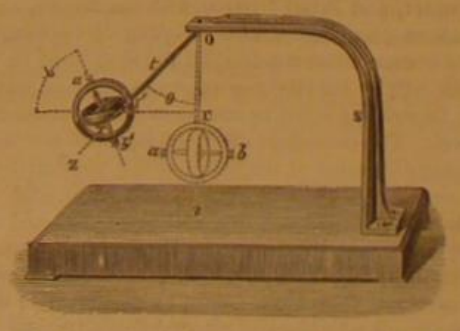
It is claimed by the inventor that a perfectly tight joint is secured without the use of an expanding tool. The surface of the tube sheet is perfectly plain and smooth, and the end of the tube is covered and protected from the fire. When this improvement is used copper thimbles will not be required.

We are informed that this method of tube setting has been thoroughly tested by some of the largest railroads in this country, and has proved very satisfactory.

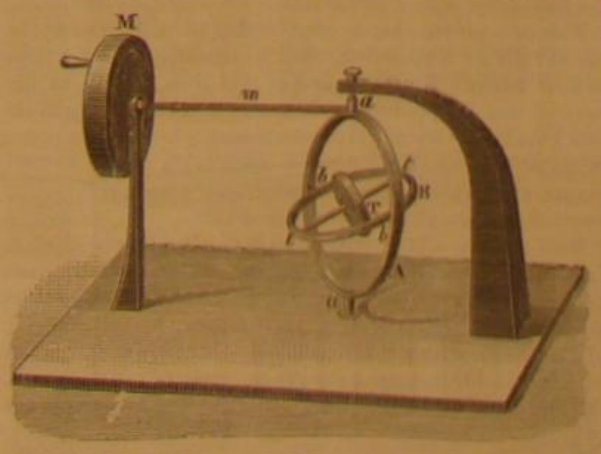
The patent is owned by the Patent Tube Setting Co., of Salamanca, N. Y. Further information may be obtained from J. F. Caldwell, secretary of the company, at Meadville, Pa.

THE GRUEY GYROSCOPE AND THE GYROSCOPIC PENDULUM.

The accompanying engravings represent two little instruments illustrating the principles involved in birotary or paradoxical motion. They were constructed by Mr. Gruey, a member of the French Academy of Sciences.



In Fig. 2, A is a brass ring suspended at *a*, so that it may swing freely around an axis, *a a*. Within this ring is suspended a second ring, B, revolving around the axis, *b b*. T is a circular disk turning with its axis, *t t*, within the second ring, B; a plane, laid through *t t*, traverses perpendicularly one laid through *b b*. At *a* the ring, A, is



connected with a rod, *m*, the other extremity of which runs smoothly in an undulating groove in the wheel, M. When the latter is turned by means of the crank an oscillating motion is imparted to the rod, *m*, and consequently to the ring, A. These oscillations are very short and unobserved by the eye; the ring, A, apparently remains at rest.

The circular disk, having received a certain initial rotary velocity, the ring, B, is struck with the finger so as to impart to it a speed of 50 revolutions per second. The speed of the ring, B, increases in the measure as the rotary motion of the disk, T, is accelerated by turning the wheel, M, more rapidly. When this operation is stopped, the apparatus gradually comes to a standstill. This simple experiment illustrates well the rotation of a body around two different axes perpendicular to each other.

Fig. 1 represents the gyroscopic pendulum. A ring similar to the ring, A, in the gyroscope, is suspended by a thread of India rubber. Within the same a circular disk revolves freely with its axis, *a' b'*. When at rest the apparatus is in the vertical position, as indicated by the engraving. If, while in this position, the thread be twisted up and again allowed to untwist, after a rotary motion has been imparted to the disk, T, by striking it with the hand, the equilibrium is at once disturbed. As the thread twists and untwists alternately the pendulum assumes an inclined position and oscillates around a conical space with wide base, till the energy of the rotary motion of the disk, T, is exhausted and the latter is at rest.—*Les Mondes.*

Petroleum Notes.

PIPE LINES.

The United Pipe Line Company was organized in 1877 by a consolidation between the following companies, viz.: The (old) United Pipe Lines, the Antwerp and Oil City Pipe Companies, the Atlantic Pipe Company, the American Transfer Company (in Clarion and Venango counties), and the Sandy Pipe Line.

At the present time (October, 1878) the company owns, and has in active operation, over 1,500 miles of 2 inch pipe, and 300 miles of 3 and 4 inch pipe. It has connected with these pipes more than 350 iron tanks, with a capacity of over 5,200,000 barrels of 42 gallons each, of which 1,800,000 barrels are owned by the company, and 3,400,000 barrels held by them under contract with the owners. It owns over 800 miles of telegraph wire connecting all its offices and stations with each other, and with the general office of the company at Oil City, Pa. It is fully equipped with boilers, pumps, and all necessary means for receiving and transporting to delivery points at least 75,000 barrels of oil per day. It has points of delivery upon all railroads in the oil regions, at which 2,500 cars, containing 225,000 barrels, can be loaded daily; and can deliver directly to refineries at Oil City, Pa.

OIL PRODUCTION.

The total production of crude petroleum, says *Stowell's Petroleum Reporter*, in Pennsylvania in November, 1878, was 1,348,952 barrels, against 1,173,420 barrels in November, 1877. Increase in 1878, 175,532 barrels.

The total amount of crude petroleum held in the producing regions of Pennsylvania December 1, 1878, was 4,289,309 barrels, against 2,471,798 barrels on the 1st day of December, 1877. Increase, 1,817,511 barrels.

The total exports of petroleum from the United States from January 1, 1878, to November 29, was 305,444,727 gallons, against 317,064,396 gallons for the same time in 1877. Decrease in 1878, 11,619,669 gallons. The Bradford district produced during the month of November, 746,279 barrels of petroleum, being about one half of the entire production in the United States.

The amount of crude petroleum represented by outstanding certificates on the last day of November was 1,784,443.35 barrels, against 1,517,484.27 barrels on the last day of October, a reduction during November of 269,959.88 barrels.

The oil produce of Pennsylvania has been to that State of more intrinsic value than all other industries combined. Its daily output of crude oil is about $500,000, varying somewhat, of course, with market values. But for all practical purposes this estimate may be taken as correct. Now, this exceeds the daily gold and silver product of the Pacific slope. We recently gave detailed statistics on this point which prove the accuracy of our present statement.—*San Francisco Post.*

KENTUCKY.—The Carter and Alexander well, which was drilled on Renox Creek, in 1865, and never tested, has recently commenced flowing oil at the rate of 100 barrels per day. The gravity of the oil is about 41° and dark brown in color.

ONTARIO.—Exports of petroleum from the United States to the Dominion of Canada during the fiscal year ending June 30, 1877:

Crude	270	bbls.,	valued at	$	2,158
Naphtha	83	"	"	"	795
Illuminating	13,224	"	"	"	187,451
Lubricating	1,728	"	"	"	21,959
Residuum	76	"	"	"	505
	15,381	"	"	"	$162,868

JAPAN.—Crude oil is obtained in ten different provinces in Japan, and its existence has been known, according to Japanese writers, since A.D. 615, but the art of purifying it was not known till some six years ago; since which time refining establishments have been erected in five different places, with a total capacity of turning out 4,000 gallons per day.

ASIA.—The valley of the Euphrates is destined to become one of the greatest commercial and important political centers of the world. I have myself seen whole caravans traveling through this region bearing nothing but American petroleum. American petroleum now lights up the dark places of Nineveh, of Jerusalem, and all the cities of the East.—*Lecture by Dr. Newman.*

Recent Facts about Poisons.

CARBOLIC ACID.

According to the *Pharmaceut. Zeitung für Russl.*, Dr. Sanftleben, on the recommendation of Professor Baumann, has used sulphuric acid with the best success as an antidote to carbolic acid, the phenol combining with the acid to form phenyl sulphuric acid, which is not poisonous. He administers it in a mixture composed of diluted sulphuric acid 10 grammes, mucilage of gum arabic 200 grammes, and simple sirup 30 grammes, in doses of a tablespoonful every hour.

POISONING BY MOULDY BREAD.

An inquest was held at Barnsley, England, October 10, in relation to the deaths of two of eight persons poisoned by partaking of bread pudding made at the Albert Dining Rooms, Barnsley. A. H. Allen, public analyst, testified that he had examined the liver and kidney of one of the victims, and the liver and lungs of the other, without finding any trace of poisonous metal. The materials used in making the pudding had been carefully examined with negative results. The glaze of the basin in which the pudding was cooked had been found to be free from lead or other poisonous metals. The pudding had been very carefully examined and no deadly poison had been detected. The negative results of the chemical examinations for various metallic poisons had been borne out by the failure of either pudding to produce purging or other poisonous effects on a puppy which was fed on the suspected pudding for two whole days. There were not a few cases on record of irritant poisoning and death being produced by mouldy bread. Thus, horses have been killed in a short space of time after eating such bread in their ordinary food. The symptoms were those of an irritant poison. In 1829 an investigation was made in France into the cause of illness due to eating bread, and it was found, by experiment, that bread in a particular state of mouldiness or decay may not only produce symptoms of poisoning, but actually cause death; and it was impossible to distinguish the harmless from the dangerous kinds of mould. As fungi grow very rapidly, it is quite possible for mouldy bread to be quite poisonous at one date, and to have lost its poisonous properties two days afterward. One of the most poisonous of these fungi is ergot, which produces symptoms very similar to those occasioned by the pudding, and the reports of the evidence in the present case have caused an eminent toxicologist to express a very strong opinion that the presence of this fungus was the cause of the poisoning. The witness stated further, that from experiments and observations he thought it clearly shown that the pudding contained a substance which resembled ergot in all its chemical reactions. The pudding was made of bread said to be mouldy, and which was several weeks old and had been in contact with ham, butter, and miscellaneous scraps. Mr. Allen then submitted extracts of letters from the leading toxicologists of the kingdom whom he had consulted on the subject, and all of whom agreed with him in his opinions as set forth above.

OPIUM POISONING.

Dr. Sewall, in the *Medical Press and Circular*, relates the case of a woman, aged 35 years, who, suffering from angina pectoris, took 2 drachms of Battley's sedative at intervals of half an hour until she became insensible; taking in all, according to estimate, 3½ fluid ounces. A convulsion and marked symptoms of opium poisoning supervened. An enema of ½ pint of strong green tea was given, and in twenty-five minutes her lips became more florid, and respirations from thrice in two minutes to six times a minute. Fifteen minutes later ½ pint more of tea was given in the same way. In 4½ hours patient recovered consciousness.

PHOSPHORUS.

Two girls, aged 14 and 16, according to Dr. Wilmore, in the *British Medical Journal*, took ½ ounce of phosphorus paste. The subacute symptoms lasted for five days before the relatives became alarmed. Neither pain nor vomiting was severe. One patient died; the other (who took the least) recovered. Turpentine was administered through the latter case.

SALICYLIC ACID.

A case is reported from Wreschen, in Prussia, where a patient suffering from acute rheumatism was poisoned by impure and partially decomposed salicylic acid. After the dose of about 12 grains he began to perspire very freely; the perspiration increased with two more succeeding doses, and after the fourth dose violent headache supervened, followed by coma and death.

THE POISON OF MILK SICKNESS.

This is one of the most remarkable and subtle poisons known. All attempts to fix it on certain plants or elements of soil or water have failed. Yet it is of the most permanent and virulent character. The following illustration of this is given by a writer in the North Carolina *Medical Journal:*

"Captain Thompson lost thirteen of his cattle from milk sickness as he was driving them from the Milestone Knob (a noted place for the disease). He had them skinned, and the hides were hung on poles between his cribs; the rats being numerous, they gnawed the cellular substance from the hides, which was so poisonous as to kill every rat about the cribs." He adds: "This poison differs from all known poisons in the world, in the following particulars: (1) It lies *quietly* in the system for a long time, without exhibiting any of its toxical power, until the person or beast is forced to take exercise; (2) it is more ethereal and diffusive than any poison known to me. Most of the poisons with which I am acquainted affect the stomach and bowels, the brain and nervous system; this pays no court to either, but extends through every muscle, bone, and tendon, affecting the whole system, even the skin and cellular substance under the skin."

The Treatment of Baldness.

In the Atlanta *Medical and Surgical Journal*, Dr. George H. Rohe writes on this widely interesting subject:

Having been himself a sufferer from seborrhea and consequent alopecia for six or seven years, the writer has, as may be supposed, tried a great many remedies with a view to its alleviation and cure. Arsenic, internally, stimulating washes or oily applications, containing in the one case corrosive sublimate, in the other quinine or tannin, in still another some of the stimulating oils, were used with no appreciable effect either on the formation of scales or the depilation. Finally, about two years ago, an item went the rounds of the medical journals to the effect that a French physician, whose name has escaped me, had found that the local use of a five per cent solution of chloral hydrate was a sovereign remedy for the trouble under consideration. Rejoiced that at last I could appropriately shout "Eureka!" I began to use the chloral wash assiduously for about three months, following the directions given as accurately as possible. At the end of the three months the production of scales was more rapid and the fall of hair greater than ever. Disgusted with the failure of all the therapeutic measures which had been so highly lauded, I almost decided to let the affection take its own course, and run the risk of a shiny bald pate at thirty. About that time the second volume of Hebra's classical treatise on diseases of the skin came to hand, and one of the first things I read was Kaposi's thorough article on alopecia. Impressed with the reasonableness of the views put forth by Kaposi, I determined to give his plan of treatment a trial, with the result of checking the fall of hair and diminishing the production of scales in a reasonably short space of time. I have since then recommended the plan in a considerable number of instances, and when it has been faithfully carried out, with uniform success.

The success of the method depends upon the use of an agent which, while mildly stimulant, removes the scales and thoroughly cleanses the scalp. This agent is the German or French soft soap (green soap, schmierseife, savon vert) in alcoholic solution. This soap is now imported in large quantities and prescribed daily by the dermatologists of Boston, New York, Baltimore, Philadelphia, and other cities. The soap, containing an excess of alkali, saponifies the fatty matter of the sebaceous secretion, and it is thus easily removed. The alcohol greatly assists this action, and seems also to have an alterative action—if such an indefinite term is excusable—on the glands. The two may be combined as follows.

R. Saponis viridis (Germ.); alcoholis, āā, ℥ ij.; solve, filtra, et adde ol. lavandulæ gtt. xx.–xxx.

The oil of lavender is added to cover the disagreeable fishy odor of the soap. The above makes a very handsome orange or wine colored preparation, with a pleasant odor, to which the most fastidious will hardly object.

This is used as a shampoo every morning or evening, pouring one or two tablespoonfuls on the head. Upon the addition of water, and smart friction with the fingers, a copious lather is soon produced. After keeping up the shampooing process for four or five minutes, all the soap must be washed out of the hair by the free use of warm or cold water, and the hair thoroughly dried by means of gentle friction with a soft towel. The immediate effect experienced is a disagreeable feeling of tension of the scalp, as if it were stretched too tightly over the skull. To obviate this effect, and to keep the scalp from getting too dry, and thus, perhaps, set up a true pityriasis, it is necessary to follow up the shampooing with some fatty application, which may contain some mild stimulant, thus: Castor oil, 1 part, to alcohol 3 or 4 parts, with a little oil of rosemary or cinnamon, or the elegant pomades and oils of Bazin and other manufacturers may be used. But the best as well as the neatest preparation that I have employed for this purpose is the hydrocarbon known in commerce as cosmoline. This is a product obtained from petroleum. It is entirely bland and unirritating; never turns rancid, and is comparatively cheap. It may be obtained in the fluid form or as a soft solid.

This procedure, shampooing, drying the hair, and applying the greasy preparation, must be repeated daily for three or four weeks. In the course of that time it will be discovered that the production of scales and the falling of the hair have been very markedly decreased. It will then suffice to repeat it two or three times a week for a month or two longer, after which a good shampoo once a week will usually succeed in maintaining a permanent cure.

Most patients will be alarmed after using this method at first, because the hair comes out in greater quantity than before. This is due to the fact that a large number of hairs are dead and only retained in their follicles by the plugging of the sheath with the accumulated sebaceous matter. The patient should, therefore, always be prepared for this result, and the cause of the increased falling of the hair explained to him.

It is not necessary, though more convenient, to cut the hair short during the treatment.

When the alopecia has lasted so long that the hair bulbs have become atrophied, nothing will restore the hair on those spots. Our endeavors must be directed to saving what remains. A prognosis favorable to the restoration of the hair must, therefore, be given with caution.

Microscopic Examination of Meat.

The microscope is, in many places, relied upon to decide upon the presence or absence of trichinæ in pork, but unfortunately, it often happens that a poor microscope or an inexperienced or careless manipulator fails to detect what is actually present, and by giving a feeling of false security does positive injury. This, too, has caused many to reject the microscopic test as useless.

The failure to detect trichinæ may, and often does, occur as the result of using too small pieces of meat for examination, rather than from inexperience, so that it is mere chance that this little scrap contains the object looked for. This is partially the fault of the books published for instruction in this subject, such as Wolf's and Lang's. Sometimes very few trichinæ are present, "few and far between." Recently an apothecary, Schaltz in Primkenau, examined twelve plates, each holding 6 pieces of meat, or 72 preparations, but found only 2 trichinæ. Tiemann demands the examination of at least 22 square inches of the substance, and introduces large glasses for this purpose, but it is very hazardous to bring very large surfaces under the microscope, and it is easy to overlook small objects, if few.

Kunstmann says that he has experimented with glasses 2 to 3 millimeters thick, of various sizes and shapes, in which the meat is held by screw clamps. At last he chose plate glass 6 or 8 millimeters thick. The power used for the examination of meat is so low and permits of so great a distance from the objective that both object glass and cover may be of the same thickness. For two years he has employed strips of plate glass 5 cm. (2 inches) wide and 40 cm. (16 inches) long, which fit accurately on each other. On one of these he puts the piece of flesh, cut with a curved scissors, spreads it out uniformly with a needle, and squeezes it between the two glasses, so that he has an unbroken preparation 2 cm. wide and 36 cm. long. Between these glasses the preparation lies fast without the use of any further pressure. This glass is passed lengthwise through under the objective, one edge being examined first and then the other, then the middle, no portion escaping. Glasses of this size can be employed with an objective that magnifies 60 diameters.

The same man, also, sometimes employs plates of glass 70 cm. (28 inches) long, but they require a special table, and can only be used in the laboratory or at home. It may seem a paradox to use such large glasses for microscopy, yet no other method offers such security. The meat examiner is compelled to examine the whole preparation, and only by the greatest carelessness can any trichinæ be overlooked. These long strips of glass can be obtained from the waste box at mirror manufacturers.

Another important point overlooked in most treatises on the subject is that the microscope must be placed high enough to look into it *without* bending the neck, which also leaves the hands in a more natural position to regulate the glass plate. A convenient cover for one eye is also desirable to avoid being obliged to hold it shut.

Two Varieties of Sciatica.

There are two varieties of sciatica, one in which the nutrition of the limb is unchanged, the other accompanied by atrophy of the limb. In the first class the neurilemma alone is affected; in the second, the nerve fibers are attacked by the inflammation and cause atrophy of the limb. There are two kinds of pain, one only present on motion of the limb, the other when the limb is at rest. In all cases the first element of cure is rest. To this in cases of the first class must be added blisters and hypodermic injections. The pain being allayed, dry fumigations should be used. Dry heat is better than douches of sulphurous or terebinthinate vapors. In default of the former, vapor douches give the best results.—*L'Union Médicale du Canada.*

Oatmeal Diet.

Undoubtedly one of the most healthful and nourishing articles of diet is oatmeal. When properly cooked and eaten with sugar and cream it forms a dish which most people relish better than meat for breakfast, and is very much cheaper. Liebig has chemically demonstrated that oatmeal is almost as nutritious as the very best English beef, and that it is richer than wheaten bread in the elements that go to form bone and muscle. Professor Forbes, of Edinburgh, during some twenty years, measured the breadth and height, and also tested the strength of both arms and loins, of the students of the University—a very numerous class and of various nationalities, drawn to Edinburgh by the fame of his teaching. He found that in height, breadth of chest and shoulders, and strength of arms and loins, the Belgians were at the bottom of the list; a little above them the English; and highest of all the Scotch, and Scotch-Irish from Ulster, who, like the natives of Scotland, are fed in their early years at least one meal a day of good oatmeal porridge.

Moral Influences of the Study of Natural Science.

If great care is taken to bring out the evidence in every case, and no statements are permitted to pass unquestioned which have not been tested by observation or experiment, a great respect will gradually arise for the truth. I believe that a conscientious regard for the truth may be established in this way without that word itself ever having been mentioned. Accuracy in observation and moderation of statement, are certainly the surest guardians, if not the keepers of truth, and these two qualities are more easily obtained by the study of objects than by any other means.—*Alpheus Hyatt.*

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.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Valves and Hydrants, warranted to give perfect satisfaction. Chapman Valve Manuf. Co., Boston, Mass.

Assays of Ores, Analyses of Minerals, Waters, Commercial Articles, etc. Technical formulæ and processes. Fuller & Stillman, 40 & 42 Broadway, N. Y.

Save your Fuel.—From one fifth to one-third of the usual amount of coal bills can be saved by the use of fireproof non-conducting Asbestos Coverings on hot air and steam pipes, boilers, heater pipes in dwellings, etc. The genuine can be procured only of The H. W. Johns Manufacturing Company, 87 Maiden Lane, New York, patentees and manufacturers of Asbestos Paints, Roofing, etc.

2d hand 2 H. P. Engine and Boiler, $140. Geo. F. Shedd, Waltham, Mass.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Moore's Regulating Valve, working between high and low pressure. L. Moore, No. 17 11th St., Louisville, Ky.

Dead Pulleys that stop the running of loose pulleys and their belts, controlled from any point. Send for catalogue. Taper Sleeve Pulley Works, Erie, Pa.

Sci. Am.; a full set for sale. A. F. Park, Troy, N. Y.

Steel Stamping Figures, 1-16 to ½ in., $1; Alphabets, $3; Dies to order. S. M. York, Cleveland, O.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Partner Wanted.—See advertisement on inside page.

The only Engine in the market attached to boiler having cold bearings. F. F. & A. B. Landis, Lancaster, Pa.

Johnson's Universal Lathe Chucks; the best are the cheapest. Lambertville Iron Works, Lambertville, N. J.

No more danger from kerosene. Sample of patent Safety Valve that fits any lamp, and effectually prevents an explosion, sent by mail for 25 cents. Agents wanted. W. B. Post, 15 Dey St., New York.

Best results obtained from Success Turbine Water Wheel. References given. S. M. Smith, York, Pa.

Right to manufacture a salable Patented Article desired. W. F. Adams, 602 North 4th St., Camden, N. J.

For Sale.—Brown & Sharp Universal Milling Machine; Bement Profiling Machine; first-class 2d hand Machine Tools. E. P. Bullard, 14 Dey St., N. Y.

Texas Machinery Depot for any kind of machinery or special hardware. P. H. Gerhard, Austin, Texas.

Send for circulars of Indestructible Boot and Shoe Soles to H. C. Goodrich, 40 Hoyne Ave., Chicago, Ill.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

1,000 2d hand machines for sale. Send stamp for descriptive price list. Forsaith & Co., Manchester, N. H.

Galland & Co.'s improved Hydraulic Elevators. Office 206 Broadway, N. Y., (Evening Post Building, room 22.)

Iron, Brass, and Steel Wire. Needle pointed English Steel Wire, for all purposes. W. Crabb, Newark, N. J.

For Fire or Power Pumps, address the Gould's Manf. Co., Seneca Falls, N. Y., or 15 Park Pl., N. Y. city.

Brush Electric Light.—20 lights from one machine. Latest & best light. Telegraph Supply Co., Cleveland, O.

The Hancock Inspirator received a gold medal at Paris, as being the best boiler feeder ever made, and the Old Colony Railroad (who have twenty-three machines in constant use) have just given it their unqualified indorsement, as the cheapest and most effective feeder ever used on their locomotives. Those interested are referred to their letter of recommendation, which may be found in our advertising columns.

J. C. Hoadley, Consulting Engineer and Mechanical and Scientific Expert, Lawrence, Mass.

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are to be sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

For the best advertising at lowest prices in Scientific, Mechanical, and other Newspapers, write to E. N. Freshman & Bros., Advertising Agents, 186 W. 4th St., Cin., O.

H. Prentiss & Co., 14 Dey St., N. Y., Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

Hydraulic Elevators for private houses, hotels, and public buildings. Burdon Iron Works, Brooklyn, N. Y.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Eagle Anvils, 9 cents per pound. Fully warranted.

Bevins & Co.'s Hydraulic Elevator. Great power, simplicity, safety, economy, durability. 94 Liberty St. N.Y.

Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the SCIENTIFIC AMERICAN Export Edition. This paper has a very large foreign circulation.

Two fine Astronomical Telescopes, 3 in. and 7 in., by first-class English maker, cheap. I. Ramsden, Phila.

Gold Chronometer Watch, by first-class English maker; cost $260, price $135; latest patented improvements. I. Ramsden, 21 Christian St., Philadelphia, Pa.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N. H.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Inventors' Models. John Ruthven, Cincinnati, O.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Warranted best and cheapest Planers, Jointers, Universal Woodworkers, Band and Scroll Saws, etc., manufactured by Bentel, Margedant & Co., Hamilton, Ohio.

Mill Stone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., N. Y.

The best Friction Clutch Pulley and Friction Hoisting Machinery in the world. D. Frisble & Co., N. Haven, Ct.

Latest and best Books on Steam Engineering. Send stamp for catalogue. F. Keppy, Bridgeport, Conn.

Improved Meat Cutter. Capacity 600 lbs. an hour. Circular and price list, J. W. McFarland & Co., Alliance, O.

Cutters shaped entirely by machinery for cutting teeth of gear wheels. Pratt & Whitney Co., Hartford, Conn.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

The new "Otto" Silent Gas Engine is simple in construction, easy of management, and the cheapest motor known for intermittent work. Schleicher, Schumm & Co., Philadelphia, Pa.

Vertical & Yacht Engines. N. W. Twiss, New Haven, Ct.

Pulverizing Mills for all hard substances and grinding purposes. Walker Bros. & Co., 23d & Wood St., Phila., Pa.

Correct thing for Holidays, Whist and Dinner Parties, is the Vanity Fair Cigarettes, with your monogram.

The SCIENTIFIC AMERICAN Export Edition is published monthly, about the 15th of each month. Every number comprises most of the plates of the four preceding weekly numbers of the SCIENTIFIC AMERICAN, with other appropriate contents, business announcements, etc. It forms a large and splendid periodical of nearly one hundred quarto pages, each number illustrated with about one hundred engravings. It is a complete record of American progress in the arts.

NEW BOOKS AND PUBLICATIONS.

UPLAND GAME BIRDS AND WATERFOWL OF THE UNITED STATES. Part X. By A. Pope, Jr. New York: Charles Scribner's Sons. $2.50.

The tenth and final number of Mr. Pope's illustrations of the principal Upland Game Birds and Waterfowl of the United States is devoted to the canvas back duck and the brant. The entire series comprises life size drawings in color of twenty species, male and female, or forty specimens in all, by an artist sportsman who has given to them years of patient and painstaking study. The printing reproduces the artist's water color effects admirably.

HAND BOOK OF ALABAMA. By Saffold Berney. Mobile: *Register* Print. $1.50.

A useful volume for those seeking information with regard to the government institutions and resources of Alabama. The State Geologist, Dr. E. A. Smith, contributes a valuable section on the geology of the State and its mineral resources (with a revision of Professor Tuomey's Geological Map of the State), and Mr. Haralson a review of the cotton manufactures of the State and its advantaegs for such industries. Parts X., XI., XII., and XIII., are devoted to the agricultural products, soils, capabilities, advantages, forest and forage products of Alabama. A report on the climate of Alabama and its adaptation to health and comfort is contributed by Professor William H. Anderson, of the State Medical College, Mobile.

HYGIENE OF THE BRAIN AND NERVES. By M. L. Holbrook, M.D. New York: M. L. Holbrook & Co.

A book of exceptional value; sensible, timely, practical; indeed one of the very few books that everybody should read. It discusses with singular directness and intelligence one of the most dangerous features of American life, high pressure activity, and unwise eating and drinking, combined with a fatal anxiety to accomplish in one year more than there is time for in two; an anxiety, we may add, which makes life at once brief, hurried, fretful, and unenjoyable, with the result in most cases of early nervous breakdown and practical life failure. If read and heeded, as it ought to be, the volume in hand will do much to correct this characteristic mistake in American life. The strong positions taken by Dr. Holbrook with regard to proper habits of eating, sleeping, working, and playing, are fortified by citations from the writings of a score or more of prominent thinkers and scientists, and twenty-eight letters from prominent men and women, describing their physical and mental habits, and giving practical deductions from their personal experience.

ANNUAL REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION FOR 1877. Washington: Government Printing Office.

In addition to the customary review of scientific work carried on under the auspices of or assisted by the Smithsonian Institution, this volume is enriched by an able review of color blindness in its relation to accidents by rail and sea, by Professor Holmgren, of the University of Upsal, Sweden; a large number of valuable communications on American antiquities; a dozen short memoirs on meteorological subjects, and other papers of permanent interest.

THE YOUNG SCIENTIST. Industrial Publication Company. New York: 50 cents a year.

A monthly journal for boys, devoted to simple experiments in chemistry, amateur mechanical work, etc.

CATALOGUE OF THE LIBRARY OF THE UNITED STATES PATENT OFFICE. Washington: Government Printing Office.

This is substantially the first printed catalogue of the Patent Office Library, which now contains some 24,000 volumes, not including duplicate specifications of patents and pamphlets.

THE AMERICAN QUARTERLY MICROSCOPICAL JOURNAL. Vol. I. No. 1. Edited by Romyn Hitchcock. New York: Hitchcock & Wall. $3 a year.

In view of the numerous failures of high grade periodicals in this and other special departments of science, the projectors of this handsome quarterly are to be commended for courage, if for nothing more. The initial number is highly creditable to them and to their department of scientific research. We sincerely hope that it will be well sustained.

MANUAL OF MINERALOGY AND LITHOLOGY. By James D. Dana. New York: John Wiley & Sons.

This, the third edition of Professor Dana's useful manual, is almost a new book throughout. It has been rearranged and rewritten, and, the author believes, materially improved. The chapter on rocks has been increased in fullness so as to make it a prominent part of the work.

JOURNAL OF THE BRITISH SOCIETY OF TELEGRAPHIC ENGINEERS. Nos. XXII. and XXIII. London and New York: E. & F. N. Spon. 1878. 15 shillings.

Contains, in addition to brief communications, correspondence, abstracts, etc., a valuable paper on "Insulators for Aerial Telegraph Lines," by John Garvey; and several papers and discussions on sound in relation to the telephone, microphone, etc.

THE MAGAZINE OF ART. Illustrated. New York: Cassell, Petter & Galpin. $3 a year.

Among the more attractive periodicals that have come to our table the past year the *Magazine of Art* must take high rank. The eighth number of the first volume was reached in December, and there is every reason to wish it a long life as a representative of fine art.

ART INDUSTRY. New York: Howard Lockwood & Co. $2 a year.

Of *Art Industry* but three numbers have been issued, and these have given promise of future usefulness. It is specially devoted to the artistic industries and is finely illustrated. The reading matter is readable and instructive.

BULLETIN OF THE UNITED STATES NATIONAL MUSEUM.

We have received from the Department of the Interior the following issues of the Bulletin of the United States National Museum:

No. 7. Contributions to the Natural History of the Hawaiian and Fanning Islands and Lower California. By Thomas H. Street, M. D.

No. 8. Index to the names which have been applied to the subdivisions of the class Brachipoda. By W. H. Dall.

No. 9. Contributions to North American Ichthyology. No. 1. By David S. Jordan.

No. 10. The same. Part II.

No. 12. The Same. Part III.

Also recent issues of the Bulletin of the United States Geological Surveys of the Territories:

Vol. III., No. 4; and Vol. IV., Nos. 1, 2, and 3. Also, miscellaneous publications:

No. 9. Descriptive Catalogue of Photographs of North American Indians. By W. H. Jackson; and No. 10. Bibliography of North American Invertebrate Palæontology. By C. A. White, M.D., and H. A. Nicholson, M.D.

PHOTOGRAPHS OF THE MOON.—It is fortunate at this time of increasing interest in the moon that arrangements have been made for supplying cheaply and in any quantity Mr. Rutherfurd's splendid photographs of that satellite. Mr. Oscar G. Mason, of the Photographic Department of Bellevue Hospital, of this city, has undertaken the publication of these valuable aids to the study of the moon, at rates which bring them within the reach of all; and as he has not only made all the prints hitherto furnished, but assisted Mr. Rutherfurd in making the negatives, there can be no doubt of his doing the work well. Three series of prints are offered, the first showing the different phases of the moon, in dimensions ranging from 17½ to 21 inches; the second series, nine views, eight inch image; the third, nine views, four inch image.

Mr. Mason is also prepared to furnish prints from Mr. Rutherfurd's negatives of the solar spectrum, recently made with his interference gratings. The prints from these plates give the finest picture of the solar spectrum yet produced.

SOME AMERICAN MAGAZINES.

Scribner's Monthly, which began by rivaling the best popular magazines of the time, has steadily gained in force and excellence. The later volumes not only surpass the earlier, but their steady improvement, especially in the matter of illustration, has compelled a corresponding advance in the quality of American art work, both for books and for periodicals. A host of attractions are announced for the new year.

St. Nicholas has no rival. Its bright and seductive pages furnish more that is calculated to cultivate in the young a taste for pure and instructive reading, and with it a taste for all that is true and clean and kindly in life and conduct, than anything else we know. And it is admirably free from the goody-goody stuff so commonly manufactured for children's reading. It is needless to add that it is absolutely free from the other extreme of juvenile literature—the viciously sensational.

The *Popular Science Monthly* promises to add to its solid attractions, and they are numerous, the merits of the *Popular Science Supplement* also, a magazine which has been in many respects the more solidly valuable of the two. In other words, the *Monthly* is to be enlarged, so as to make it represent the scientific field more completely, by absorbing the *Supplement*, but without any increase in its price. This will be especially gratifying to those who have wanted both publications, yet have felt unable to afford the cost of the two.

The removal of the *North American Review* to New York, and the change of plan in making it more alive to timely questions of public moment and their discussion by men of experience and practical information, rather than by closet students, have added much to its force and value; certainly to the mass of active men who care more to know what prominent men are thinking about matters of general interest, than for the lucubrations of pure scholarship.

Notes & Queries

(1) C. R. writes: I am making some simple laboratory experiments and find alcohol very expensive for heating retorts, flasks, etc. Is there any method of constructing a lamp to burn kerosene, by which the soot and smell may be avoided? There is no gas in my house. Is there any other substance I can use, supposing kerosene is not available? A. Kerosene has not been successfully used for the purpose mentioned. The substitutes for alcohol are wood naphtha (crude methylic alcohol) and gas, the latter used with a Bunsen burner to secure perfect combustion.

(2) C. D. F. asks: 1. Why do opticians charge so much more for lenses (4 or 5 inches in diameter) of short focus (6 or 7 inches) than they do for lenses of same diameter and long focus? A. Because the more convex and shorter focus lenses are of necessity ground singly, whereas several of the longer focus lenses may be ground at one operation. 2. If the difference is in the processes of manufacture, why will not one process answer for both thick and thin lenses? A. Common convex lenses are secured to a convex tool or form and ground by moving over them with a gyratory motion a concave tool, the contact surfaces being charged with the grinding or polishing material. It is obvious that the form having the least convexity will contain the greatest number of lenses. 3. Why is crown instead of flint glass used for condensing lenses, when the refractive power of flint is greater? A. Crown glass of a uniform density is more easily made than flint glass of the same quality. 4. Is there a stereoscopic camera, which takes the views erect instead of reversing them, as in an ordinary instrument? We think not. 5. If not how are the prints made on one piece of paper, and mounted without cutting apart and changing the right for the left? A. The prints or the negative must be cut and transposed, or the views must be transposed in the camera. 6. Why is it necessary that there should be an odd number of cutting edges in the fluted countersink described on page 387, vol. 39? A. It insures a smooth cut. 7. What is used with mercury for tempering drills, which will make them tough enough to stand in drilling tempered steel? A. Nothing. After hardening draw the temper as near as possible to the cutting edge.

(3) C. L. S. asks: 1. Should the ratio between the teeth of different gears be the same as that between their diameters? A. Generally, yes. 2. What is the best work on cotton manufacturing; also on mill engineering? A. Address the book publishers who advertise in our columns for catalogues.

(4) C. L. U. writes: 1. I have 12 lbs. of zinc in three gravity batteries; the current is not strong enough. I would like to make a Bunsen battery; could I make one, using the above zinc, and how? A. The zincs should be recast in cylindrical form, with a slit in one side to permit of circulation. 2. What is the meaning of "ohm" as used in telegraphy? A. The ohm is the unit of resistance to the passage of an electrical current: it is equivalent to a wire of pure copper one twentieth of an inch in diameter and 250 feet in length, or 330 feet of No. 9 iron wire.

(5) E. E. H. asks: How can I finish parlor brackets, made of walnut and cigar box lumber, cheaply, durably, quickly, and beautifully? A. Varnish the lumber before sawing, saw with thin boards between and on the sides of the lumber, and use a fine saw.

(6) S. G. B. asks: 1. Can insects and snakes hear? A. Yes. 2. How are knife blades tempered, so as not to warp? A. By plunging them straight down in the water in the process of hardening.

(7) M. L. A. asks how to drill a hole one half inch in diameter through the bottom of a large glass flask. It is intended for a home made electrical machine. A. A copper tube ½ inch in diameter pressed against the glass lightly and plentifully supplied with emery and water, and rotated by means of a lathe or drill stock, will accomplish it.

(8) C. E. O.—Directions for making induction coils are contained in the SCIENTIFIC AMERICAN SUPPLEMENT No. 160.

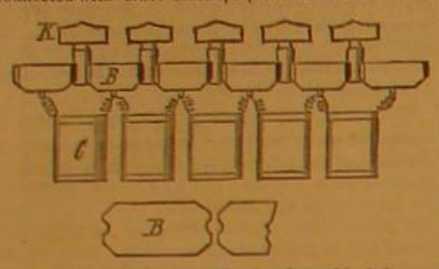
(9) E. K. asks: Who was Eastlake, and what are his principles of design in furniture? A. Eastlake is a living designer of furniture, etc., in London, Eng.; also art critic and author. His work on household art is published by Scribners. Clarence Cook's work, also published by Scribners, will explain Eastlakism.

(10) G. W. B. states that the shrinking and swelling of the wooden cases of telephones is one cause of derangement. We suggest soaking the wood in melted paraffine or giving them a coat or so of shellac varnish in the inside.

(11) F. S. writes: I am a surgical instrument maker, and in my work I have to bend steel rods, which must be polished before bending, as they have to be perfectly round when bent. The bending of the rods is done with a wooden mallet. 1. Is there anything that can be put on the steel or in the fire by which it might be kept from scaling? A. Apply to the steel before heating a thin paste of 75 parts of sifted wood ashes, and 25 parts of fat clay without sand, mixed with water. 2. Can you give me a receipt for soldering steel to malleable iron? A. Use silver solder.

(12) H. A. D. writes: 1. How can I fix up a small, cheap electric light so as to exhibit it before a large class? A. The simple electric light apparatus described in SCIENTIFIC AMERICAN SUPPLEMENT No. 149 would probably answer your purpose. 2. How much battery power would I require? A. 6 or 8 Bunsen cells. 3. Would a machine 7x4 inches generate sufficient electricity for it? A. As we do not know what kind of machine you refer to we cannot say SUPPLEMENT No. 161 contains instructions for making a machine that will answer the purpose. 4. Should I use an induction coil? A. You may obtain beautiful effects by using an induction coil in connection with vacuum tubes, but a very brilliant light cannot be obtained in this way. 5. Have you given information as to how to make induction coils? I am getting up some experiments for the purpose of giving a free exhibition to school children. By answering the above, you will confer a favor on an amateur, and may thus stimulate young minds to look into facts for themselves. A. SCIENTIFIC AMERICAN SUPPLEMENT No. 160, will contain full instructions for making induction coils.

(13) H. C. and others.—The principle of the rheostat may be understood by referring to the engraving. Several coils, C, of measured resistance, are connected with brass blocks, B, which are fitted into



the top of the instrument. The first brass block is connected with one terminal of the first resistance coil; the second brass block is connected with the other terminal, and with one terminal of the second coil; the other terminal of the second coil is connected with the third brass block, and so on. The adjacent ends of the blocks are notched to receive the keys, K. Whenever one of the keys is inserted, the coil immediately below it is cut out of the circuit, and the current passes directly from one of the brass blocks to the other, through the key.

(14) J. M. asks how the wire should be wound on an electro-magnet. A. The manner of winding the wire on an electro-magnet is shown so clearly in the cuts as to require little explanation. Fig. 1 shows the two soft iron cores separated from the soft iron bar to which they are attached after being wound.

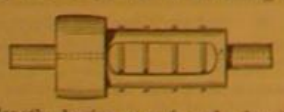
Fig. 1.

Fig. 2.

Fig. 2 shows the manner of connecting the spools of a U electro-magnet. If the iron core were straightened and the spools placed together, it would be seen that one spool is simply a continuation of the other.

(15) Maudie writes: I am a little girl eight years old. In a little book my papa got of you, called the SCIENTIFIC AMERICAN Reference Book, I found a rule for making soap bubbles, and as I like real well to blow soap bubbles, I got papa to get me the glycerin and I tried it just as the rule says, but I could not make any, they would not even form in the pipe. Papa says perhaps the printer made a mistake and that I might write to you about it. I have tried so many ways to make soap bubbles that papa calls me his little chemist and says I ought to have been a boy. The best way I have found is to put half an ounce of castile soap into a pint of distilled water. I have blown bubbles from this 4 inches through that would last 2 minutes, and I have blown them as large as 7 inches through. A. You probably used too much water or diluted glycerin. The receipt, which we have often tried with very satisfactory results, is given by Professor Josiah P. Cooke, as follows: "Procure a quart bottle of clear glass and some of the best white castile soap (or, still better, pure palm oil soap). Cut the soap (about 4 ounces) into thin shavings, and, having put them into the bottle, fill it up with distilled or rain water, and shake it well together. Repeat the shaking until you get a saturated solution of soap. If on standing, the solution settles perfectly clear, you are prepared for the next step; if not, pour off the liquid and add more water to the same shavings and shake as before. The second trial will hardly fail to give you a clear solution. Then add to two volumes of soap solution one volume of pure concentrated glycerin." "The New Chemistry," p. 29. Grand soap bubbles can be blown with this preparation.

(16) G. F. C. asks how to make a simple wire straightener? A. Such a tool is shown in the accompanying cut. It consists of a casting about 10



inches in length, having on each end a bearing which may be supported in suitable boxes. The pulley is a part of the casting, and is 3 inches in diameter and two inches wide. Four steel pins are inserted 1 inch apart and a little to one side of a central longitudinal line. A hole a little larger than the wire to be straightened is drilled axially through the bearing. The wire passes through the tool over and under the steel pins. It is well lubricated and is pulled through as the tool revolves.

(17) C. M. sends the following formula: To find the area of a circle, multiply the square of the diameter by 77, divide the product by 100, and add to the result 2 per cent of same (that is, increase the result by 2 per cent). Do you consider the above an easier rule than the usual one (r^2. [π]. 3·1416), the solution being identical? Your formula in SCIENTIFIC AMERICAN Reference Book brings the same result. A. In many cases the rule given by you would be simpler.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

November 19, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Acid, making acetic, A. Pirz	209,978, 209,979
Adding machine, M. Norgren	209,977
Animal trap, C. Isbell	210,040
Animal trap, S. H. Wiesedeppe	210,071
Azimuths, device for taking, W. Thomson	210,068
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Wringer, J. Todd	210,170

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Cigars, cigarettes, etc., F. P. Earle	6,804
Cigars, cigarettes, etc., J. Hirsch	6,807
Cigars, cigarettes, etc., S. Rosenbaum	6,809
Cigars, cigarettes, etc., Hirschl & Bendheim	6,808
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Handles for spoons, forks, etc., C. F. Richers	10,912
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Oil cloths, C. T. & V. E. Meyer	10,916 to 10,919
Padlocks, J. Gerard	10,913
Pulls for drawers, etc., G. W. Tucker	10,920

English Patents Issued to Americans.

From December 13 to December 17, inclusive

Disintegrating mills.—L. Pennett, Buffalo, N. Y.
Firearms.—M. Coloney, St. Louis, Mo.
Ice machinery.—F. M. McMillan *et al.*, Cleveland, Ohio.
Letter holder.—J. T. Foster, Arlington, N. J.
Lighting apparatus.—A. H. Hearington, ——, Mich.
Machine guns.—M. Coloney, St. Louis, Mo.
Match box.—W. Pickersgill, N. Y. city.
Printing presses.—W. S. Appleton, N. Y. city.
Pumping machinery.—G. H. Corliss, Providence, R. I.
Sewing machines.—Howe Machine Co., N. Y. city.
Screw cutting machinery.—E. Nugent *et al.*, B'klyn, N. Y.
Shuttle.—J. Burton, Newark, N. J.
Wood working machinery.—W. H. Doane, Cincinnati, O.

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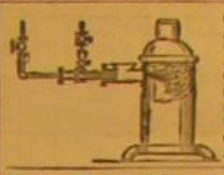

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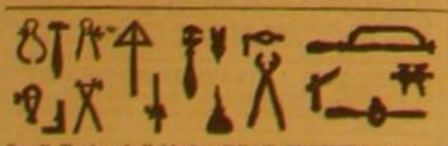

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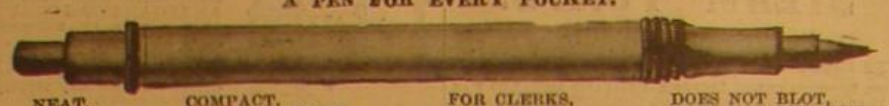

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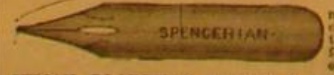

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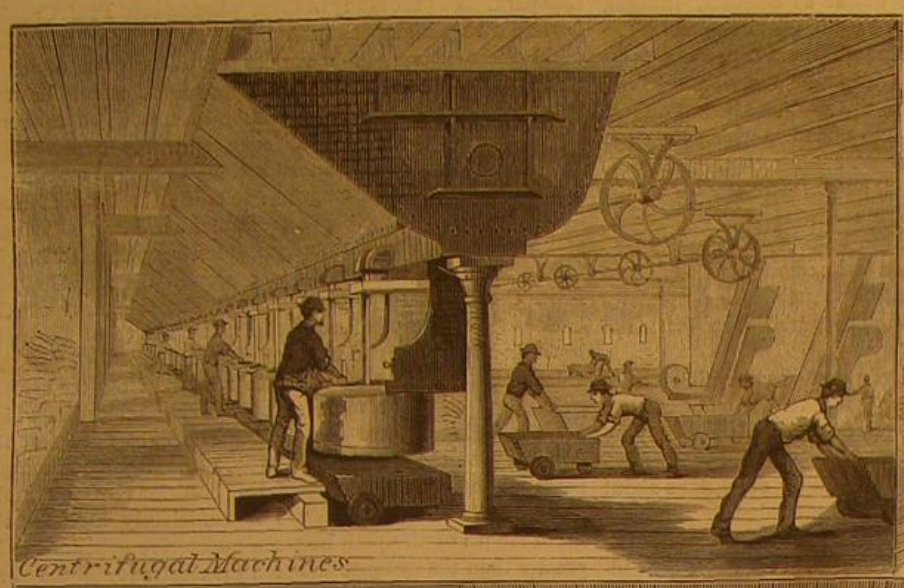

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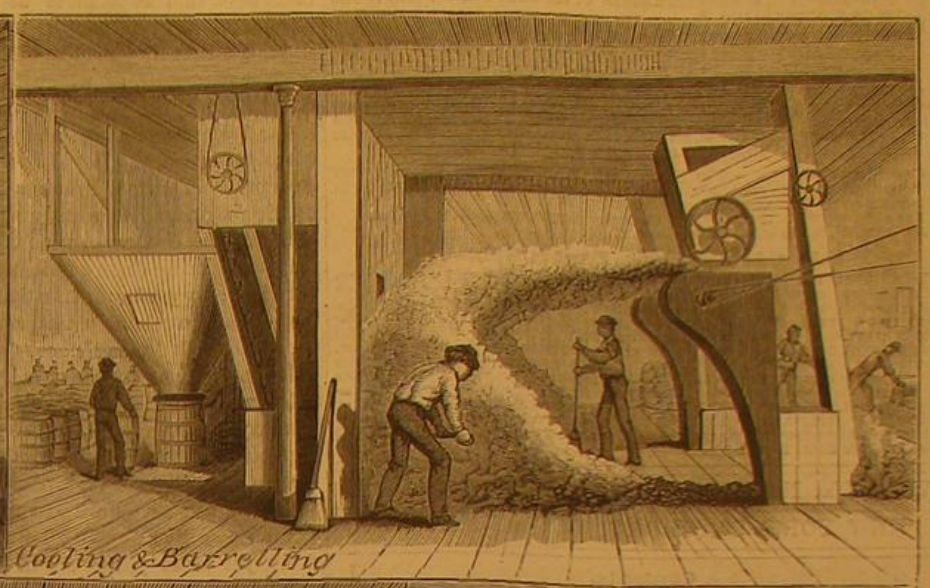

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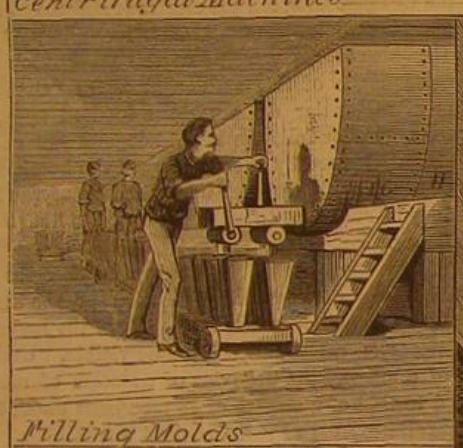

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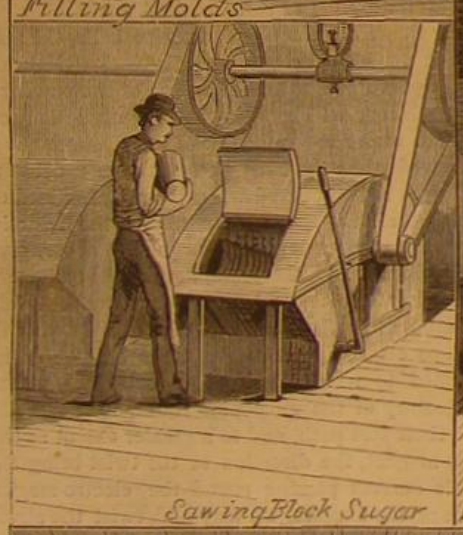

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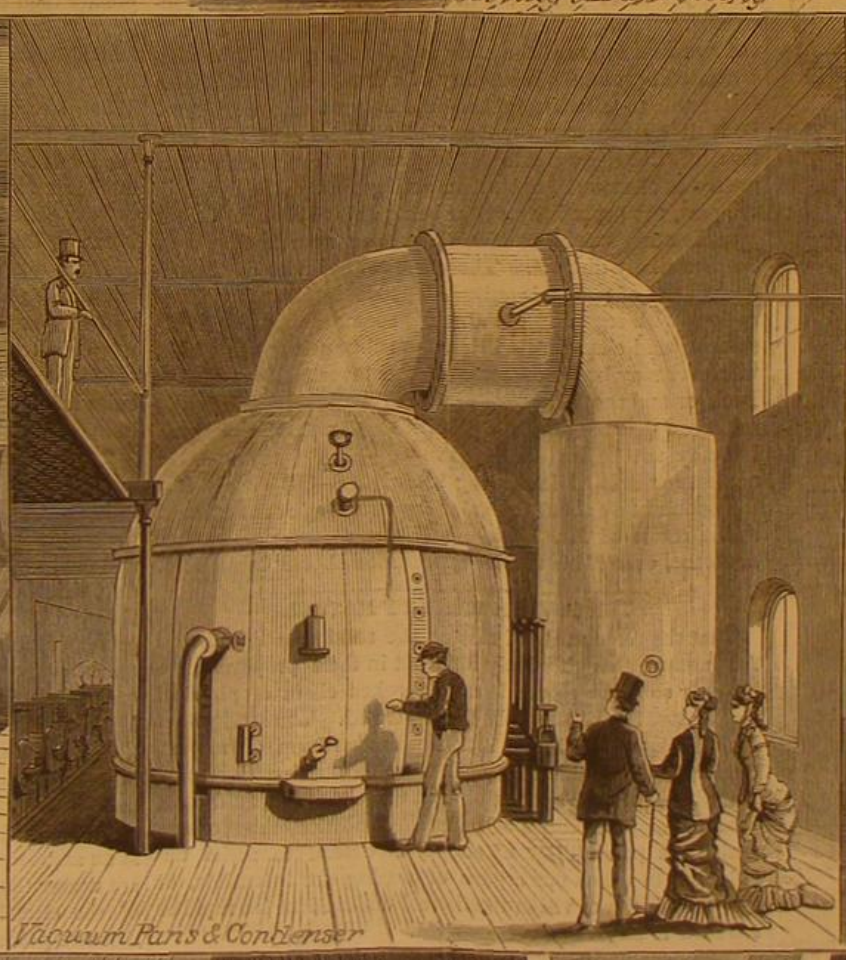

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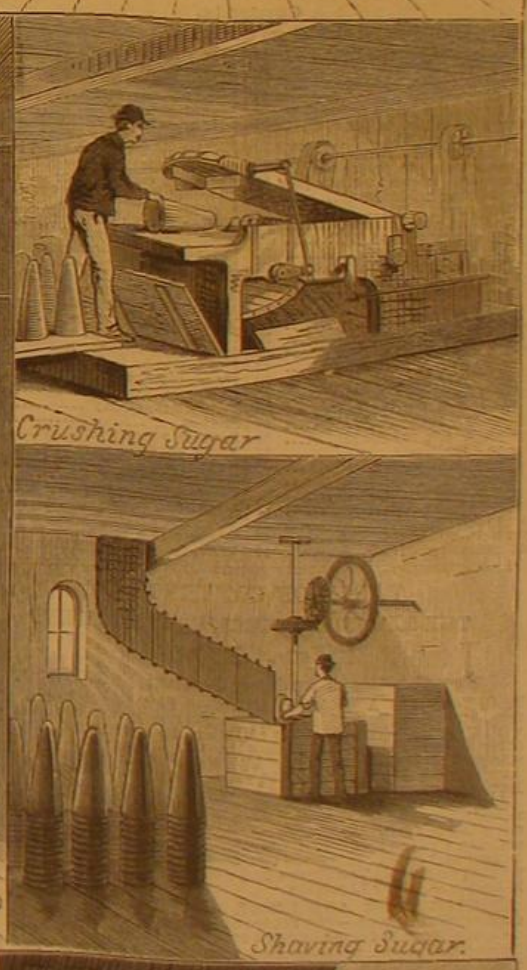

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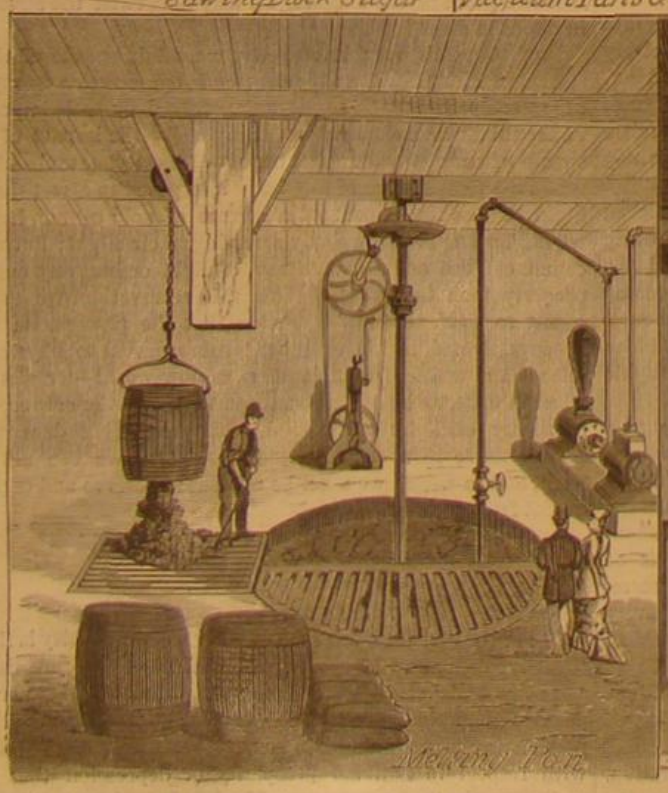

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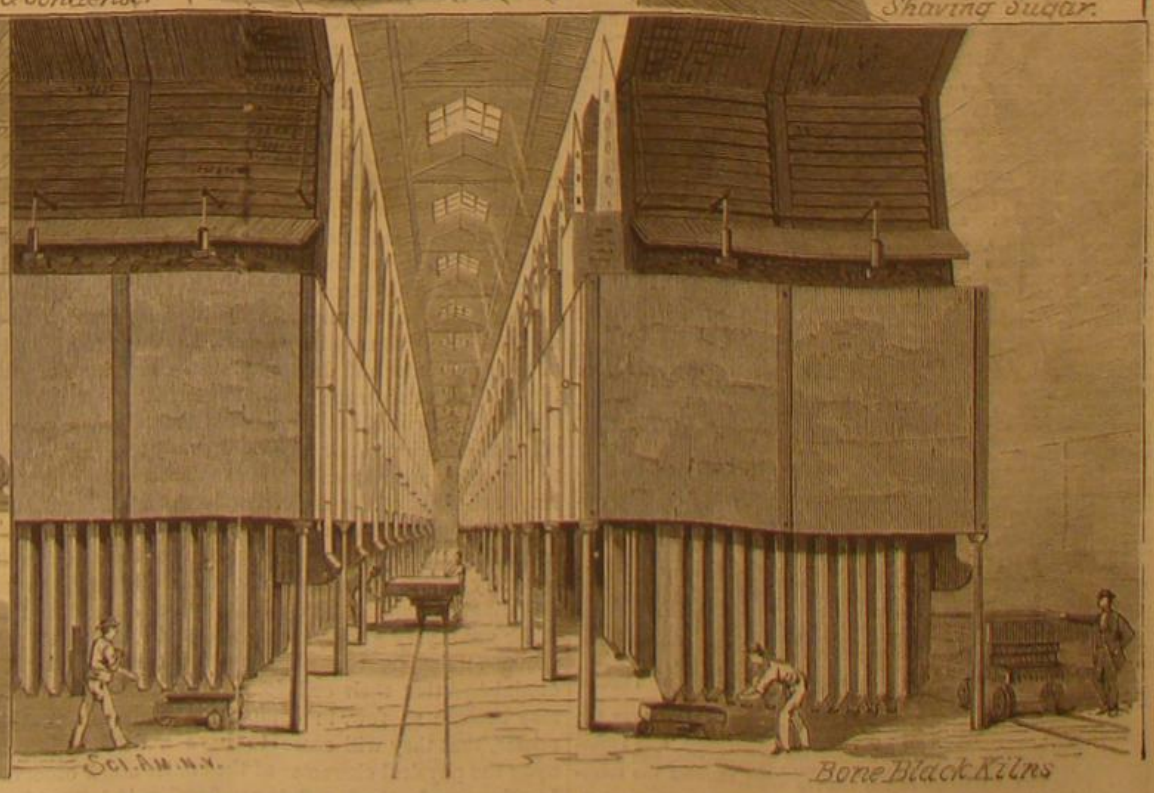

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NEW YORK, SATURDAY, JANUARY 25, 1879.

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II. ARCHITECTURE AND DECORATIVE ART.—The United States Capitol, Washington.—The failure of Concrete at Cambridge.

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III. TECHNOLOGY.—Electro-Gilding.—Bailey's Apparatus for Testing Lubricating Oils, 3 figures.—Manufacture of alum. By MM. A. GAUDIN and J. P. FONQUERGNE.—The Foster Brick Kiln, with 4 figures.—Blue alizarine. By MM. H. KOECH and M. PRUDHOMME.

Australian Timbers. Their value for furniture, building, cabinet-making, pianos, turnery purposes, coach building, railway cars, cooperage, and minor purposes. The eucalypti and their valuable products.

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IV. CHEMISTRY AND METALLURGY.—Chemical Novelties. Griffith's paint. Manufacture of gelatine. Tartaric acid. Zinc pigments. Aureosine colors. Rosaline acid colors. Preservation of wool. Prussian blue. Sulphuric acid. Removing iron from clay.—Glycerine. By E. DONATH.

Spectral Analysis and the Identity of Chemical Elements. Experiments on the Halogen elements, and their apparent identity.

V. ON THE MINUTE MEASUREMENTS OF MODERN SCIENCE. By ALFRED M. MAYER. No. XVI. On the determination of the number of vibrations made in a second by a tuning fork, with examples of the uses of the tuning fork as a chronometer to mark minute intervals of time. The velocity of rotation of a wheel measured by a tuning fork. The laws of falling bodies written on a falling plate by a tuning fork. The velocities of cannon balls measured by the tuning fork. The speed with which the nervous motion and sensitive agent travels along the nerves, measured by the tuning fork. With 5 figures.

VI. ELECTRICITY, LIGHT, HEAT, ETC.—Plateau's Films. Experiments upon liquids which have been freed from the influence of gravity. Laws governing the formation of liquid films, with recipe for making permanent films. 15 figures.

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Collin's City Time Regulator. 2 engravings.—Stroumbo's Apparatus for Determining the Magnetic Inclination and Declination. 1 figure.—A Breath Battery and Telephone. 4 figures.

VII. MEDICINE AND HYGIENE.—The Remains of William Harvey, the discoverer of the circulation of the blood. An interesting account of the death of Harvey Hempstead Church, his burial place, with 2 illustrations, the memorial tablet and bust, with 1 illustration, and a portrait. View of the interior of the Harvey vault, showing the sarcophagus of Harvey as it now exists.

Milk as a Vehicle of Contagion. By ALEXANDER R. BECKER, M.D. The germ theory of disease. The present milk laws and milk inspectors. A probable cause of some city epidemics.—Laughter as a Medicine.

THE TRANSMUTATION OF ELEMENTS.

Not a little nonsense has been written with regard to Mr. Lockyer's recent assertions concerning the probable composite nature of several, possibly all, of the substances hitherto accounted elementary, and the probability that all the elements so called are but varying phases of some fundamental matter-stuff.

It has been commonly assumed that if these assertions should be verified, the dreams of the alchemists would come true, and chemists would be able to change one form of matter into another, as lead into gold or silver. This assumption is altogether gratuitous. In his studies of the spectra of different substances under varying conditions of heat and pressure, Mr. Lockyer has indeed come to doubt the integrity of the elements as commonly understood; and to believe that substances as unlike as calcium, lithium, iron, and hydrogen, may be not only not fundamentally distinct, but that they may be merely different aspects of some basic matter-stuff, of which hydrogen is the simplest form at command. As yet, however, the evidence he has offered is far from convincing; and able chemists who listened to his paper before the Royal Society, among them Professors Roscoe, Williamson, Frankland, and Gladstone, are of the opinion that he has merely demonstrated the presence of impurities in elements supposed to be perfectly pure.

But supposing these gentlemen to be wrong, and Mr. Lockyer right; supposing it true that all matter is fundamentally one—would we be any nearer to the practical realization of the alchemist's dream?

If matter be at bottom only hydrogen or some still simpler substance, the existence of strongly marked phases of matter, like oxygen, iron, gold, and so on, can be explained only by supposing them to be the result of a process of natural selection operating through past ages, under conditions about which we can have but the vaguest knowledge.

We know that life in all its phases is fundamentally the same, yet those phases are in the main, so far as we are concerned, unchangeable, certainly not transmutable. Even if the common origin of the horse and the zebra should be demonstrated beyond the possibility of a doubt, we should be no better able to transmute zebras into horses than we are now. So if it be demonstrably true that two phases of one matter-stuff, like silver and lead, have resulted from the cosmical processes of material evolution, acting through the cycles of the past, the probability of our being able to change the one into the other would be scarcely greater than if they were fundamentally distinct. The chemical behavior of the different sorts of matter is quite independent of any theoretical notions with regard to the ultimate constitution of such substances; and chemistry will remain substantially what it is, whatever may be the outcome of the investigations of Mr. Lockyer and those engaged in similar work. By this we do not mean that the prevailing theories and practices of chemists may not be materially changed—such changes are the necessary result of increasing knowledge—but simply that the popular talk about the radical overturning of the science, as the result of Mr. Lockyer's alleged discoveries, is sheer nonsense, even if his utmost expectation should be realized.

THE FOURTH STATE OF MATTER.

That the three states of matter, the solid, the liquid, and the gaseous, though widely different in their properties, are yet only so many stages in an unbroken chain of physical continuity, has been amply demonstrated. The solid passes into the liquid, the liquid into the gaseous form of matter, by insensible gradations; and there is nothing any more improbable in the supposition that these three states do not exhaust the possibilities of material condition, than in supposing the possibilities of sound to extend to aerial undulations to which our organs of hearing are insensible, or the possibilities of vision to ethereal undulations too rapid or too slow to affect our eyes as light.

Indeed, while Pictet and others have been converting into liquids and solids the most tenuous of gases, by successively shortening the range of their molecular movements, Prof. Crookes has, on the other hand, succeeded in refining gases to a condition so ethereal as to reach a state of matter fairly describable as ultra-gaseous, and exhibiting an entirely novel set of properties.

The means by which this remarkable result was achieved were exhibited and described by Prof. Crookes at a meeting of the British Royal Society early last December; and the processes by which the discovery was made were discussed at length in a paper unfortunately too long even to be summarized here. It may be possible, however, to give an idea of their character and drift without the aid either of graphic illustrations or abstrusely scientific terms.

Our readers need not be told that the physical properties of gases are due to their molecular condition; in other words, to the swing and impact of their molecules, and the average length of flight of the molecules between collisions. As the number of molecules in a given space is reduced by mechanical exhaustion, the frequency of molecules collision is of necessity reduced, and the mean molecular flight is correspondingly extended. Now it is obvious that if the tenuity of the gas is very greatly increased, as in the most perfect vacua attainable, the number of molecules may be so diminished that their collisions under favorable conditions may become so few, in comparison with the number of misses, that they will cease to have a determining effect upon the physical character of the matter under observation. In other words, the free flying molecules, if left to obey the laws of kinetic force without mutual interference, will cease to exhibit the properties characteristic of the gaseous state, and take on an entirely new set of properties. That this is a matter of fact, and not of theoretic speculation, is demonstrated by the researches of Prof. Crookes.

In his previous studies of molecular activity in connection with the radiometer, the molecules were set in motion by means of radiations producing heating effects. In the present series of experiments the molecular motion was determined or increased by the induced current from an induction coil. The investigation began by a study of the dark space which surrounds the negative pole when an induction spark is passed through rarefied gas. The width of this dark space was found to vary with the degree of exhaustion of the tube; with the kind of gas employed; with the temperature of the negative pole; and in a slight degree with the intensity of the spark. For the study of these phenomena Prof. Crookes devised a very ingenious instrument, which he calls an electrical radiometer, and a variety of other apparatus, of wonderful delicacy and power, by means of which he was able to illuminate lines of molecular pressure; to converge streams of molecules upon a focus, with the evolution of light and heat and mechanical action; to deflect streams of molecules by means of magnets; to study the laws of magnetic deflection; to observe molecular shadows, so called, and other novel and extremely interesting phenomena.

The nature of the dark space around the negative pole Prof. Crookes interprets as follows: The thickness of the dark space is the measure of the mean length of the path between successive collisions of the molecules. The extra velocity with which the molecules rebound from the excited pole keeps back the more slowly-moving molecules which are advancing toward the pole. The fight occurs at the boundary of the dark space, where the luminous margin bears witness to the energy of the collisions of the molecules. When the exhaustion is sufficiently high for the mean length of the path between successive collisions to be greater than the distance between the electrode and the glass, the swiftly-rebounding molecules spend their force, in part or in whole, on the sides of the vessel, and the production of light is the consequence of this sudden arrest of velocity. When streams of molecular discharge are focused upon a strip of platinum wire or foil, the metal becomes not only luminous but highly heated by the severity of the bombardment; so, too, the molecular impact upon the side of the inclosing glass may be sufficient to make the spot too hot to be borne by the finger.

The limits of our space forbid any attempt to describe at length the phenomena of magnetic deflection or the ingenious apparatus by means of which the action of the magnet upon the trajectory of molecules was made visible. Under the influence of a magnet the behavior of a stream of molecules is likened to that of a stream of cannon balls under the influence of gravitation. In Prof. Crookes' words:

"Comparing the free molecules to cannon balls, the magnetic pull to the earth's gravitation, and the electrical excitation of the negative pole to the explosion of the powder in the gun, the trajectory will be flat when no gravitation acts, and curved when under the influence of gravitation. It is, also, much curved when the balls pass through a dense resisting medium; it is less curved when the resisting medium gets rarer; and, as already shown, intensifying the induction spark, equivalent to increasing the charge of powder, gives greater initial velocity, and, therefore, flattens the trajectory. The parallelism is still closer when we compare the evolution of light seen when the shot strikes the target with the phosphorescence on the glass screen from molecular impacts." Applied to a stream of molecules the magnet twists the trajectory of the molecules round in a direction at an angle to their free path, and to a greater extent as they are nearer the magnet, the direction of the twist being that of the electric current passing round the electro-magnet. The two poles of the magnet, we may add, twist the stream in opposite directions.

Prof. Crookes, very improperly, we think, speaks of the stream of molecules thus brought under observation as rays of molecular light. True, light is evolved by their impact under suitable conditions; so it may be by the impact of a stream of cannon balls. The impact of the flying molecules raises the temperature of any body interposed to arrest their flight, just as the impact of a stream of cold cannon balls would heat a resisting body arresting their flight; but we cannot call the one stream a ray of light or heat any more properly than the other. With this reservation, we may assent to Prof. Crookes' assertion that the phenomena he has investigated in his exhausted tubes reveal to physical science a new field for exploration, a new world—"a world wherein matter exists in a fourth state, where the corpuscular theory of light holds good, and where light does not always move in a straight line, but where we can never enter, and in which we must be content to observe and experiment from without."

AMERICAN INDUSTRIES.—No. 3.

BY HAMILTON S. WICKS.

REFINING SUGAR.

One of the best thermometers of a nation's prosperity is the sugar it consumes. In epochs of great financial depression and commercial stagnation the consumption is small as compared with periods of general prosperity. Indeed the proportionate consumption of sugar is so accurately distributed with respect to national prosperity or depression that it really constitutes a true gauge of both. It is also a good test of civilization and cultured taste—the more civilized

nations consuming the most, and the consumption decreasing in regular ratio through the less cultured and semi-civilized nations to the barbaric. This ratio of consumption is explained on the principle that a luxury follows the means to procure it, and that with increased means there ensues an increased use. Sugar, although classed as a luxury when compared with breadstuffs, meats, and vegetables, has yet become essential to modern civilization through the multiplex uses it has been put to. The sugar industry ranks about seventh among American industries. Following close in importance on such leading national industries as flour and grist milling, lumber, the manufacture of boots and shoes, clothing, cotton and woolen goods, and forged and rolled iron, as determined by the amount and value of their products, it stands next to tobacco and spirits as a special governmental resource, paying into the national treasury, in conjunction with molasses and melada, fully one sixth the total annual revenue levied as import duties.

In the United States the sugar business is both an agricultural pursuit and a manufacturing industry. Louisiana is the largest grower of sugar cane among any of the Southern States, though Texas and Florida swell the aggregate annual yield considerably. These three States during the year 1861 produced more than 191,000 tons of sugar. The pursuit of cane-growing was abandoned during the war of the Rebellion, but after its close was taken up with renewed energy, Louisiana alone producing from 1869 to 1873, 61,863 tons. The principal foreign supply of sugar is derived from Cuba. In fact, the importation from all other foreign countries together amounts to less than half of that imported from the Great Antilles. None of our other imports, excepting bullion, can approach sugar in value or quantity. In the year 1877 the quantity aggregated over a billion and a half of pounds, and had all of it been carried in American bottoms it would have greatly assisted our shipping interests. The large bulk of this trade should be commanded by American ships, because Cuba, Brazil, and Porto Rico, countries which grow nearly two thirds of the world's sugar production, are eager for improved commercial relations with the United States.

The quality of all sugar is determined by the amount of saccharine it contains. The yield of saccharine from sugar cane is much superior to the yield from any other fruit or vegetable. The amount obtained from sugar beets is next to that obtained from the cane, and hardly distinguishable from it when refined. Besides these two sources sugar is derived from dates, sorghum, maple trees, and corn. The latter is called grape sugar or glucose, of which the public has lately heard so much in connection with adulteration. It is produced by the chemical change of the starch in the Indian corn, through the action of sulphuric acid. It contains less saccharine, and is much cheaper than other sugars. There are three varieties of sugar known to commerce and readily determined by experts; *i. e.*, the Muscovado, the clayed, and the centrifugal. The first two are made according to old methods, the last is the modern improvement.

It is the purpose of this article chiefly to consider sugar as a manufacturing industry. Coming as it does in a very crude state from the plantations, intermixed with dirt, sand, bits of cane, fungus, and animalcula infinitely more repulsive than those of our midsummer croton, it has to undergo a thorough refining to throw off all these impurities and yield an article fit for commercial and domestic use. This industry utilizes the services of an army of 15,000 men; profitably employs $25,000,000 capital; and dispenses in wages $9,000,000 annually.

To illustrate the methods of sugar refining the establishment of Havemeyers & Elder, in Williamsburg, L. I., has been selected. It is not only the largest, but has the most approved methods of any refinery in operation, although most of the machinery is the same as that adopted by the largest refineries the world over.

The illustrations on the first page, if carefully studied, will impart to the reader as general a knowledge of these methods as though he himself were shown through the mammoth works by the superintendent, as the writer of this article was. It is not intended to portray every little detail of mechanism; that would require a volume. Only the most important machinery is given, such as is essential to the different processes of refining, and illustrating the important steps in these processes.

Such a refinery as Havemeyers & Elder is a world of activity in itself. Each of the many departments has its separate force of laborers, with well defined duties, working toward a common result. One becomes bewildered in the intricacies of their vast buildings. The investigator is taken two stories underground, and eight above. He walks under the street, and traverses in the departments above, 16 acres of flooring. The machines and apparatus illustrated are distributed in various parts of the refinery. Most of these are duplicated many times, and all of them only indicate the magnitude of the rooms in which they are operated.

This refinery, in common with all others, takes the "raw sugar," in all its varieties, and first of all, dissolves this crude article in large mixing vats, one of which is shown in the illustration, entitled "Melting Pan." These vats each hold 2,500 gallons. About 46 parts of water is added at a temperature of 110°, and the small engine, also seen in the illustration, performs the mixing. The raw sugar is pumped up eight stories into the heating tanks, where it is partly clarified by the introduction of an albumen, and 210° Fah. is applied to it by steam pipes running through the bottom of the tanks. If from any cause the sugar is sour, this is corrected by the use of lime water. The heated liquor is run from the tanks, and received into filter bags, arranged underneath, which strain out all dirt, sticks, and coarse impurities. The strained liquor is then run into the boneblack filter, where it comes in contact with the boneblack, and is entirely decolorized. The illustration entitled "Bone-Black Kiln" shows the vastness of the retorts necessary to reburn the large quantities of boneblack used. At this point the processes diverge for the production of Soft and Hard sugars. In the former the decolorized sugar is taken to the Vacuum Pan, shown in the center of the illustration, and is cold-boiled to a grain from 2 to 6 hours, according to the quality. Valves on the bottom of the Vacuum Pan discharge the grained liquor into large receptacles over the centrifugal machines.

These machines are among the most wonderful modern inventions for expediting the manufacture of Soft sugar. The illustration gives a good idea of them. They consist of a strong steel basket, holding 230 pounds, inside of which is a sieve, and a plate, as finely perforated as one of Edison's phonograph foils. The sieve is between the basket and the plate, to protect the latter. The whole is protected by a solid wrought iron Curb, within which the basket revolves with its contents at the rate of 1,000 revolutions per minute, and the centrifugal action forces the sirup through the perforations, which are too small for the passage of the sugar grain, into the Curb. Havemeyers & Elder have 32 of these machines in operation. The sugar after undergoing this process is emptied into wagons underneath the centrifugal machine, and dumped into bucket elevators, which run up over a powerful fan, that throws the sugar against a partition near by, and cools and mixes it at the same time, after which the sugar is ready for barreling. The cooling and barreling will be seen in the illustration.

The processes for manufacturing Hard sugar are the same up to the time the raw liquor goes into the Vacuum Pans. It is boiled in a slightly different manner. After running into a receiver from the Vacuum Pans the mass is filled into conical iron moulds, 4 feet in height and 12 inches in diameter across mouth. Each has a hole in the bottom like a flower-pot. The moulds are allowed to stand in the filling room downstairs for 12 hours, with the holes plugged up, so as to allow the sugar to cool a little, and "set." They are then hoisted up into the drying rooms, and the plugs are taken out of the bottoms. They are placed on "bedsteads" and drain. After all the sirup runs off that will, the top of the moulds are brushed smooth, and a saturated solution of white sugar and water is poured on top and percolates through the Titlers (as the contents of the moulds are called), carrying off the remaining sirup. The discolored tips are now cut off, and they are placed into large ovens, heated by steam to 110°, where they remain one week, coming out ready for the crushing, pulverizing, and sawing processes. In the former the Titlers are crushed into irregular shape; in the second, it is finely pulverized; in the saw mill the titlers, which are like columns of granite, are sawed through horizontally into wheels, laterally into strips, and then are chipped into cubes. Illustrations of these processes are shown, and sufficiently indicate the manner in which the titlers are worked up for the market.

Soft sugar, by the use of the centrifugal machine, is refined in twenty-four hours, while hard sugar requires a fortnight.

The establishment of Havemeyers & Elder has an existence of half a century. It employs 1,000 hands, and turns out a million and a quarter pounds of sugar daily. The accusation of adulteration made by certain parties against several of our largest refiners of sugar has, according to Mr. Wells' recent report on the subject, no foundation in fact. Careful tests have been made by the highest chemical authorities, which seem to verify his statement. Furthermore, the establishment described in this article invites the most thorough investigation by any competent authority.

THE BILL TO DISCOURAGE INVENTIONS.

It is doubtful whether any section of the proposed amendment of the patent law (Senate bill 300) was so generally approved by those who appeared before the Congressional Committee on Patents last winter, as section 11; a marvelous illustration, it seems to us, of the proneness of men to clutch at the nearest remedy for a present evil, without stopping to think whether the remedy may not in the end be worse than the disease.

Our readers will remember that this section introduces the principle of cumulative fees, a radical innovation in the working of the American patent system. As we have shown in previous issues of the SCIENTIFIC AMERICAN, the principle is entirely at variance with the spirit of the patent law as it has been interpreted hitherto, and one calculated to work no little harm to inventors and purchasers of patents.

A careful examination of the reasons offered, in Congress and in the Committee room, for making this change, proves them to be in reality but varying statements of one complaint, which was succinctly expressed by Mr. Christy in these words:

"After a patent has got established and become successful, it is a common thing to hunt up similar prior issues, purchase the patents, and, under the facilities afforded by law as reissues, obtain a reissue patent covering what somebody else has invented, and then sue the real inventor. This (section 11) will wipe out at least 75 per cent of that class, and then we will have a great deal less trouble from that law."

The class of patents which Mr. Christy had been speaking of were those which Mr. Raymond had described as "trivial, impractical, and invalid patents," and "those which become of value late in their existence, and then only for the purpose of infringement suits and speculations."

The advantage to be derived from officially killing "trivial, impracticable, and invalid patents," is not very apparent. Such patents must, by their very nature, be dead to begin with, so far as their possible influence is concerned. No inventor of anything that is not trivial, impractical, or invalid, is likely to be worried about them or by them. There remain a small number of patents which become, rightly or wrongly, the occasion of infringement suits and other forms of litigation, the majority of which are reissues of the sort described by Mr. Christy. These are indeed the occasion of much trouble, the desire to get rid of which furnishes the only excuse for the proposed alteration of the law.

How large is the number of such mischief-making patents?

From the noise made in certain quarters one might suppose that a patent was little else than a summons to appear in court to begin or defend an infringement suit. In reality there is no species of property about which there is proportionally so little litigation.

It was shown in the Committee room, by an advocate of section 11, Mr. Chauncy Smith, that 60 per cent of the patent litigation of the country arises upon reissued patents, while the number of patents reissued is not over 4 per cent of the whole number of patents. How enormous, then, is the proportion of patents about which there is no litigation!

There is an old and pertinent story about the killing of a fly with a sledge hammer. The fly was an annoyance, truly; the sledge hammer most effectually smashed the fly. But the avenger had no further use for his nose. Improperly reissued patents, misused for speculative purposes, are flies on the face of the patent system. Section 11 is a sledge hammer, which may hit them. Is it a fit means for accomplishing the desired end?

Mr. Christy and others say that the section will enable us to get rid of 75 per cent of the obnoxious reissues; in other words, three of the four patents in the hundred, which occasion three fifths of the patent litigation. Mr. Raymond says that a similar provision in the English patent laws annuls 75 per cent of all the patents issued. That would be a terrible blow for so small a fly!

An amendment preventing the reissue of patents "covering what somebody else has invented," in other words, more than the original patent included, would seem to be a more suitable as well as more effective remedy.

It is claimed for the proposed amendment that, at its best, or worst, it will do away with not more than three fourths of the vicious reissues; this, at the cost of, let us say, one half of all the patents issued, as the proposed section is not quite so severe in its operation as the corresponding provision of the English law.

Consider the probable effect of annulling, in their early years, one half the patents issued in this country. The majority of inventors are poor men. The majority of those who make important and valuable inventions are poor men. The majority of important and valuable inventions require more than four years, or eight years, wherein to become firmly established and commercially successful. The proposed amendment would therefore discriminate against valuable inventions quite as surely as against the trivial. The nose would be hit severely, though the fly escaped.

Consider the injustice of imposing upon all inventors heavy penalties in the form of fees, which are uncalled for in all cases, and which, in many cases, must be equivalent to the practical confiscation of the inventor's rights, simply because he happens to be poor as well as meritorious. How often it happens that an inventor dies before his invention is financially developed! Shall the United States rob his family of their only inheritance because they are not able to work it up at once, or redeem it by the payment of special taxes?

Consider the impolicy of adding to the discouragements of inventors (toiling, it may be, under privation to develop and persuade the community to use improvements which may be of enormous public benefit) by compelling them to meet such arbitrary and needless demands on pain of forfeiture of their rights.

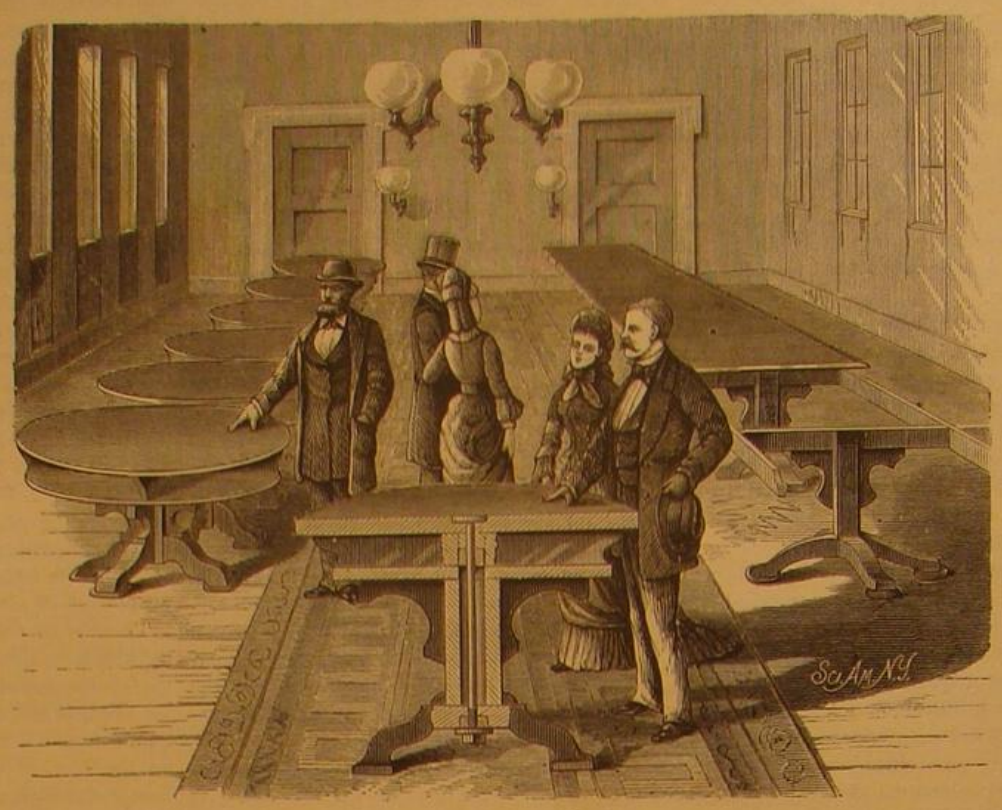
Consider, too, the door that would be opened by this section for injury to purchasers of limited patent rights, since it would make the permanence of their rights contingent upon the payment of successive fees by the inventor. As the law stands it is safe to purchase a manufacturer's or user's right under a patent for any State or locality, because a patent once issued and approved is unconditionally good for its whole period, and the buyer can estimate its value accordingly. Under the proposed amendment it would not be safe, for the inventor might, through willfulness, carelessness, or inability, neglect or fail to complete his title. The change proposed would, therefore, very seriously diminish the market value of all patented inventions the manufacture or use of which could not be monopolized by one firm, to the serious injury of a large number, perhaps the larger number, of patentees. And it would needlessly increase the risk of all who should undertake a new industry resting on such a precarious footing. Such a law might thus be fairly styled a law for the discouragement of progress in the arts.

Surely it would seem possible for Congressional wisdom to devise some plan for preventing or punishing the evil aimed at with greater certainty and with vastly less cost to the entire community.

AN IMPROVED TABLE.

The accompanying engraving represents an improved table recently patented by Mr. J. C. Melcher, of Black Jack Springs, Fayette county, Texas.

This table is designed for general use, being equally well adapted to the parlor, dining room, office, to steamboats, and to almost every other place where tables are used. Its novelty consists in features of construction which render it a very simple matter to either take it apart or put it together. This is of importance in an article of furniture as bulky as a table, especially when the matters of shipping and storage are considered. The legs cross each other at right angles, and upon them a hollow standard is placed, which is forked or slotted in two directions across the top for receiving the crosspieces, which cross each other at right angles and support the top. Below the crosspieces there is a shelf supported by brackets, which serves as a receptacle for small articles and as a supporter of the crosspieces. The brackets are fastened by an ingenious and simple arrangement of double wedges, and the top is secured by a long bolt that extends through the hollow standard and also through the legs. The construction of the table will be readily understood by reference to the sectional view in the foreground of the engraving. The long table at the right is a modification of the form just described, and is adapted to dining rooms, saloons, etc. The table is made without glue; the expense of manufacture is said to be less than that of ordinary tables. For further particulars address the inventor as above.



MELCHER'S TABLE.

Medals for Fairbanks' Scales.

Fairbanks & Co. have on exhibition in their window, No. 311 Broadway, the seven medals which they received at the Paris Exhibition, and which attract much attention from passers-by. They received five medals on scales—two gold, two silver, and one bronze; a gold medal on the type writer, and a bronze medal on oscillating pumps. They announce that they were awarded more medals than any other exhibitor at any world's fair. A recent test in Russia of their scales resulted in detecting an attempt to swindle the Saviour's Cathedral of Moscow out of $2,500, in stating that a bell weighed 64,800 lbs., when it really weighed only 59,562 lbs.

Who Invented the Torpedo Boat?

To the Editor of the Scientific American:

I notice in a recent number of the SCIENTIFIC AMERICAN an engraving of a torpedo boat recently constructed by Captain Ericsson, of which he claims being the inventor. Some 17 years since I submitted to the Naval Department plans for a torpedo boat, which I now send you for examination, and I think you will agree with me that there is great similarity between the two.

I must for the present decline making public the interior arrangements of my boat, the manner of working the spar, etc., but from what I can learn, Captain Ericsson's plans vary but little from mine.

RICHARD TEN EYCK.

New York, December 20, 1878.

[NOTE.—The accompanying engravings were made from the plans to which our correspondent refers as having been submitted by him to the Naval Department as long ago as 1861. A close similarity to the invention of Captain Ericsson, illustrated in these columns not long ago, is certainly observable; but whether the details in construction are alike or not we are unable to determine, as neither of the claimants to the invention seems inclined to make public the secrets of the internal arrangement of his craft.—ED.]

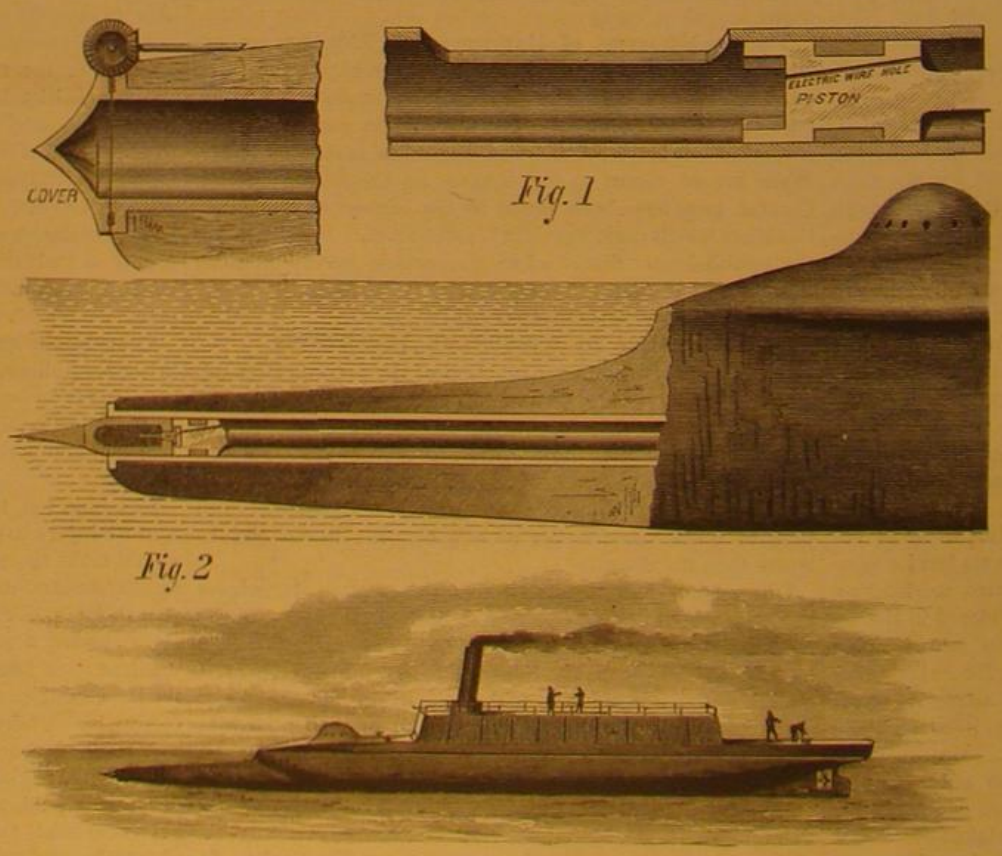


Fig. 1

Fig. 2

TEN EYCK'S TORPEDO BOAT.

The Largest Locomotive Engine.

The largest and most powerful locomotive engine ever built in this country, probably in the world, recently went West for service on a long and heavy grade on the Rocky Mountain section of the Southern Pacific Railroad. It is a 10 wheeel tank engine of consolidated pattern, having 8 driving wheels and a pony (2 wheel) truck. The cylinders measure 20 by 26 inches, and the driving wheels are but 42 inches diameter. The boiler is enormous, being straight, 58 inches diameter. It has 213 tubes, each over 11 feet long. The fire box is about 10 feet long. A water tank, almost the entire length of the boiler, rests on top of the engine, and when filled with water will add considerably to the weight. The truck wheels are 30 inches in diameter, and are of paper, with steel tires, similar to those now being used so extensively under the Pullman sleeping cars, and on the Metropolitan Elevated Railroad, New York. This engine, when in working order, will weigh 118,000 lbs. The great weight and size of the boiler and the small driving wheels combined form a tremendous power, well suited to the work the engine has to perform. The eight driving wheels are merely to distribute the weight, for if the weight rested on but four, no track ever laid could withstand the pressure. The weight is so great that the Western railroads, over which it must pass, would not permit it to go over their bridges, so it had to be taken to pieces and carried over in sections. The Pittsburg *Telegraph* says that it passed over all the bridges of the Pennsylvania road without being dismantled.

Catching Cod with Nets.

Professor Baird has made certain modifications on the Norwegian nets introduced by the United States Fish Commission at Gloucester. The latter having meshes proving too small for the purpose, Professor Baird is adopting the lake gill nets, with meshes 10 and 12 inch extension measurement, made of rather fine twine. At the first trial with the improved net, over 1,000 lbs. of cod were landed. This is the first capture of cod made with nets, as far as is known, on the coast of North America. Fishermen are, of course, very much interested, and have expressed their intention of having gangs of nets. There is no doubt that American ingenuity will very much improve on the Norwegian processes. In certain localities, by netting the fish, much larger hauls can be made, and the slower and more dangerous process of trawling can be done away with.

New Inventions.

Madame Claudine Ribod Weyer, of Lyons, France, has patented an improvement in Annealing Glass, which consists in first burying the glass when cold in powdered stone, plaster, lime, fire clay, or any substance capable of attaining the degree of heat necessary for the annealing operation and then raising it to the required temperature. The object of the process is to render articles of glass stronger and more capable of sustaining transitions of heat and cold.

Mr. William J. Hamill, of St. Catharine's, Ontario, Canada, has invented a Trotting Sulky, in which the thills are made with a bend or offset at a little distance from their rear ends. The frame is formed by the combination of the bent thills, two crossbars, the seat, the foot rests or stirrups, and the connecting braces.

Mr. Wm. H. Douty, of Shamokin, Pa., has patented a device for holding rolls of wrapping paper, so that the desired quantity may be drawn off the roll and torn from the sheet.

An improved Pump Valve has been patented by Mr. Eugene Hawkes, of San Diego, Cal. This pump valve is so constructed as to afford a direct and free passage to the water, to close quickly and with little shock or jar.

Mr. James P. Boesen, of Hoboken, N. J., has patented an improvement in that class of Line Fastenings used in connection with a line run from the window of the house to a pulley fixed outside the house, and where the clothing is strung on the line and drawn out by means of the pulley connection. The object is to enable the clothing to be hung on the line within the window, and thus avoid the danger and exposure of leaning out of the window to get at the line.

Mr. Parham B. Thaxton, of Jerseyville, Ill., has patented an improved Scraper for grading roads, lawns, etc., and for other purposes that require soil to be moved short distances. It consists of a double scoop pivoted so that one or the other of its scraping edges is always in position for use.

Mr. Charles Bellenot, of Richmond, Va., has patented an improved Sign for the class of street lamps which have separate name plates or signs (bearing the names of the streets on which the lamps are located) attached thereto.

Mr. Alphonse Bodart, of Huy, Belgium, has patented an improved Pipe Joint and Coupling, which consists in packing the joint with a leaden ring having an inner circumferential bead interposed between the two adjacent ends of the pipes, and securely packed and held in position by two external rings having an internal contour that permits the leaden ring to be wedged between it and the pipe, and securing the whole together by a hoop encircling the two iron rings, and a filling of cement on each side of the coupling.

An improved Reversible Melting Furnace has been patented by Mr. Albert Piat, of Paris, France. This is an improvement in portable and oscillating furnaces for melting metals, glass, etc. The crucibles are protected against injury from sudden changes of temperature, and the furnace may be handled with great ease. The furnace has a melting pot that is supported in an inclosing wall having detachable base portion and covers with air supply and exit holes.

Mr. Davenport Rogers, of Galion, Ohio, has patented an improved Apparatus for Separating Refined Petroleum into oils of different grades and fire tests. The object of the invention is to obtain from ordinary kerosene or refined petroleum a burning oil of less volatility, and which shall consequently give a higher flash or fire test.

Mr. Joshua Davies, of Muskegon, Mich., has devised an improved Hose Coupling, which consists in making a dovetail connection between the two parts and fastening them together by means of a flat spring working in a socket.

An improved Ruler for ruling parallel lines for section lining, and for various other purposes, has been patented by George Cousins, of Oswego, N. Y. It is simple and accurate.

M. Eugene Durand, of Paris, France, has invented an improved Machine for Cutting or Chopping Tobacco Leaf to make what is known as "picadura," such as is used in Spain, Havana, and in South America; also for cutting or chopping up herbs or medicinal plants designed to be used in the manufacture of chemical cigarettes or to be prepared for distilling purposes.

An improved Addressing Machine has been patented by Mr. John Piner, of Bonham, Texas. This invention is in

tended to furnish for newspaper offices, and business purposes in general, an addressing machine of exceedingly simple construction.

SATURATOR AND REGULATOR OF MEKARSKI'S COMPRESSED AIR MOTOR.

Many attempts have been made at locomotion by compressed air; but serious difficulties are encountered. Air absorbs heat or "produces cold," just in proportion as it produces work by its being used in a compressed state through a motor. This absorption of heat has many inconveniences. From a dynamic point of view, there is a considerable difference between the foot-pounds of work which the same amount of compressed air can furnish, according as the work is got out at a constant temperature or without addition of heat. From a physical point of view, the cooling causes the freezing of the water contained in the air, and of the oils and greases employed in the machine, and forms of the two a sort of mastic which prevents proper operation of the working parts.

All the means hitherto employed to combat these inconveniences have been so inefficacious that inventors had almost given up the idea, and, in consequence, the duty obtainable from compressed air machines remained very low. In the Mékarski system, which is illustrated in Figs. 1 and 2, these inconveniences are avoided by admitting to the driving cylinders air saturated with steam at a high temperature. This mixture is obtained by causing the air to pass, in the form of fine bubbles, through a column of hot water, inclosed in a receptacle at a temperature of about 150° to 160° C. at the commencement, and of which the volume is so calculated with respect to that of the air that the proportions of the mixture rest constant during the period of work. The proportion of vapor varies between $\frac{1}{2}$ and $\frac{1}{4}$. These conditions are easily realized; as, during the period of expenditure, the pressure of the air in the reservoir diminishes, as does also the temperature of the water; and, in consequence, the tension of its vapor diminishes in the saturating apparatus.

Fig. 1 shows part of this apparatus as applied to the platform of a locomotive driven by compressed air. It is without firebox, and is filled with hot water while the air reservoirs are being charged. After its force is spent the temperature is brought up again by an injection of steam. Coming from this reservoir, the gaseous mixture passes through the regulator, shown in Fig. 2. There is an orifice controlled by a conical valve, so arranged that it closes by the pressure of air in the reheater, and opens only when there is an opposite pressure put against it. This pressure can be produced by a flywheel connected with the piston of a small hydraulic press with air spring. The pressure is transmitted to the conical valve by a rubber diaphragm separating the two parts of the apparatus. The amount of flow being once determined, equilibrium will establish itself, when the pressures are the same above and below the diaphragm. Now the pressure above is that of the air spring of the hydraulic press;

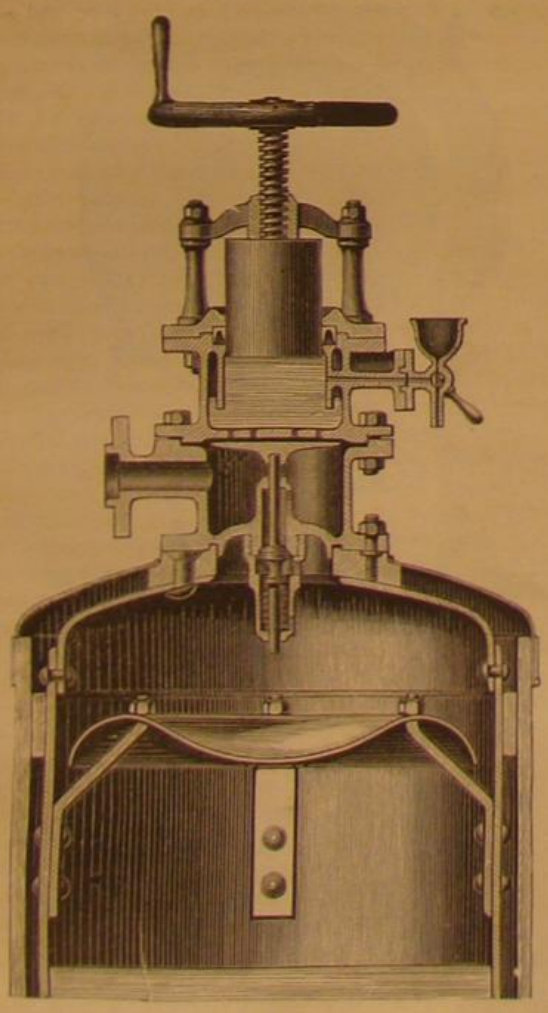
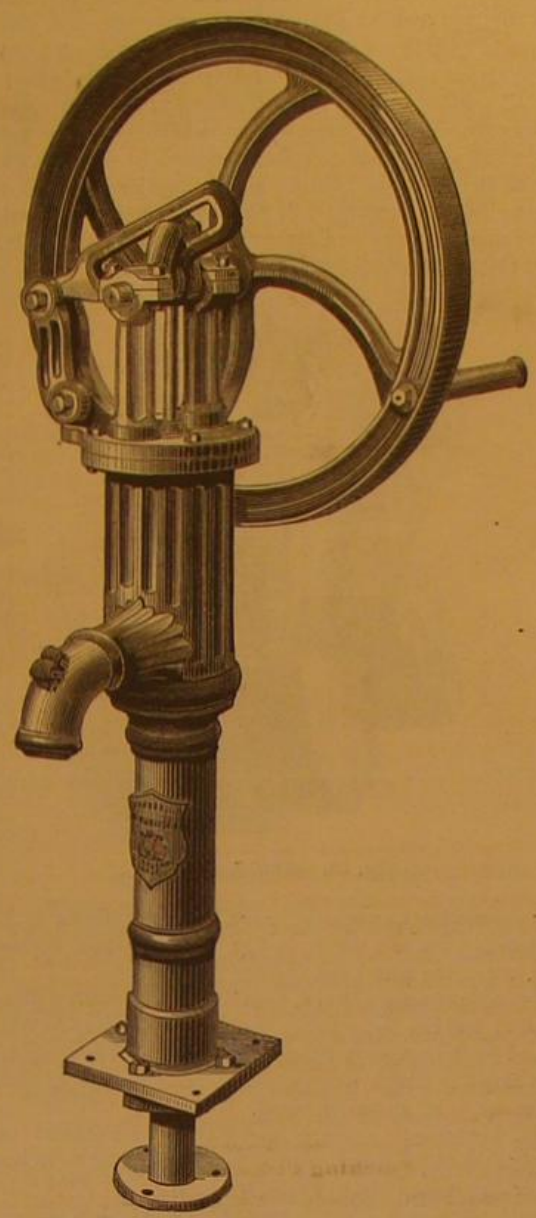


Fig. 1.—SATURATOR, MEKARSKI COMPRESSED AIR LOCOMOTIVE.

and that below is that of the supply of the gaseous mixture. This last will thus remain automatically constant as long as the air spring is kept at the same tension; and is thus varied at the will of the driver, who can compress the air spring more or less by means of the flywheel.

ROTARY LIFT PUMP.

Messrs. Henry Bamford & Sons, Uttoxeter, England, have introduced to public notice a new and improved rotary lift and force pump, for which they claim several features of importance. The engraving shows the general outline of the pump, which is strongly made and compact in all its parts.



ROTARY LIFT PUMP.

The makers state that it has a very powerful and smooth action, much more so than in any of the ordinary rotary pumps. Its specialty consists in a slow upward stroke and quick downward movement, thus equalizing the work. It has double bearings, and is adapted both for hand and steam power, to be used either for shallow or deep wells, or as a force pump. The position of the pump head is reversible, so that it may be worked on any side by hand or steam power to a depth of 25 feet. The head is arranged to form an air chamber. It is fitted with heavy flywheel, wrought iron crank and turned rod, brass stuffing box, draw-off tap, and retaining valve, screwed for iron tube. The barrels vary in diameter from 3 to 4 inches, and can be had with or without copper linings.

The Electric Light in London.

The first experiment of public lighting in London by means of electricity, commenced a short time ago at Billingsgate Market, has now received a very important extension on the Thames Embankment and the Holborn Viaduct. Between Westminster and Waterloo Bridges twenty Jablochkoff candles illuminate the Embankment and the river with a novel brilliancy, and turn the gas lamps—which perforce are kept burning—very yellow with their pure white brilliancy. On the west side of Charing Cross Railway Bridge, upon the Embankment, and about 50 yards from the river wall, a wooden shed has been erected containing the motive power and the machine. The former is supplied with one of Messrs. Ransomes, Sims & Head's semi-portable engines of 20 horse power nominal. This engine, which is an excellent example of workmanship, has two 10 inch cylinders of 13 inches stroke, and has 360 feet of heating surface. This engine is provided with a very sensitive automatic governor, and having a large margin of power beyond what is required for driving the machines now installed, is extremely well adapted for its purpose. It will, in fact, indicate from 60 to 70 horse power. At present it is worked with a steam pressure of 62 lbs., and at a speed of 140 revolutions. From the pulley on the engine a belt transmits power to an intermediate shaft mounted on a timber framing, and carrying, besides the pulley for the engine belt, two others, from one of which the Gramme continuous current machine is driven, and from the other the Gramme dividing machine. The speed at which the first machine is driven is 650 revolutions, while the dividing machine has a velocity of 700 revolutions. The current from this machine is divided into four circuits of five lights each, and the length of circuit is the greatest yet successfully reached, the furthest light being about 700 yards from the source of power, and the total distance between the extreme lights is 1,170 yards. The lamps are distributed so that there are ten between Westminster and Charing Cross Bridges, one under this bridge, and nine from this point to Waterloo. The lamps in the latter series are placed somewhat more closely together than those on the western side of Charing Cross Bridge.

Circuit No. 1 supplies the four lamps which extend from Waterloo Bridge to the Cleopatra Needle, and one on the west side of it. Circuit No. 2 provides for the remaining three lamps, east of Charing Cross Bridge, one under that bridge, and one on the west side of it. The other ten are connected with circuits 3 and 4. The wires from the machine are led underneath the road through a drain pipe into the Embankment subway. This pipe is 4 inches in diameter, and contains all the eight wires forming the four circuits. On reaching the subway the wires are taken right and left, and are attached to boards fastened to the side of the subway. Where each lamp occurs the wires are led up through the tubing let into the granite pedestal and so to the lamp. Each globe contains four candles, so as to secure a light for six hours. Circumstances rendered it necessary to place the commutator at the top of the lamp instead of near the base, a very awkward arrangement, since the attendant has now to mount a ladder to shunt the current, instead of doing so from the ground. The average distance apart of the light is 45 yards, but the spacing is irregular, the maximum distance being 120 yards between the lamp under Charing Cross Bridge and the adjacent one to it on the western side. The corresponding lamp on the eastern side is 115 yards away.

The Holborn Viaduct is illuminated by sixteen Jablochkoff candles, and are supplied from similar Gramme machines driven by a 20 horse power engine furnished by Messrs. Robey & Co. The machinery is placed in a wooden shed erected near the bridge. The wires are laid in pipes from the shed to the subway, and thence conducted to the lights. The commutators are here fixed near the ground level, a much more convenient arrangement.

The general effect produced by these lights both at the Viaduct and on the Embankment is, of course, extremely pleasing, and the contrast to the gas lamp very great. At the former place the conditions approximate to those on the Avenue de l'Opéra, in Paris, a wide street being illuminated by lamps on each side, while a good deal of reflected light is thrown from the adjacent houses. On the Embankment, however, the case is different. Here we have a single line of lamps with a great void of darkness on either side, on the one hand the river and on the other the width of the Embankment. Much of the available light is, therefore, lost, and all that radiated from the upper portion of the globes is distributed skywards, as is visible by the glow with which the air is filled for a considerable height above the ground, and more clearly by the bright illumination of the underside of the bridge. Probably when some alteration in this respect has been made, a considerable improvement will be obtained. Meantime the result can hardly be considered as highly satisfactory, more especially as an irregularity or pulsation in the light given, is too often noticeable. Possibly this defect may be overcome shortly, since at present the installation has scarcely passed out of the experimental stage. That

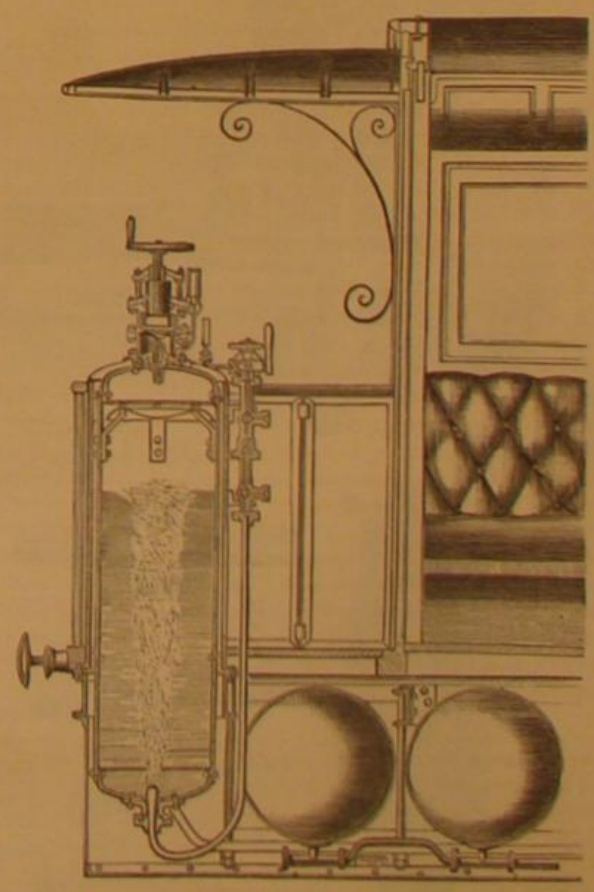


Fig. 2.—REGULATOR, MEKARSKI COMPRESSED AIR LOCOMOTIVE.

it must be overcome is certain before the light can be regarded as a success, and that this is possible appears evident from the good results obtained in many places.

When this has been satisfactorily adjusted, there will remain the important question of cost, and this question, which

has never yet been clearly answered, will doubtless receive the careful attention of the Board of Works. That it will cost far more than the present illumination of the Thames Embankment is clear, since at present the electric light there is actually supplementary to the gas lamps, still kept burning, and necessarily so. When the cost has been ascertained, two points will present themselves for consideration: first, whether the luxury of an increased light is worth paying for, and second, whether for the same extra expense an equal and better diffused light cannot be obtained by gas. Meanwhile we are glad to see that in many directions, both in the metropolis and the provinces, a wide experience will be gained in the course of the next few months with the electric light, especially with the Jablochkoff system, which for the present appears to be the most suitable for general lighting purposes that has yet been introduced.

We should not omit to mention that the installations both on the Viaduct and the Embankment have been thoroughly carried out by Messrs. Wells & Co., of Shoreditch, under the superintendence of M. J. A. Berley, the representative of the Société Générale d'Electricité, at Paris.—*Engineering.*

AMATEUR MECHANICS.

CHUCKING.

In spite of all possible appliances to be used in a general way for chucking work in the lathe, a degree of inventive skill is often required to accomplish it quickly and securely.

The accompanying cuts are designed to aid the amateur in chucking, but after all is said, there is a world of knowledge that can be gained by experience only.

The arrangement of a metal disk in the lathe so that it can be turned on its face, and upon its edge, cannot well be accomplished by means of chucks; for this purpose recourse is frequently had to cement. A good cement for this purpose consists of Burgundy pitch, 2 pounds; resin, 2 pounds; yellow wax, 2 ounces; dried whiting, 2 pounds; melt together the pitch, resin, and wax, and stir in the whiting.

To chuck work with this cement, apply a small portion of it to a face plate devoted especially to this purpose; heat the plate so that the cement will cover the greater portion of its surface. The plate may be allowed to cool. Whenever it is desirable to chuck a metallic disk, it is heated and placed against the cement on the face plate, and allowed to remain until the cement begins to stiffen, when a tool having a right-angled notch is applied to the edge of the disk, as shown in the cut, the lathe being rotated until, by the compound action of the tool pressure and the rotary motion, the disk becomes perfectly true.

To chuck a spindle or any similar object a cement chuck like that shown in section in Fig. 2 is sometimes used. The larger portion is screwed on the lathe mandrel, and the inner end of the hole in the outer portion terminates conically. The hole is filled with cement, and the article to be chucked is warmed and introduced. It may sometimes be necessary to heat the chuck with an alcohol or gas flame. The lathe is rotated and the spindle is held lightly until it becomes true and the cement begins to harden.

To remove the work from a cement chuck, it must be warmed by means of a lamp or otherwise. Most of the cement adhering to the work may be wiped off after heating it; whatever remains may be removed with a little turpentine.

A common method of chucking work on the face plate is shown in Fig. 3; the wheel is temporarily retained in place by a pointed rod, A, which is forced against the wheel by the tail spindle. A little rapping one way or the other readily centers the wheel. A piece of crayon held in a crayon holder supported by the tool rest may be used to discover which side of the wheel is "out." After the wheel is trued, it is fastened by the short bars, B, whose outer ends rest upon any convenient blocking while they are drawn by the bolts, so as to clamp the wheel firmly to the face plate.

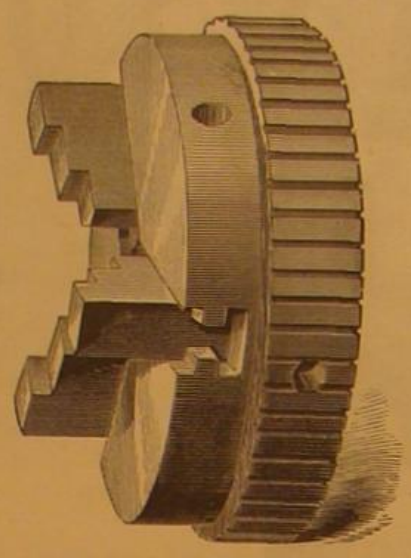


Fig. 14.—SCROLL CHUCK.

It is sometimes preferable to use the yoke shown in Fig. 4 instead of the bars shown in Fig. 3; it is placed diametrically across the wheel and secured by two bolts.

Fig. 5 represents a chuck, consisting of a wooden disk, *c*, bored to receive the wooden hoop, *d*, which may be forced inward by the common wood screws, *e*, which bear upon it. This chuck is useful where a considerable number of similar pieces are to be turned or bored.

Fig. 6 represents a simple and well known chuck. It is simply a block of wood secured to a face plate by a screw center and turned out to fit the work.

Fig. 7 represents an easily made chuck, which is useful for holding plugs of wood to be turned or bored. It consists of a piece of hard wood fitted to the mandrel, turned, bored, and split longitudinally, as shown in the engraving. Its outer end is tapered, and to it is fitted a metallic ring that serves to contract the chuck when it is forced on.

Fig. 8 represents a tapered and split mandrel, which may be either of metal or wood according to the purpose to which it is to be applied. The part F is bored conically at the smaller end before splitting, and to this hole is fitted the conical plug, G, which being forced in expands the mandrel.

In Fig. 9 the mandrel, C, has permanently attached to it the cone, D, and upon it is placed the movable cone, E, which is forced against the work held between the two cones by a nut which turns on the threaded end of the mandrel.

In Fig. 10 the manner of chucking work on the angle plate, H, is shown so clearly as to require no explanation. It may be well, however, to state that when the work is rotated rapidly a counterbalance should be attached to the face plate on the side diametrically opposite the angle plate.

Fig. 11 shows a jaw for attachment to the face plate, which consists of a right angled piece, I, a jaw, J, which has two guide pins, entering holes in the piece, I, and the screw, K, which passes through a tapped hole in the piece, I, and bears against the jaw, J. The piece, I, has a dowel, *a*, that keeps it from turning, and a screw, *b*, by which it is secured to the face plate.

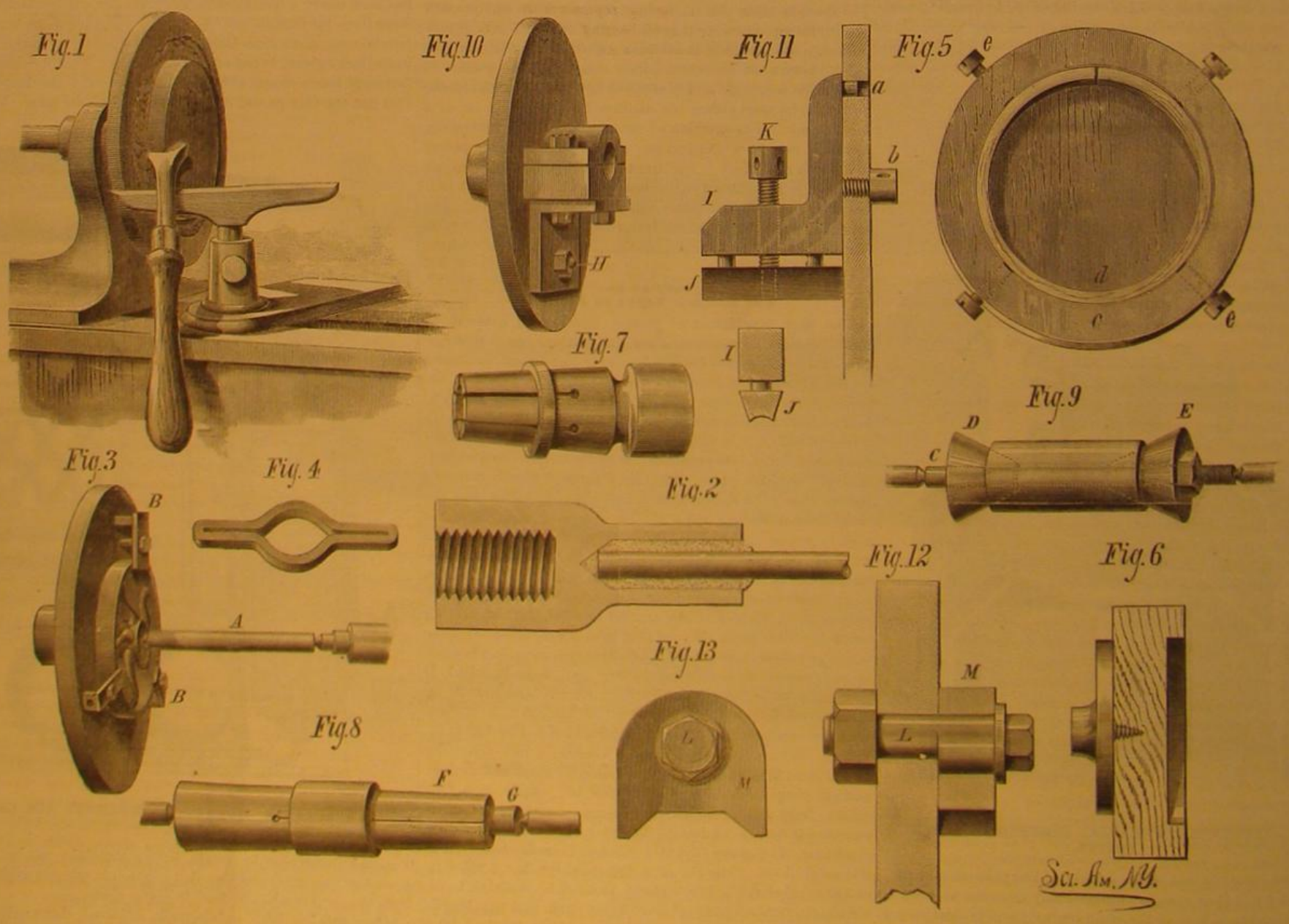
In Figs. 12 and 13 the pin, L, is fitted to the face plate, and has formed on its projecting end an eccentric which fits the jaw, M. It has also a hexagonal head for receiving the wrench by which it is turned. Three pins, L, are fitted to the face plate, which is quite thick. Two of the pins need not be turned after being adjusted for a certain kind of work; the third is loosened and turned when work is put in and taken out of the lathe. After the work is clamped tightly by turning the eccentric the nut on the back of the face plate is tightened.

In Fig. 14 is shown a type of the most convenient and most universally useful chuck in existence. Its construction and use are so well known as to need no description.

M.

Kerosene Dangers.

A correspondent mentions a source of danger in the use of kerosene lamps which seems to have been generally overlooked, namely the habit of allowing lamps to stand near hot stoves, on mantelpieces, and in other places where they become heated sufficiently to convert the oil into gas. Not unfrequently persons engaged in cooking or other work about the stove will stand the lamp on an adjacent mantelpiece, or even on the top of a raised oven; or when ironing will set the lamp near the stand on which the heated iron rests. It is needless to enlarge upon the risky character of such practices.



CHUCKS AND METHODS OF CHUCKING.

The Microphone.

Thomas S. Tait, of Baroda, India, communicates to *Nature* a suggestion as to new uses for the microphone. Two subjects of interest in connection with the practical application of the microphone have lately been brought to my notice, says the writer, by Raja Sir T. Madava Row, K.C.S.I., Dewan of Baroda. In the hope of securing a little assistance from some of your scientific readers I hasten to lay them before you.

The first question is with reference to the use of a microphone as a stethoscope. It seems that native ladies of high position decline altogether to allow a doctor to examine the chest in the ordinary manner. Sooner than submit to such an examination they would prefer to die—certainly rather a staggering fact for those imbued with European ideas. In the cause of humanity it is therefore desirable to do something for those whose position and caste would be imperiled by direct examination. If the microphone could be so delicately arranged as to transmit the auscultatory sounds, a medical ear, even at a distance, would surely be able to detect the existence of any disease of the heart or lungs. In the few experiments that we have made with our limited appliances we have been able to hear the ticking of a watch at a distance of about 200 yards, and the roar of a black ant when attacked by his companion, but as yet we have heard no internal sounds from the human breast. Perhaps with better devised instruments some one may have been able to obtain that which has yet been denied to us. I am sure many native ladies would be glad to get an affirmative answer to the question, "Can the microphone be used as a stethoscope?"

The second subject seems to be a more difficult one to grapple with:

"In the undulating region of Travancore, where the water bearing strata heave and fall according to the locality concerned, I have come across a set of professional men who are generally consulted by those who wish to sink wells in view to ascertain whether, at a given spot, a well may be sunk with the probability of finding water near enough. These professional men undertake to predict where the springs will be found near, and where they will be found at great depth, and their predictions are generally verified with great accuracy. I took some trouble to ascertain how these men are enabled to predict the proximity, or otherwise, of the springs underground. Brushing aside the ceremonies and incantations they perform in view to deceive others and perhaps themselves also, I found that they detect the proximity of the subterranean springs by lying down on the bare ground in the dead silence of night, with the ear in contact with the ground, and trying to hear the sound of the flow of water in the strata beneath. By practice the ear is made very sensitive, and the degree of distinctness with which they hear the sound of flowing water enables them approximately to predict the depth of the springs. It is in this manner that appropriate spots are selected for sinking wells.

"Now, would any of the instruments you are experimenting with magnify the sound of the subterranean flow of water so as to greatly facilitate the process I have described? If so, it may be a considerable practical gain."

To this query I have hitherto been able to return no other answer than a negative one. Both the subjects are practical ones, and I only hope that there will be before long some light cast upon them.

Le Conte's Theory of Mountain Formation.

Dr. Joseph Le Conte, in his "Elements of Geology," lately published, gives a very complete theory of mountain formation, based upon the supposition that the earth is solid.

The earth is regarded as made up of concentric isothermal shells, each cooling by conduction to the next outer, and the outermost by radiation into space. For a long time the outermost would cool fastest. But a time would come when the outermost would become of a nearly fixed temperature, receiving heat from external and internal sources, while the interior would still continue to cool by conduction. The interior, because cooling faster, and also because the amount of contraction for equal cooling is greater at high than at low temperature, would contract faster than the exterior. The interior would tend therefore to shrink away from the exterior, which, following it down, would be subjected to powerful horizontal pressure, and must finally yield somewhere. Mountain chains are the lines along which the yielding of the surface to horizontal thrust has taken place. This yielding is not by upbending into an arch, leaving a hollow space beneath, nor yet into such an arch, filled and supported by an interior liquid, as usually supposed; but by mashing or crushing together horizontally, like dough or plastic clay, with foldings of the strata, and an upswelling and thickening of the whole squeezed mass.

The theory here presented accounts for all the principal facts associated in mountain chains. This is the true test of its general truth. It explains satisfactorily the following facts: 1. The most usual position of mountain chains on the borders of continents. 2. When there are several ranges belonging to one system, these have been formed successively coastward. 3. Mountain chains are masses of immensely thick sediments. 4. The strata of which mountain chains are composed, are strongly folded, and, where the materials are suitable, are affected with slaty cleavage; both the folds and the cleavage being usually parallel to the chain. 5. The strata of mountain chains are usually affected with metamorphism, which is great in proportion to the height of the chain and the complexity of the foldings. 6. Great fissure eruptions and volcanoes are usually associated with mountain chains. 7. Many other minor phenomena, such as fissures, slips, and earthquakes, it equally accounts for.

A NOVEL BRIDLE BIT.

We illustrate herewith a novel bridle bit recently patented by Dr. J. G. Peterson, of Morganton, N. C. It consists of a single piece of steel wire doubled and bent at right angles with the bar and twisted together, as clearly shown in the engraving. An expert blacksmith can make these bits very rapidly, as no forging is required; and the bit, when finished, is very strong, and is claimed to be equal if not superior to the more expensive kind.

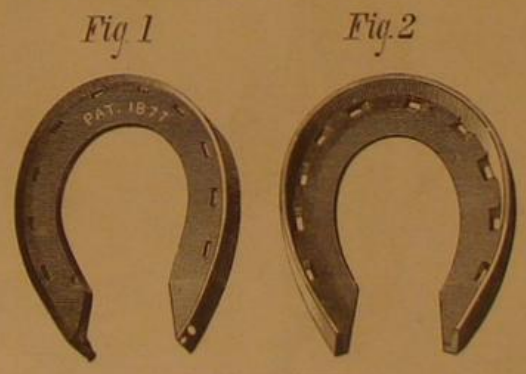
PETERSON'S BIT.

It is said that Americans can make anything out of wire; this bit is another example that goes to prove the statement true. Further particulars may be obtained by addressing J. G. Peterson, M. D., as above.

A NEW CONTINUOUS CALK HORSESHOE.

When a prominent horseman states that in the city of New York there are not ten horses in a hundred that have been upon our street pavements one year that have sound feet, and when eminent veterinary surgeons say that nearly all of their business comes from the present mode of shoeing horses, it becomes a matter of serious consideration to owners of horses to know whether there is a way of avoiding the evil. The remedy seems to lie in the adoption of a shoe of standard form adapted to the peculiarities of the horse's foot and capable of being easily applied by any blacksmith. A shoe which, we are informed, fulfills all requirements has been recently patented by Mr. John D. Billings, and is manufactured by the John D. Billings Patent Horseshoe Company, 265 Broadway, New York.

Fig. 1, in the engraving, represents the shoe as seen from the top, showing a level bearing surface. Fig. 2 shows the under or calk side of the shoe.



BILLINGS' HORSESHOE.

This shoe is made from an L shaped bar of steel, the steel being, by a patented process of manufacture, completely enveloped in a coating of tough iron, which renders it capable of being bent hot or cold, and imparts to it the desirable qualities of lightness, strength, durability, and elasticity. The bars being cut into suitable lengths and the ends of the pieces sheared off, they are then bent into shape around forms or dies made from drawings of the foot; the nail holes are then punched, and the shoe is complete.

The shoe has a continuous calk, which is similar in form to the crust or wall of the hoof, and is, therefore, the most natural, and, as stated by the manufacturers, the most efficient shape for a horseshoe. The upper surface of the shoe has a narrow beveled edge or rim, which takes the place of the clip in the ordinary shoe.

It is stated that the peculiar form of the shoe adapts it to all kinds and conditions of feet. The manufacturers state that it has cured tender feet, when existing, in every instance where the shoe has been tried; and the change which takes place in the tender footed animal, that has had an old shoe replaced by this, is said to be quite remarkable. While formerly he gave expression to the uneasiness and pain from which he suffered, by frequently shifting his weight alternately from one foot to the other, with the new shoe he stood squarely upon his feet without a sign of discomfort, showing clearly that he was at his ease.

The many advantages claimed for this shoe cannot be well enumerated here, but we are informed by thema nufacturers that it is largely in use, and is giving excellent satisfaction.

Correspondence.

The Black Spot of Jupiter's Disk.

To the Editor of the Scientific American:

The call for information through your columns relative to the black spot on Jupiter's disk seems to elicit but little attention. In the last number of the SCIENTIFIC AMERICAN I notice that Mr. R. D. Schimpff, in reply to Mr. Eadie, says that "it was unquestionably the shadow of one of Jupiter's moons," from which any reader would infer that it could not possibly be anything else. By reference to any good work on astronomy, it will be seen that both bright and dark spots have been observed in Jupiter's belt at irregular intervals for the last two centuries. It was by watching these that the rotation of the planet on its axis was ascertained. One of these spots, first noticed in 1665, disappeared and reappeared regularly in the same form for more than 40 years.

On the night of August 23, the writer, while watching a transit of one of Jupiter's satellites, noticed the appearance of the black spot above mentioned. It came into view at 8:54 P.M., some time before the shadow of the moon had left the planet, and disappeared at 12:13. The next night at 8 P.M. it was plainly visible near the middle of the northern belt, the planet having made about 2 3-10 revolutions. On the night of the 10th inst. I saw it again. It is distinguishable from the shadow of a satellite by being both larger and darker, in fact black. As to what it is, or the cause of its existence, we do not pretend to say, but we do say that it is a veritable spot, and by no means the first one ever seen.

A. S. HOWREN.

Corsicana, Texas, Nov. 23, 1878.

Shifting of the Grain Belt.

The Bureau of Agriculture furnishes some very interesting tables, illustrating the westward movement of the centers of grain production. The product of wheat per capita, in New England, has fallen between 1849 and 1877 from four tenths to three tenths. In the same period in the Southern and South Atlantic States, the per capita has risen from 2·38 bushels to 6·11 bushels, so that those States, from buyers, have become sellers of wheat. In the Ohio and trans-Mississippi States, in the same period, the per capita produced has increased from 12·65 bushels to 30·49, and in the Pacific States from 2·16 bushels to 27·49 bushels. The wheat crop of 1849 was 100,485,944 bushels, divided into equal volumes by the lines of 81° west from Greenwich. In 1877 the crop was 365,094,800 bushels, and the center line of production the meridian of 89° 6′ west. In 1849 the corn product was 591,071,104 bushels, and the central line in the 85° west longitude. In 1877 the corn product was 1,342,558,000 bushels, and the center line 89° 6′. In 28 years the movement westward has been: for wheat, 8° 6′ (about 500 miles), or from the eastern line of Ohio nearly to the center of Illinois; for corn, 4° 6′ (250 miles), or from the eastern line of counties in Indiana nearly to the longitude of Cairo.

The Antiquity of Weaving.

The earliest records of the art of weaving are to be found in the Old Testament. Pharaoh arrayed Joseph in "vestures of fine linen," and Job lamented that his days were swifter than the weaver's shuttle, the use of the simile proving that the shuttle was a common and well known object at the time. Portions of woven cloth and a weaver's shuttle have been found among the remains of the Lake dwellings, and as the latter are believed to belong to the stone age, the origin of the art may possibly have been nearly coincident with the existence of man. Few if any savage races have been discovered altogether ignorant of the art, and many of them have brought it to a considerable degree of perfection; while the relics of the ancient Peruvians and Egyptians show that they were skilled weavers. Some fragments of Egyptian cloth were found on examination to be woven with threads of about 100 hanks to the pound, with 140 threads to the inch in the warp, and 64 in the woof. Although the art was practiced extensively, and with no mean skill, in very ancient times, it progressed slowly and gradually—by small steps at long intervals. The great advances in the art of weaving have been made during the past 300 years, mainly during the past century.

New Coral Beds Near Sicily.

During the past year a new and valuable coral bed was discovered on the southwest of Sicily, between Sciacca and Porto Empedocle. The coral is not only abundant, but of excellent quality. One coral merchant of Torre del Greco, having fifty barks employed on the bed, secured in a few days ten tons of coral of the very finest quality. The Algerian coral grounds have been nearly deserted on account of the new finds.

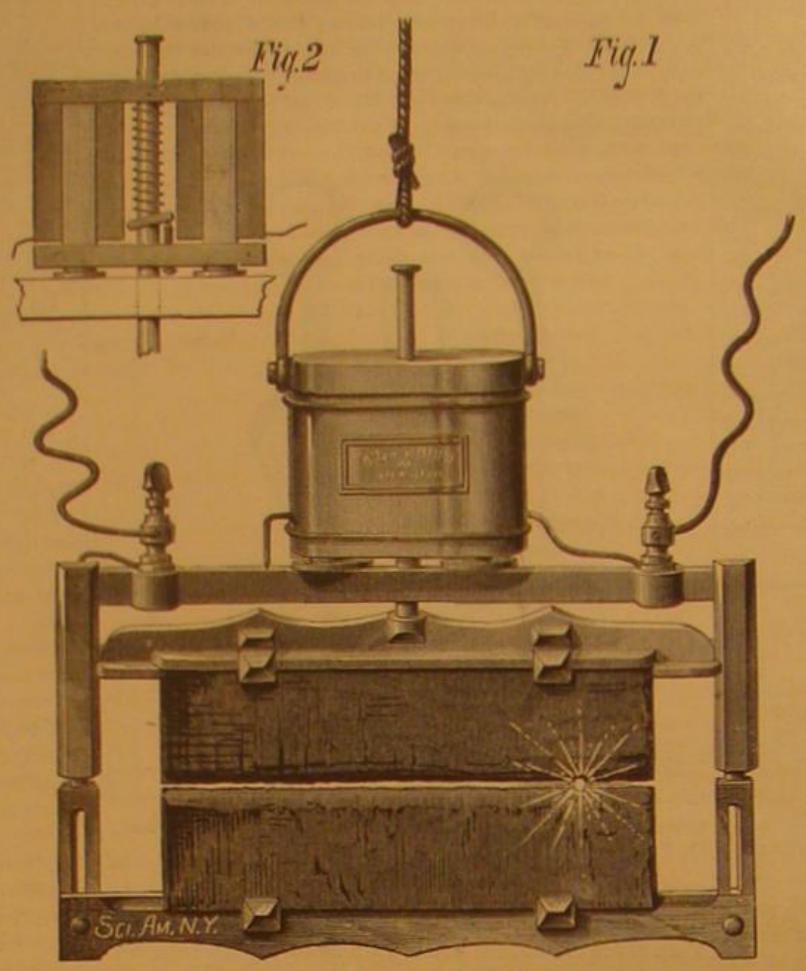
Military Improvements Wanted.

The Board on Army Equipment, in session in Washington, invites brief communications from persons in the military service regarding any improvements that can be made in the general equipment of troops, which have been suggested by observation and experience, and requests inventors and manufacturers to send to the Board samples, accompanied by drawings and specifications, of any improvements made in the equipment of troops, keeping in view the lessening of weight to be carried by the soldier, increasing his efficiency, and at the same time preserving and increasing the durability of the articles to be used.

THE WALLACE-FARMER ELECTRIC LIGHT.

The Wallace-Farmer system of electric lighting has been brought prominently forward in England within the last few weeks, and is quietly being pushed forward in this country. The lamp, which is the subject of the accompanying illustration—Fig. 1 being a perspective view and Fig. 2 a sectional view of the magnet—consists of a metal frame of brass, fitted with terminals for the current, as shown. This frame carries the two gas carbons forming the electric wick. These carbons are in the form of short rods or slabs about 9 inches long by 3 inches broad, the upper, or positive, being about half an inch thick, and the lower, or negative, being only about a quarter of an inch thick. The lower carbon is fixed to the bottom of the frame, and the upper is carried by a crosspiece, which can slide up or down in grooves in the sides of the frame. The upper carbon is therefore movable, and can be drawn apart from the lower one to any adjusted distance, say one eighth of an inch, so as to determine the luminous arc. When the lamp is not in use, this upper carbon is let down into contact with the lower one, and rests upon it; but the act of putting on the current raises the upper carbon one eighth of an inch and establishes the light. This is effected by means of an ingenious electro-magnetic contrivance, supported above the frame and shown in Fig. 2. The vertical stem, which is fixed to the sliding crosspiece carrying the upper carbon, passes between the two bobbins of a double poled electro-magnet, shown in section. This magnet is inverted, the free poles and movable armature being undermost. This armature, which is perforated to allow the stem to pass through it, carries a screw, which, when the armature is attracted upward by the current, tilts a small metal ring, or washer, hung from a spiral spring, and inclosing the stem into an inclined position, so that it jams the stem tight and holds it fast in the manner delineated. The first act of the current, then, after it is put on, is to attract the armature until it jams the stem attached to the upper carbon, and the armature being further attracted into contact with the poles of the electro-magnet, it lifts the stem with it, and raises the upper carbon plate until its lower edge is about one eighth of an inch above the upper edge of the lower plate. The arc then either establishes itself at the points of least resistance between the two carbons, or it may be established at any place desired, say at one corner, by inserting a metal conductor for a moment between the two carbon edges. The arc once started continues to subsist at that point until the consumption of carbon widens it to such a degree that a shorter and less resisting path for the current is to be found at a neighboring point. The current then chooses this point, and the arc is established there, until waste of the carbons causes it to shift its place as before. In this way the arc travels slowly along the whole edge of the carbons, and when it reaches the other end it turns and comes back again. For 100 hours the light can, in this way, be maintained without change of carbons and at a cost of about two cents per hour per lamp for the latter. When the current is cut off, the armature falls away from the poles of the electro-magnet, the screw releases the clamping washer, the vertical stem is freed, and the upper carbon drops down into contact with the lower carbon. When the distance between the carbons becomes at any time too great and the current is enfeebled, the armature will of itself fall away from the poles, and the carbons will close up to each other in this manner. This causes the current to regain its full strength, and the armature being again raised, the upper carbon is again withdrawn from the lower and clamped, and the light thus restored automatically.

It will be understood from our description that the upper carbon cannot be withdrawn in this manner from the lower one to a distance over one eighth of an inch, the determined range through which the armature can move. Thus, however much the carbons may have been wasted away, at the resetting of the arc they are always withdrawn one eighth of an inch apart.

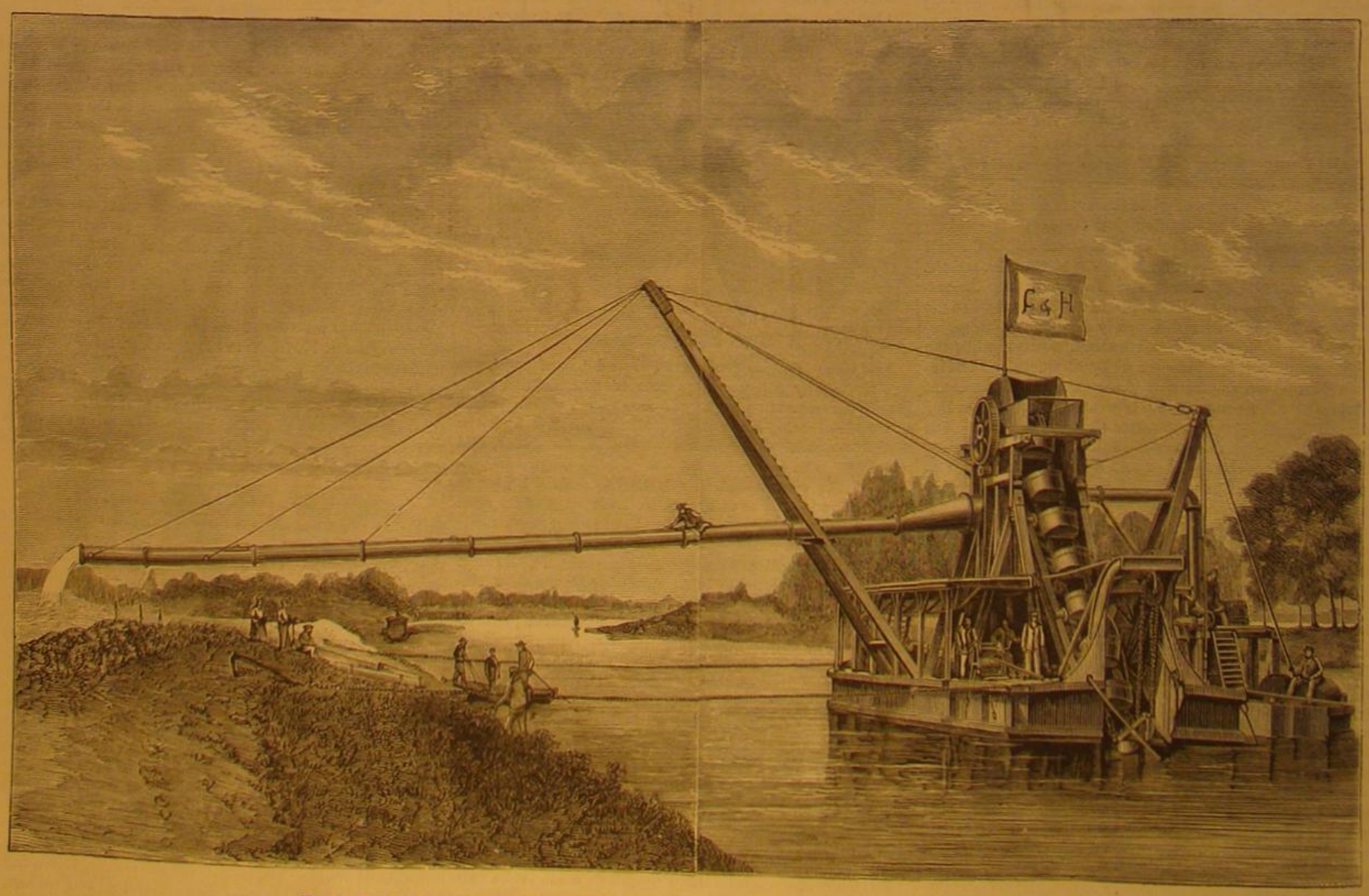


THE WALLACE-FARMER ELECTRIC LAMP.

EXCAVATOR ON THE GHENT AND TERNEUZEN SHIP CANAL, BELGIUM.

The floating dredgers employed in making the excavations on the Ghent and Terneuzen ship canal are 88 feet 7 inches long, 19 feet 8 inches wide, and 7 feet 9 inches deep; the arm is 39 feet 4 inches long, and passes through the hull. The axis of the driving wheel of the bucket chain is 26 feet 3 inches above the water level. A simple conductor has been used by which the sand and mud excavated can be delivered at a point 140 feet and 150 feet from the dredge and at a height of 13 feet above the water line. The excavated materials fall into the concave conductor, 6 feet below the point of their discharge, and, on falling, they encounter the action of a stream of water which is constantly pumped along the conductor, and by which they are converted into semi-liquid mud; the slope of the conductors is generally 1 in 2,000; it is supported by cables attached to a staging connected with the framing of the dredge, and the base of which rests on the deck of the vessel; the conductor is counterbalanced by a platform, on which is placed the portable engine and pump used for lifting the water into the conductor. This platform is suspended to the dredge in the same manner as the conductor itself, and the general arrangement is shown in the engraving. The supply and the maximum incline depend on the facility of disintegrating the ground, and on the quantity of water contained in the mixture. The proportions generally used are three parts of water to one of sand.

The floating excavators are placed on two hulls, carrying an iron framework on which is mounted the staging supporting the bucket wheel. The engines and boilers are installed in one of the hulls, and in the other is placed the pump and engine for driving it. The upper level of the conductor is 78 inches below the bucket wheel. The con-



EXCAVATOR ON THE GHENT AND TERNEUZEN SHIP CANAL BELGIUM.

ductor, 100 feet in length, is of the section corresponding to that of the buckets, 17¾ inches in diameter. It is supported by three cables attached to a staging, resting on the boat and secured to the bucket wheel frame. The slope is 1 in 400, which allows the material to be deposited at a level 22 feet 8 inches above that of the water.

The position of the depots often involves the necessity of transporting the dredged material to distances of 1,200 feet or 1,500 feet from the excavator. In such cases supplementary conductors are added. These are open, and are laid on the ground with a slope of 1 in 1,000. When this mode of transport cannot be adopted, barges are employed to receive the dredged material and remove it to convenient points of discharge.

The contractors for this work have adopted an arrangement which consists of a system of pipes with flexible joints floating on the surface of the water, and connected at one end with a well in the excavator, into which is discharged the dredged material mixed with water to reduce it to the desired consistency, and at the other end with a conduit on the bank where the contents are discharged. This arrangement, only recently adopted, has given every satisfaction.

THE PENCILED EAR HOG.

The Red River hog was described for the first time in the year 1848, by Professor H. Schinz, in his book on mammals as *Sus penicillatus*. Two years later a living specimen was brought to Liverpool from the River Comoro, and was bought in September, 1852, by the Zoological Society of London for their gardens. Mr. J. E. Gray described it in the "Annals of Natural History," in 1852, under the name of *Chœropotamus pictus*. As he, however, soon afterward found out that Cuvier had already given this to a fossil member of the hog family, he changed the original description to *Potamochœrus*. The *Potamochœrus pictus* and *Sus penicillatus* are one and the same animal, which Gray has established without doubt in the "Annals" of the year 1855, and the name "penciled siver hog" has remained as a generic title. The color of the "penciled ear hog" varies very much, and Du Chaillu has met with a white-faced one, which Dr. Gray has declared to be simply a variety of the species.

Milk Snake Swallowing a Striped Snake.

Mr. John M. Howey, of Canandaigua, N. Y., states that, in last August, while mowing out fence corners with a scythe, a milk snake (*Ophibolus*) started out of the grass in front of him. He struck it and cut it into two parts, the scythe passing within about three inches of its head. "Imagine," he says, "my surprise when a tail stuck out of the wound. I pulled it out and found it to be a snake of the common 'striped' variety (*Eutænia*), and about two thirds as long as the milk snake. It had, of course, been swallowed head first, and the head was nearly digested."

American Dinosaurs.

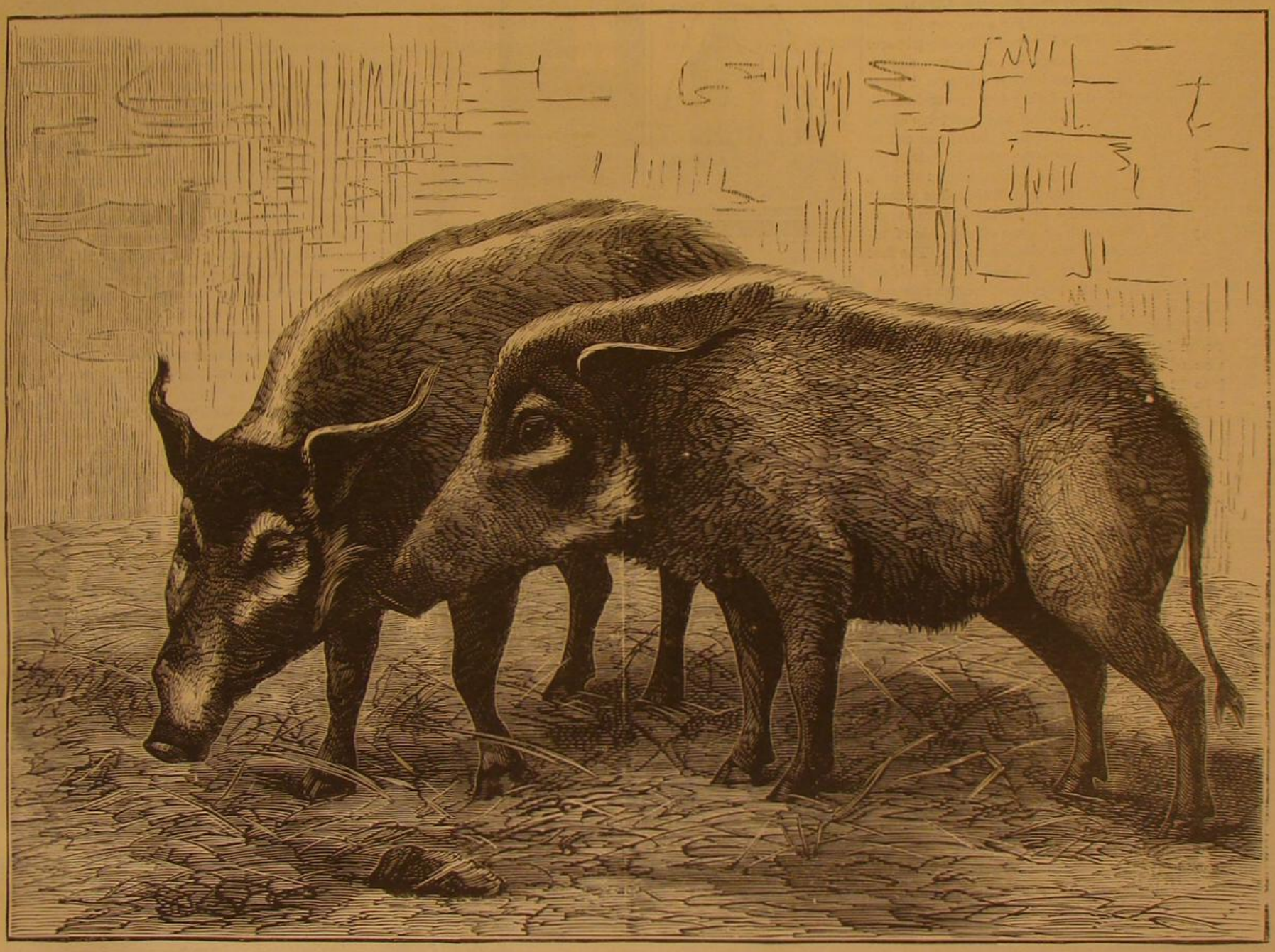
On the flanks of the Rocky Mountains a narrow belt can be traced for several hundred miles, which is always marked by the bones of gigantic dinosaurs. The strata consist mainly of estuary deposits of shale and sandstone, and the horizon is clearly Upper Jurassic; the dinosaurian remains in this series of strata are mostly of enormous size, and indicate the largest land animals hitherto known. One new species (*Atlantosaurus immanis*) must have been at least 80 feet in length, and several others nearly equaled it in bulk. With these monsters occur the most diminutive dinosaurs yet found, one (*Nanosaurus*) not being larger than a cat. Some of these new forms differ so widely from typical dinosauria that Professor Marsh has established a new sub-order to receive them, called *Sauropida*, from the general character of the feet. They are the least specialized forms of the order, and in some of their characters show such an approach to the Mesozoic crocodiles as to suggest a common ancestry at no very remote period. In them the front and hind limbs are nearly equal in size; the feet are plantigrade, with five toes on each foot. The carpal and tarsal bones are distinct; the precaudal vertebræ contain large, apparently pneumatic cavities; the sacral vertebræ do not exceed four, and each supports its own transverse process. The pubic bones unite in front by a ventral symphysis; the limb bones are solid. One of the species described and partly figured in Professor Marsh's paper, in the *American Journal of Science and Arts*, for November, is called *Morosaurus grandis;* when alive it was about 40 feet in length; it walked on all four legs, was probably very sluggish in its movements, and had a brain proportionately smaller than any known vertebrate

Cattle Raising in Montana.

While Montana is chiefly noted for its mineral wealth, it is claimed that not a little of its future glory will result from its value as a grazing country. The winters are long, yet horses, sheep, and cattle find subsistence on the nutritious grasses for which the Montana valleys are remarkable, and almost without care or attention. In the assessment for 1877 the enumeration of cattle was 182,659 head, all ages, valued at more than $2,000,000. To this amount must be added fully 50 per centum for 1878, and then far less than the real value will be covered.

A writer, who professes to be personally acquainted with the business, says that there are not less than 300,000 head of cattle now in the territory. There are several herds numbering from 3,000 to 5,000 head, and one now reaches fully 7,000 head. The average increase ought to be 80 per centum of the number of cows, but one third probably comes nearer the general increase. Four-year-old steers are considered beeves and 25,000 have been driven out of the Territory this year. Montana beef will soon take rank among the staple meats of the Eastern markets.

In making purchases for stocking a ranch a cow and calf would count as one, a yearling one, two-year-old one, and sometimes in making large purchases three-year-olds are included, and the whole would cost from $13 to $15 a head. If there were many of the three-year-olds this last price would be demanded. Beeves readily sell for $25. The larger the herd, the less the proportionate cost of keeping. In one case 50 cents a head a year will fully cover the cost, including taxes, but 75 cents would be nearer the truth generally. The grand "round up" for about six weeks in the spring and one month during the autumn, when the assorting takes place and the calves are branded, is the chief item of expense. Two years ago a gentleman bought 500 or 600 head of yearling steers at an average cost of $9 each. They were kept near his sheep range, and the expense of keeping was not more than $2 per head. They sold readily this year at $25 each, leaving a clear profit of not less than $14 a head. The profits resulting from this industry, at the lowest possible estimate, are more than 2 per centum a month on the capital invested. Indeed, many persons have borrowed money at that rate of interest and still made a handsome profit.



PENCILED EAR PIGS AT THE ZOOLOGICAL GARDENS, REGENT'S PARK, LONDON.

Popular Errors Regarding Papyrus.

In Adams' "Roman Antiquities" the Egyptian papyrus plant is described as about ten cubits high, and as having several coats or skins one above another like an onion, which coats were peeled off with a pin in the process of paper making. In Smith's "Dictionary of Greek and Roman Antiquities," it is said that the papyrus tree grows in swamps to the height of ten feet or more, and paper was prepared from the thin coats or pellicles which surround the plant. Liddell & Scott's Greek Lexicon says that paper was made of the inner bark of the papyrus. And similarly other works of high character, encyclopedias and the like, give a false account of this interesting plant.

Calling attention to these misstatements, in the *Library Journal*, Mr. Ezra Abbott, of Harvard University, says: "The papyrus plant (*Cyperus papyrus* of Linnæus, or *Papyrus antiquorum*, Willd.) belongs to the family of *Cyperaceæ*

or Sedges; it is an endogenous plant, with a triangular stem; and to talk about its "inner bark," and "layers" like the coats of an onion, is a simple absurdity. One might as well speak of "the inner bark" of a stalk of Indian corn or of a bulrush. The error has originated from ignorance or forgetfulness of the elements of botany, and the consequent misinterpretation of the passage in Pliny (*Hist. Nat.*, xiii. 11–13, al. 21–27), which is our chief source of information about the ancient manufacture of paper from this plant. One of the words which Pliny uses to describe the very thin strips into which the cellular substance of the stem was sliced in making the paper is *philyra*, which strictly denotes the inner bark of the linden tree, also employed as a writing material. Hence the papyrus has been conceived of as an exogenous plant, with its outer and inner bark, and has actually been called a "tree." The botanists of course have not made such a mistake.

Mr. Abbott points out a still more absurd mistake in the English translation of Guhl & Koner's "Life of the Greeks and Romans," which says: "The stalk . . . was cut longitudinally, after which the outer bark was first taken off; the remaining layers of bark, about twenty in number (*philyra*), were carefully severed with a pin; and, afterward, the single strips plaited crosswise; by means of pressing and permeating the whole with lime water, the necessary consistency of the material was obtained." The word mistranslated lime water is *Leimwasser*, which means glue water.

Nitric Acid Produced by the Electric Light.

Mr. T. Wills, F.C.S., has been making some experiments on the production of oxides of nitrogen in the electric arc. The atmosphere of course consists mainly of oxygen and nitrogen, but simply in a state of mechanical mixture; if these gases become chemically combined, they form several oxides of nitrogen, most of which are strong and corrosive acids. At a high temperature small quantities of these gases can be made to unite. This is the case when electric sparks are passed through air; also during the combustion in air of a very hot flame, such as that of hydrogen; it therefore seemed probable that, as the temperature of the electric arc is undoubtedly very high, nitric acid, or some other oxide of nitrogen, might be produced by the electric light. The first experiment was rather surprising. A glass cylinder placed over an electric lamp (Foucault's regulator) for two minutes, and afterward examined, was seen to contain a perceptible amount of red fumes, due to peroxide of nitrogen (N_2O_4). The air surrounding the lamp was next drawn through a solution of potash, and the amount of nitric acid estimated; this gave 10 to 12 grains of nitric acid produced per hour (it may eventually prove to be more, the difficulty being to collect the whole of it). The next step in the research will be to examine the various forms of electric light, with a view to determine the amount of nitric acid produced by each. One of the advantages heretofore claimed for the electric light over gas light has been that the products of combustion of the former were harmless, while gas light produces the deadly carbonic acid.

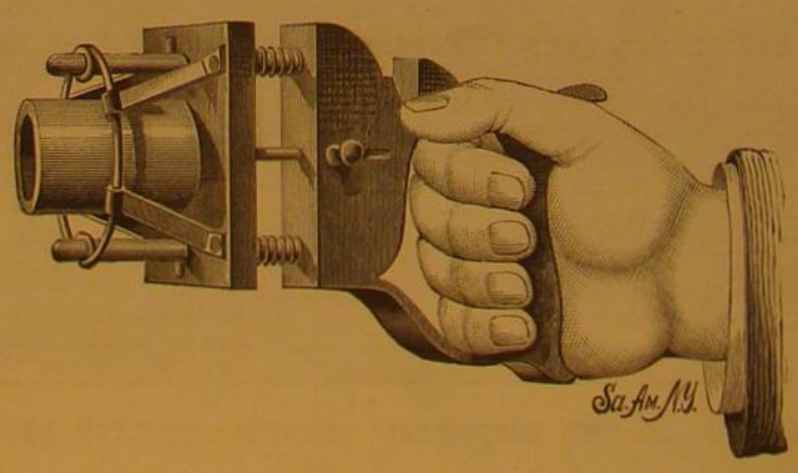
A NEW FIREARM.

The novel firearm shown in the accompanying engraving consists of a short barrel attached to a base plate that slides upon two rods projecting from the handle. The barrel is pressed forward by spiral springs which surround the guide rods. The handle or stock is similar to a saw handle, and contains a lock or spring mechanism which throws the needle forward into the cartridge when the trigger is pulled.

The recoil which follows the discharge of the weapon is taken up by the spiral springs, thus relieving the hand from the shocks which generally follow the discharge of firearms.

This weapon would seem to be especially useful in fighting at close quarters, as in the case of a marine engagement. Its large caliber enables it to carry formidable and effective ammunition, while its length is such that it can be used when rifles and ordinary pistols are useless. Either shot or shells may be used.

This firearm was recently patented by Mr. Jarvis Royal, of Rochelle, Ill., from whom further information may be obtained.



ROYAL'S IMPROVED FIREARM.

Wine from Oranges.

Experiments have recently been in progress in countries ravaged by the phylloxera, in regard to the substitution of orange juice for grape juice in wine making. The first wine made from oranges, in Spain, has just made its appearance in the market of Valencia. Four kinds have been produced, one of them a sparkling wine. They are all said to be of an attractive color, perfectly clear, of an agreeable, sweet, slightly acid flavor, and of an alcoholic strength of about 15 per cent.

A Little Seaport's Monopoly.

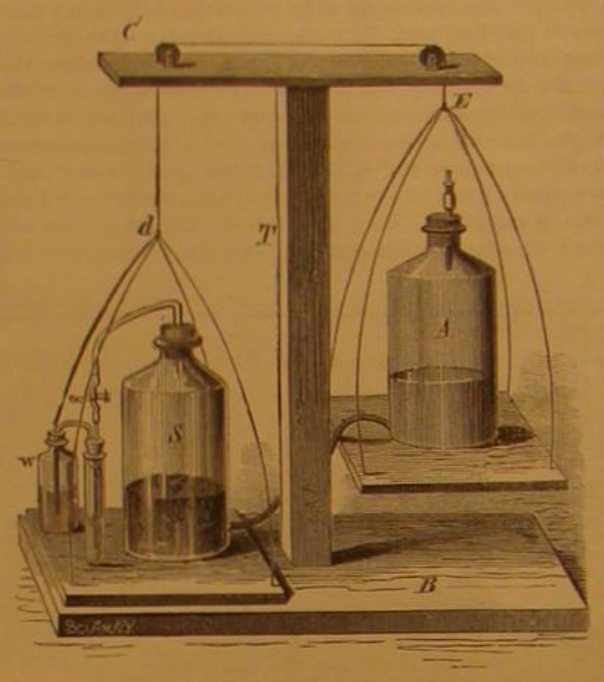
The little seaport of Scituate, Mass., is almost the only place in the country where "carrageen," or Irish moss, is gathered and cured, although it may be found everywhere along the coast of eastern New England. Scituate is the great center of the moss business, and supplies the entire Union from its beaches. The moss is gathered by means of long rakes into dories, and the wives and daughters of the boatmen prepare it for the market. Everybody knows its use in jellies and blanc mange, and it is also largely used in the manufacture of lager beer. The annual product is 10,000 or 15,000 barrels, worth to the producers about $50,000. About 150 families are engaged in harvesting the moss.—*Worcester (Mass.) Spy.*

A NEW FORM OF SULPHURETED HYDROGEN APPARATUS.

BY LE R. C. COOLEY, PH.D.

Since hydric sulphide is one of the most indispensable and troublesome of chemical reagents, no apparatus can be more welcome to the chemist than one which is able to yield an abundant supply of this gas and at the same time shield the laboratory from invasion by its disgusting odor.

To furnish the gas at any moment, to generate it only when in use, to retain the excess, which escaping in bubbles from the fluid under examination contaminates the atmosphere, and at the same time to be easily and cheaply constructed and conveniently used; these are the most desirable qualities of the apparatus, but qualities which hitherto have been found very difficult to combine. Believing that no other form is at once so efficient, so nearly odorless, so cheap, and so convenient in use, I offer the following description of an arrangement represented in the accompanying cut:



Notice, first, the plain but strong wooden frame, consisting of the base board, B, the standard, T, supporting the crosspiece, C, on top of which, near its ends, are two iron pulleys.

Notice, next, two platforms, each provided with four stiff curved iron wires, which meeting at the points, D and E, are fastened to the opposite ends of a strong cord passing over the pulleys at the top. By this means the two platforms, like a pair of scale pans, have a free vertical motion.

The materials for generating the gas are placed in two bottles, A and B, one on each platform. These bottles being tubulated near the bottom are connected by means of a piece of thick rubber tubing, which is rendered more impervious to gas by immersion in melted paraffine. The bottle, A, is to be filled to one half its capacity with the dilute acid, while in the other bottle, S, fragments of the ferrous sulphide rest upon a thick layer of broken glass or of silicious pebbles.

The gas bottle, S, is provided with a tightly fitting rubber or paraffined cork stopper, through which passes the delivery tube, which may be opened and closed at pleasure by means of the usual nipper-tap arrangement shown in the cut.

At the lower end of the delivery tube is a long tapering rubber stopper perforated with two holes. One of these holes is lined with a piece of rubber tubing, the ends of which project a little beyond the stopper. The end of the delivery tube is thrust into this rubber tube until it reaches half way through the stopper. This arrangement permits the insertion of a separate piece of glass tube into the lower end of the stopper, by which a solution may be fed with gas, and its removal for cleansing after each operation. From the other perforation of the stopper a bent tube passes over into a bottle of ammonia water, W. The cut represents this apparatus in operation.

The fluid to be tested is placed in either a test tube or flask. For small quantities the tube is very convenient. The operation is as follows:

Insert the short glass tube into the lower end of the stopper. Press the tube or flask containing the fluid up until its mouth is tightly closed by the tapering stopper. Depress the platform carrying the gas bottle, and carefully open the nipper tap. The acid flowing from the bottle presses the gas from the bottle, S. It bubbles through the liquid in the tube or flask, and the excess then passes over into the bottle, W, where it is completely absorbed by the ammonia. Close the nipper tap, lift the platform carrying the gas bottle, remove the test tube or flask and also the short delivery tube from the stopper; the apparatus is then ready for the next experiment.

Whether the apparatus is used continuously or at intervals, the joints being well made and the foregoing directions carefully followed, the laboratory will be free from the odor of the noxious gas, except that due to the small quantity that remains filling the tube or flask when it is removed.

A single apparatus with bottles of one gallon capacity has furnished the gas needed in the Vassar laboratory for the last three years, the classes numbering from 25 to 50 students. The exhausted acid is easily replaced, and the ammonia removed from time to time, as may be necessary.

Brier Root Pipes.

Much of the wood used for making the so-called "brier root" pipes is derived, it appears, from Corsica. The white heath, or *bruyère* (of which "brier" is a corruption), grows in great luxuriance and very abundantly among the trees and shrubs which form what is called the "maquis" covering the mountain sides.

In the course of the last few years, since brier wood pipes have become such a large article of trade, the heath trees have become a source of lucrative industry. The roots are dug up and cut into rough forms of tobacco pipes by circular saws worked by the water power of the mountain streams. The pieces, when cut up, are sent in sacks to France, and thence to America, to be eventually manufactured into "brier root pipes."

Cincinnati Faience.

The fine enameled ware known as Cincinnati faience originated with Miss M. Louise McLaughlin, of that city, whose experiments were first successful in 1877. It is fired in a kiln at the temperature of 9,000°, the famed Limoges faience of France being fired to no more 5,400°. The enamel of Cincinnati faience is exceedingly brilliant in color, and so hard that the point of any steel instrument is said to make no impression upon it. This invention is indirectly a result of the excellent schools of design for which Cincinnati is justly honored.

New Mechanical Inventions.

Mr. Christian Bissmann, of New York city, has patented an improved Spring Balance that takes up less space than the ordinary weights and pulleys, and by which the raising and lowering of the sash are accomplished easily and without noise.

An improved Alarm Bell has been patented by Mr. Charley H. Smith, of Delphos, Ohio. This is an improved fire alarm, which is simple in construction and is easily and conveniently operated.

An improved Cane Shaving Machine has been patented by Messrs. Charles L. Jones, James W. Smith, and Henry H. Adams, of Gardner, Mass. The object of this invention is to construct a cane splitting machine that will permit of changing the knives without loss of time, and also to make the knives adjustable according to the size of the cylinder.

Mr. Julius Bluemel, of San Francisco, Cal., has patented an improvement in Breech Loading Firearms, the object of which is to obtain rapidity in loading and firing shotguns and rifles, and prevent liability of accidental discharges.

Mr. Hosea T. Stock, of Toledo, O., has patented an improvement in Supporting Frames for Excavating Machines, which can be loaded, supported, and moved from place to place on a railroad track, upon an ordinary flat or platform car. Only certain portions need be removed in order to enable the apparatus to be transported like an ordinary railroad car.

New Caustics.

Two caustics, which promise to be most valuable, have recently been introduced to the notice of the medical profession by Dr. B. W. Richardson. They are sodium and potassium alcohols. When applied to the skin these alcohols are said to cause "gradual destruction of tissue, which may be so moderated as hardly to be perceptible, and may be so intensified as to act almost like a cutting instrument."

These caustics have the advantage that they will dissolve opium, like ordinary alcohol, and also that their action can be stopped immediately by dropping on the eschar a little chloroform, which decomposes the caustic into chloride of the metal and triethylic ether, which is inert locally.

ELIZABETHAN FIREPLACE.

The accompanying engraving represents an Elizabethan fireplace from the factory of Messrs. Barnard, Bishop & Barnard, of Norwich, England. This admirable specimen of ironwork was a part of the furniture of the Elizabethan house placed at the disposal of the Prince of Wales at the Paris Exhibition.

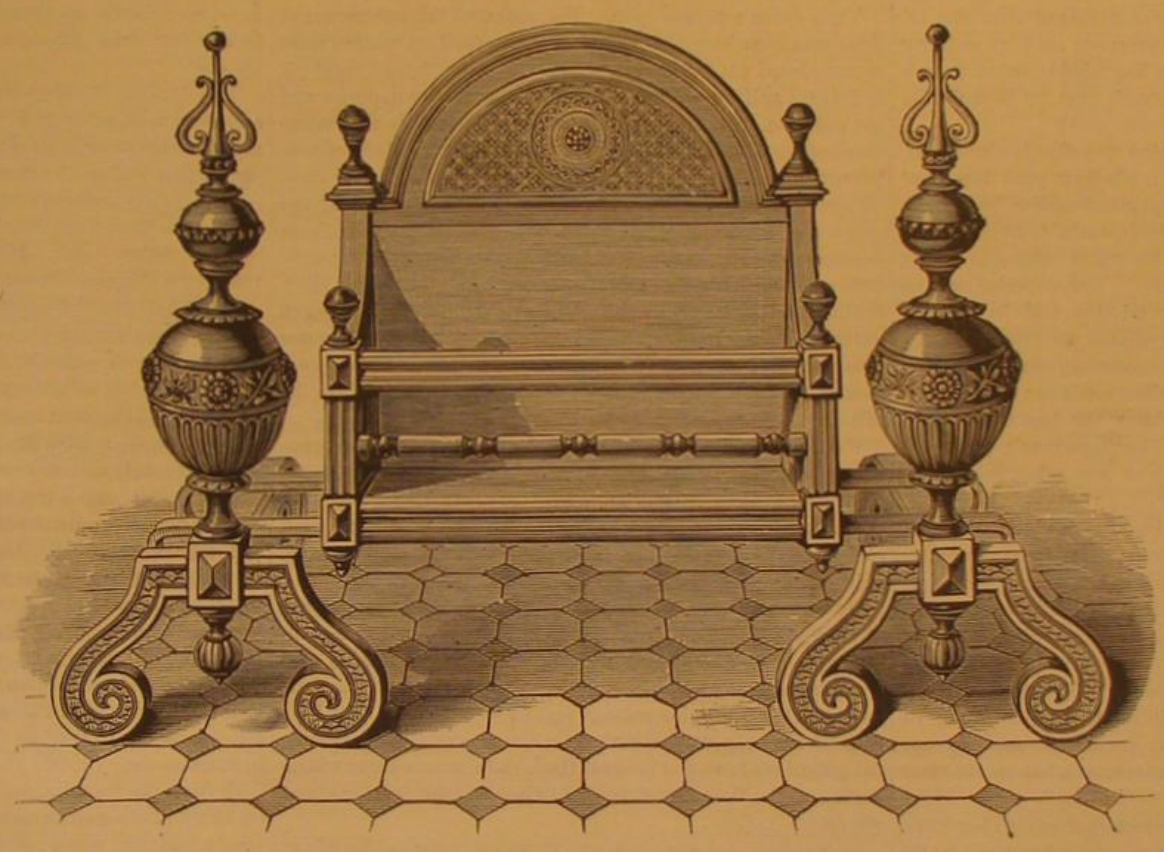
The American Potteries.

A *World* reporter has gathered some interesting facts regarding the growth of the pottery industry in this country during the last twenty-five years, and the present condition of that industry, from which we extract:

At the last convention of pottery manufacturers, held in Trenton a few weeks ago, forty firms were represented, including manufacturers of yellow and Rockingham wares, of cream colored china, of white granite ware, and of pure china and decorated goods. Pottery, as a distinct and important industry, was not known in this country twenty-five years ago. There were potteries then, but they turned out only the most common articles and of a poor quality. At that time the tariff on imported pottery, exclusive of the best china and decorated ware, was 20 per cent, and so it remained until 1861, when it was raised to 25 per cent. The protection thus afforded, although small, gave an impetus to the trade, and better wares were immediately put upon the market. When the tariff was finally raised to 40 per cent the industry leaped up, and at present there are enough potteries in operation to produce twice the quantity of wares imported from Europe and Asia. The result, the potters claim, has been, in a general way, to reduce the price of wares, so that jobbers can sell them 18 per cent cheaper than they could in 1860, and to improve the quality of the goods themselves.

A minor hinderance to the progress of the industry has been the high price of clay, flint, and spar, the materials most largely used in manufacture. The difficulty in this respect is not yet altogether obviated, for the best imported qualities may be obtained at less cost in this city than the best qualities from Missouri. Such a condition of affairs will soon end, however, if the project of the convention—to co-operate with the owners of the best mines and clay beds to the extent of encouraging them to wash the ball clay—should be carried out with success. The manufacture of yellow and Rockingham wares, which is conducted chiefly in the West, was the first step toward introducing home products into the market. These wares are of the cheapest and most common order. Cream colored ware, which is manufactured chiefly at East Liverpool, Ohio, Jersey City, and Trenton, is next in the order of superiority. It includes common table ware and household crockery. Next in the order of manufacture comes "white granite," sometimes known as "American china." It is the best porous bodied ware, and is superior to cream colored ware chiefly because it has a vitreous glaze. It also is manufactured in Trenton, where there are sixteen potteries, and in other places in a smaller way. The manufacture of china is confined almost exclusively to Greenpoint, where it was first tried as an experiment in 1863, although no goods were put upon the market for two years afterward. The superiority of china to other wares for household use is due to its homogeneity in body and glaze, neither of which is porous. Experiments in designing and decoration were from the first quite expensive, and had it not been for the high prices which prevailed for all sorts of ware during and soon after the war, the manufacturers would have abandoned them. Their aim has been to supersede not only imported ware, but foreign designs, and to give to the decorated goods that leave the factory a distinctive American character. The Century Vase, for instance, which was exhibited at the Centennial, has a central figure in relief of Washington, medallion style, embellished at the corners with small pictures representing the chief industries of the country. Tea and dinner sets are decorated with native leaves or ferns, or in a style pronounced and original.

MALLEABLE BRASS.—A German periodical is responsible for the following method of making malleable brass: Thirty-three parts of copper and twenty-five of zinc are alloyed, the copper being first put into the crucible, which is loosely covered. As soon as the copper is melted, zinc, purified by sulphur, is added. The alloy is then cast into moulding sand in the shape of bars, which, when still hot, will be found to be malleable and capable of being brought into any shape without showing cracks.



ELIZABETHAN FIREPLACE IN THE PRINCE OF WALES' PAVILION, PARIS EXHIBITION.

Weatherproof Houses.

The conditions essential to what may be called comfortable house building—just now forced upon us by the weather—seem, if not misunderstood, to be willfully misapplied by some architects and builders. The gospel of true economy has been preached to them with unremitting zeal, but as far as house construction is concerned, with little or no good result. We constantly see houses built with the intention, apparently, of wasting heat and space, and these two fundamentals are considered to be provided for if the grates are not made too deep or large, and the front passages or halls are squeezed to the narrowest proportions. The most commodious of all forms in which a house can be built is a square. Now it must be noticed the builder adopts this shape of house because it saves the expense of outside walling and expensive roofing, and the architect abhors it because it is inartistic. The consequence of which is that the square or bungalow form of dwelling, even in the suburbs of towns, where it is most appropriate, has grown unpopular of late years, more especially since Gothic has been the prevailing style. It is satisfactory to find a return to it, though economy has less to do with the matter than fashion. Now, we believe economical house building near all large towns must ultimately adopt the square or rectangle. But there is something more in the square plan than a saving of walling and roofs. It is the only form that economizes the warmth of a house, as the larger proportion of the wall surfaces are internal. In the irregular and picturesque style the outer walling is so much more cold surface added to the work the fires have to perform; and we may say the waste of heat in the fashionable villa residences is quite 30 per cent more than in houses built in the row. The "picturesque loving" architect—and who is there that does not admire the accidental grouping and succession of breaks and gables in an old manor house of the later Tudor or the Stuart period?—increases his external walling by every projection and recession he makes; in fact, one of the articles of his creed is to pronounce his separate rooms, which cannot be done except by adding to their outer exposed surfaces. All these charms of piquancy and outline are unfortunately bought at the cost of fuel and comfort, and we may appeal to every candid and outspoken member of the profession in whom the man of science is not irretrievably lost in the enthusiast for style, whether a house of the square form is not more comfortable than the irregular and gabled villa or chateau? But the principle is self-evident that in a plan of square form the outside walls are minimized, and the internal warmth of a central stove-heated hall or the internal fireplaces equably diffused throughout every part of the building. The advantage of well built hollow walls, and the importance of damp-proof courses, we need not in a professional journal insist upon. In considering walls, however, the question of a facing occurs; and the profession generally have set their faces against cement as an external covering.

We are not inclined to enter again into a controversy that has been waged so often—a correspondent the other day in our journal discussed the subject from a practical point of view—but we think that there has been a great amount of absurd prejudice entertained by architects of the muscular Gothic school against the use of Portland cement. The fact is the material was so abused by a former generation—it covered up such vices of construction—that a well founded contempt for stucco sprang up. But why should a valuable material suffer because of its ignorant employment? For Portland cement is a most valuable ally to the architect when employed rationally, and for the outer surfaces of rough brick or concrete walls it is often absolutely necessary. The great evil of its use, we have always contended, is its being made to represent such features as stone cornices, trusses, and other details for which stone or bricks can be only rightly used; but if used for the plain surfaces of walls it admits of many forms of appropriate decoration.

The next important feature in a weather-proof house is the roof. Here, again, the advantages of a plan in which the external boundaries partake of a square are obvious to every practical builder, but for like reasons to those at which we have hinted in regard to irregular houses, the fact is disregarded by the "artistic architect." A square trough shaped roof is both unpleasing and easily choked up, and a lofty pyramidal roof is quite as ungainly and ugly. But both these evils can be obviated by making one or two slight breaks, by which a rectangular arrangement of two or more span roofs may be gained, always remembering that the simpler the roof is, and the fewer its component parts, and therefore gutters, valleys and hips, the better. It is somewhat amusing to find this rule disobeyed, all conceivable jumbles of steep roofs, flats, and gables being adopted to produce piquant bits of effect by the young architect, though it is by no means a laughing matter with tenants who have to do external repairs. The bad arrangement of roofs with respect to aspect is one of the commonest defects. It is not unfrequently that one sees a house with the valleys opening toward the most exposed quarter, or a series of open gutters in such a position that every wind would convert them into eddying troughs. Hopper-shaped roofs and inclosed gutters are arrangements always better avoided, and the principle should be to expose as little roof surface to the wind and wet as possible. The conformation of a roof we believe to be of immense importance to the comfort and security of a house, and no part thereof should be open to the attacks of heavy rainfalls or severe gales. For duchess or countess slates a lap of 3 inches is not too much for ordinary pitches, and 2 inches is much too small; each slate should be secured with two nails, and these ought always to be of copper, zinc, galvanized iron, or dipped in oil. Again, lead should be of at least from 6 lbs. to 7 lbs., the latter in the flat gutters and the former in the hips and valleys. Patent ridge and hip rolls, made of slate, fastened with screws set in oil putty, are next to lead in effectiveness, and it should ever be remembered that cheap roofs are the dearest in the end.

There is also an immense amount of ignorance about chimney building, or as to what constitutes a good drawing and what a bad drawing chimney. We know it is perfectly useless to frame a code of rules on chimney building, when the exigencies of house design have to be consulted, but when nothing interferes all chimneys should be placed on the sheltered sides, as internal stacks undoubtedly draw the best. Chimney stacks should always be built high enough to clear the effects of obstructing roofs, as a "blow down" is often experienced in flues that barely overtop an adjacent roof, and in those in a valley between two roofs. Of course, the inducing currents must be considered in reference to the prevailing winds, and not from the lee sides. One common error is to make flues too capacious, and to build them with large throats, the consequence of which is the upward currents or gases are cooled down and the velocity retarded. The heated gases ascend in the center of the flue, which, if too large, cause down currents to be established, and the phenomena of smoky chimneys are greatly due to this cause. We might extend these remarks to the best position for fireplaces, upon which much might be said; but, as we have just remarked, the exigencies of plan are paramount, and the builder or architect has to consider rather the least objectionable of modes than the adoption of the best course.—*Building News.*

Staining Floors.

THE London *Furniture Gazette* commends the following method of staining floors in oak or walnut colors: Put 1 oz. Vandyke brown in oil, 3 ozs. pearlash, and 2 drms. dragon's blood, into an earthenware pan or large pitcher; pour on the mixture 1 quart of boiling water; stir with a piece of wood. The stain may be used hot or cold. The boards should be smoothed with a plane and glass-papered; fill up the cracks with plaster of Paris; take a stiff brush, dip in the stain, and rub this in well; the brush should not be rubbed across the boards, but lengthwise. Only a small piece should be done at a time. By rubbing in one place more than another an appearance of oak or walnut is more apparent; when quite dry the boards should be sized with glue size, made by boiling glue in water, and brushing it in the boards hot. When this is dry the boards should be papered smooth and

varnished with brown hard varnish or oak varnish; the brown hard varnish will wear better and dry quicker; it should be thinned with a little French polish, and laid on the boards with a smooth brush.

THE LURAY CAVERN.

BY H. C. HOVEY.

(*Continued from page* 37.)

At the southern end of the area known as the Elfin Ramble begins Stonewall Avenue, not yet thoroughly explored, but seeming to lead toward Ruffner's Cave. Its chief attractions are Brand's Cascade, unsullied alabaster, and the most beautiful formation of its kind in this locality; the Twin Lakes, united by a tunnel; a curiously carved and inlaid floor; a bank with a profusion of mottled drapery; and also various grotesque similitudes.

On returning we cross a natural bridge to the Imperial Spring, 16 feet deep, in a grotto 35 feet long and 25 wide. Brown columns form the wall, with white stalagmitic statuettes set in niches, and between them snowy alabaster gushes out and over the rocks below. The roof slants from front to rear, and is set as thickly as possible with stalactites about a foot long, and averaging by count 64 to the square foot. Calculating on this basis, there are within this little grot 44,800 pendants, each tip glistening with a pearly drop. What millions there must be in the whole cavern!

One of its distinguishing features is the existence of these pools. There are hundreds of them. None of true springs, and none are large enough to be called lakes, though both terms are used. The basins vary in size, from 6 inches to 50 feet in diameter. They are often found in strange places; on a ledge, on top of a mound, or on an overgrown stalagmite. The water is so absolutely transparent that the incautious explorer may learn of its presence only by walking directly into it; and more than one has tried to drink from a bowl that had run dry. This purity is due to percolation through the rocks.

The refined carbonates in solution are slowly deposited. Where continuous trickling into a shallow pool has kept the water in a state of agitation, spherical bodies have been formed. These concretions are called pearls, marbles, birds' eggs, and snowballs, according to their size; there is a very large one called the "cannon ball." The exterior of the nodules is often highly polished by friction, and the interior, on fracture, exhibits a shining, radiated structure. They become attached to the bottom whenever aqueous agitation ceases; and, if the drip meanwhile continues, they often grow up into a cone. This explains the fact that stalagmites frequently rise out of pools. The same result, however, would ensue if a bit of limestone or any other hard substance should fall into the water.

It was some time before we realized the fact that all these calcareous basins were built up by deposits from the water they contained. The beautiful crystals, drusy, feathery, fern-like, lining the sides and bottom of every water-filled cavity, are not mere ornaments. They are the materials of which the walls are made. Under the microscope grains from the substance of the wall are identical with the lining crystals, in shape as well as composition. Many of the well known varieties of calcite are found; and in some of the long crystals a prismatic development led us to class them as aragonite.

The more rapid evaporation at the surface so aids the work of crystallization as to make the edges grow over the water and give the exterior of the basin a remarkable curve, of which a beautiful illustration is given in the structure of the Coral Cascade, near the farther end of the cave. Ten little terraces, with ruffled margins, rise in succession, each catching the overflow of the one next above, and the upper one is over three feet deep, with the front greatly curved. The appearance of the crystals is not unlike the grouping of corals.

The variations of water level are strongly marked by rings or ridges, especially in some of the larger pools. Brodus Lake, for instance, not only reposes on a bed of crystals, overarched by a vault bristling with stalactites, but it is girdled by a crystalline strand once covered by its bright water. It is now 50 feet across, but was formerly twice as wide and 5 feet deeper, judging from the curved rampart, whose margin it must have touched, and whose horizontal folds clearly indicate the changes of level. To the same cause are due the outgrowths about the roots of some rich buff stalagmites slashed with white, and others less conspicuous. These are flat on top and rounded underneath like varieties of woody fungus. They vary in size from one to 8 inches, and some of them have a velvety coat of olive-tinted crystals and are tipped with red and purple.

When the excess of carbonic acid, by which the carbonate of lime is held in solution, evaporates rapidly, besides the crystal crust below, a sheet, like a film of ice, is also shot across the surface. A fine example of this is found at the Fairy Spring, whose brim nearly meets the stout stalactites that hang above it; and whose surface, 12 feet broad, only shows half its extent, the rest being concealed by such an icy film as that described.

We nowhere found the acicular crystals of sulphate of magnesia, nor the gypsum rosettes, for which the caves of Kentucky and Indiana are so celebrated.

But we are lingering too long amid the sparkling pools and their calcite gems. We cross Pluto's Chasm, near its southern end, where a curious palisade of stalagmites grows to bulky dimensions on the further margin. By the bridge stands Proserpine's Pillar, one half brown and the other white. Down the dark gorge a specter seems to wave its arms. It is only another snowy column.

On the left a sloping ascent of red clay, deeply furrowed, shows that we are not far from the surface. As a visitor was writing up his notes, near this point, a rabbit sprang by, upsetting his lamp, and disappeared up the slope. A pit of considerable size, not far away, together with our subsequent survey of the surface, indicates that the locality is directly under the great sink northwest of the entrance.

After admiring the charming formations of Oberon's Grot, and especially the Crown and Fairy Veil, an elegant bit of transparent drapery, we pass beyond a stalagmitic curtain, only 6 inches thick at the edge, but 30 feet wide and 50 high, and find ourselves in the Giants' Hall, of whose concourse of wonders no clear idea can be had without repeated visits.

Seated on this Fallen Column, that looks like a prostrate and moss-grown oak in the forest, let us study cave history.

The popular notion that volcanic upheavals caused these subterranean cañons is correct probably only as to the original rift in the rocks; all else was done by the chemical and mechanical action of acidulated water. This subtle agent sought out the joints, seams, and other lines of weakness, till the water-swept channels deepened into what is now Pluto's Chasm. Softened ledges were dislodged, successive floors undermined and cut through, walls between this and other chasms broken down, until cavities were finally scooped out far more prodigious than those now visible; and the axis of erosion was S. W. to N. E. Branches at different levels were also excavated.

Room was made by this means for calcareous deposits, and the vast halls began to be slowly filled up by stalactites and stalagmites, many of them growing to great size.

Then came a catastrophe. The outlet of the subterranean river was somehow obstructed, and the pent up waters were accumulated till the entire cavern was filled from lowest pit to loftiest gallery—a fact proved by the earthy deposits and the uniform erosion of dripstone. (Dripstone is a term authorized by English geologists, representing all kinds of cave formations.) During this period, whose duration we have no means of conjecturing, the carbonic acid absorbed by the rain water from the atmosphere, and more especially from decomposing vegetation and surface soil, would be brought into contact with the calcareous deposits, destroying their texture and causing a species of decay. Under the blackened exterior of this Fallen Column is what once was alabaster firm as ivory, but now it is transformed into a chalky substance, through which a knife blade can be thrust to the hilt.

Finally a new outlet was found, independent of the original system of drainage, and supposed to be in the deep spring near Blackford's Furnace. There is every indication that the waters departed with violence, tearing down loosened rocks, hurling stalactites to the ground, and felling huge columns like trees in the tornado's path.

On an eminence to our right stands a sublime monument of aqueous energy. It is the Hollow Column, 100 feet in circumference and 40 feet high. Finding it too rugged and compact to be overturned, the fierce waters pierced its marrow, leaving a tubular passage from top to bottom that is at present the only way of access to the extensive and beautiful galleries above the Giants' Hall, the distance from whose ceiling to the floor below is said to be in certain places about 160 feet.

In Stebbins Avenue, near the entrance, besides the Silver Lake and other attractions, is the Leaning Tower, a mass of stalagmite, whose enormous weight broke down the ledge of limestone, 3 feet thick, on which it had been created. The waters undermined it, and it fell about 6 feet into the depression, where it now stands amid a broad pool; it was not overturned, only tilted like the Campanile of Pisa.

The flow of subsiding waters became gentler toward the last, merely removing the softened exterior of the dripstone, leaving a wavy surface with sharp angles and polished sinuosities, often exhibiting diversified layers like the gnarled grain of precious woods.

The volumes flooding the cavern from the funnel-shaped sink overhead brought in, first and last, a quantity of clay and soil equal to the dimensions of the sink, plus the washings from the upper hillside. The sink is now about 800 feet across and 40 feet deep, and may have been larger before the general surface was lowered. Hence the sum total of alluvial filling is many thousand cubic yards. This cause, together with the decomposition of dripstone, accounts for the embankments in the Elfin Ramble, whereby that portion narrowly escaped obliteration.

Quiet having been restored, and the water trickling instead of rushing, a totally new set of stalactites came into existence. Some of them were formed, as usual, from the crude materials furnished by limestone; but others from the refined substance already once used in the older formations.

Thus originated very striking contrasts. How grandly the Angel's Wing, with snowy plumage, sweeps out from the dingy and corroded mass whose inner substance it only recasts! Those softly-draped and tinted figures in the Saracen's Tent really owe their being to the grim ogers that guard them. The finest of them all, 8 feet high, and lovely as a Houri, has its rippled and dimpled contour, because the pellucid alabaster so faithfully followed the wrinkles, while it rounded the angles of the ancient and worn form that it incases.

Before leaving the Fallen Column let us take its measure and ask its age. It is exactly 12 feet in diameter and 21 feet long as it lies, with its butt lower than its tip, shortened at least 15 feet by the fall. By burning magnesium we discern far above us the scar made when it was wrenched away and fell swaying to and fro. Time enough has elapsed for a cluster of stalactites to form hanging transversely from the end now uppermost. They are 11 inches wide and 4 feet and 5 inches long. According to long-continued observation of the rate of stalactitic growth in Wyandot Cave the age of this group would be exactly 1,325 years. But the only way to tell the age of Luray Cavern is by a series of local experiments; and even then only an approximation can be made.

Music may be had in these subterranean halls. Mellow tones, like tolling bells, follow blows on the Chimes. Another large group of musical stalactites is well named the Organ. It fell, with the ledge on which it grew, points downward, into the mud, leaving many of its 56 pipes free and sonorous. They are solid, not tubular, and vibrations of the larger ones last a full minute. The entire musical scale can be produced by striking selected stalactites, and simple airs may be played by a skillful hand.

Space is desired for more than the mere mention of Babel, with its 22 stories rising on dwarf colonnades; the Mosque, with its domes and minarets; the Bridal Chamber and its alabaster floor; the Turbaned Sultana; the Empress Column, white, with a pink capital; and many a stately but nameless shaft. A secret way leads back from the Spectral Column to the Empress, and on to the Pavilion.

The Swords of the Titans are monstrous blades, 40 feet long, suspended from aloft, and keen of edge. Their hollow structure can be seen where was once broken off a section that has now disappeared. Their origin, and also that of the delicate scarfs already described, is in trickling limestreams, running together on a sloping surface and then growing downward till the curved sides meet in one edge. Acids have made some specimens in the cave look like sides of leather or even like threadbare blankets and flimsy old shawls.

The Double Column is surrounded by the Naiads' Bath, and is as unique as it is grand. A stalactite, 50 feet long, tapers to the floor with unbroken longitudinal grooves. Its companion stalagmite, instead of meeting it point to point, rises in joints and stories 30 feet and holds it in an embrace.

The Pavilion is approached through a corridor walled in by huge fallen rocks. It is circular, with many alcoves; is 100 feet wide, and is floored for the use of assemblies.

The Chalcedony Cascade, at the entrance of this room, is a mass of mammillary alabaster, 25 feet high and 30 wide, a continuation of a similar formation above, that can only be seen by difficult climbing. It is semicircular and remarkable for its variegated hues: brown, yellow, steel-gray, ashes-of-roses, drab, milk-white, and blue. It is a new formation upon the old, and a row of stalactitic teeth 4 feet long, ancient relics, skirts the base.

By a perilous ascent over stubby stalagmites we gained admittance to Campbell's Hall, and a noble room to its right. In the former stands the Mermaid, 5 feet high, tapering from 2 feet at the base to 1 at the flat white top. Strings of shining beads adorn the sides downward, growing into scales like those of a pine cone, only pearly instead of brown, and with pink edges. Increasing still in size they turn to a lead-blue. Dispersed about the base are little white stalagmites seeming to float on milk. Brown mossy crystals grow in clusters near by this marvel of beauty.

Beyond the Pavilion is the Coral Cascade, and still further on an exquisite grotto named in honor of Mr. J. J. Collins, whose graphic word-painting and ingenious theories have interested so many thousands in the scenes of Luray Cavern.

The distance from the entrance directly to Collins' Grotto does not exceed 1,500 yards, and might be shortened. But the tunnels, catacombs, and galleries expand into a labyrinth, for exploring whose intricacies many days are required. The task will be much abridged when the proprietors carry out their plans for making every portion easily accessible.

(*To be Continued.*)

New Agricultural Inventions.

Messrs. R. S. Squires and Frank Kaiser, of Kansas City, Mo., have patented an improved Baling Press for baling hay, straw, cotton, for pressing pomace, grapes, etc., in cider and wine making, and for other similar uses. It is simple, convenient, and effective.

Messrs. John J. Reicherts and David Tipton, of Delaware, Ohio, have patented an improved Field Roller and Planter, by which the seed is dropped by simple mechanism, and then covered by the roller, the ground at the same time being crushed and broken and left in good condition for after operations.

Mr. Robert L. Patterson, of Belle Plaine, Kan., has patented an improved Attachment for Corn Planters, which is so constructed that the dropping slide is operated by the advance of the machine to drop the seed at uniform distances apart.

Mr. Horace W. Thompson, of Bellows Falls, Vt., has patented an improved Scythe Snath Fastening, in which the ferrule attached to the end of a snath has a projecting head or plate, in whose outer end is formed an arc-shaped slot to receive and permit lateral adjustment of the loop or eyebolt which clamps the shank of the scythe.

Mr. Henry Hardick, of Liberty, N. Y., has patented an improved Fence. The invention consists in a metallic post having an anchoring crossbar or foot cast upon its lower end, and buttons upon one of its vertical sides, for the attachment of the wire rails; an intermediate stay post is also provided which anchors a vertical cross tie connecting the longitudinal wire rails.

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NEW BOOKS AND PUBLICATIONS.

DIE TECHNOLOGIE DER WIRKEREI, FUR TECHNISCHE LEHRANSTALTEN UND ZUM SELBSTUNTERRICHT. Leipzig: Arthur Felix. 2 vols. 8vo.

In this work, the author, Mr. G. Willkomm, Director of the College of Textile Industry, in Limbach, near Chemnitz, Saxony, has laid down the experience of a life of practical labor and theoretical study. Part I., which appeared in 1875, treats of the elements of knitting, looping, embroidering, etc., as well as of the more simple machinery and appliances used in handworking. Of great practical value is the second chapter, which gives a detailed description of all goods of this character occurring in the market and their relative value. A brief sketch refers to the early history of that branch of textile industry. Part II., just issued, treats principally of weaving machinery, describing about one hundred of the best machines now in use in Europe and the United States. The illustrations are very carefully executed, some of the smaller parts of the machinery being shown two or three times their natural size. For each illustration the exact proportions are given. There are 24 large plates, containing not less than 550 illustrations. Great pains have been taken by the author to add to all the technical terms in German the corresponding expressions in English and French. This feature will make the book valuable to those who, possessing only a superficial knowledge of the language, are not acquainted with German technical terms. A special index connects the drawings with the corresponding passages in the text. On the whole, the book will be found of great value as a handbook for the manufacturer and mechanical engineer, and also as a text book for the student of textile mechanics.

SAW AND PLANING MILL DIRECTORY OF THE UNITED STATES AND CANADAS. Milwaukee, Wis.: Publication Office of the *United States Miller*. $5.

A useful directory giving the names of all the sawmills and planing mills in the United States, Canada, New Brunswick, etc., with the names of their owners.

The publishers of the *Miller* have also issued a similar directory of the flour mill owners of the United States and the Canadian Dominion.

Notes & Queries

(1) H. M. P. asks how to prepare artists' canvas. A. Dampen the canvas, tack it on the stretcher, apply a thin coating of starch sizing, when dry apply thick paint of the desired tint.

(2) G. B. asks: 1. Why is it that a wagon wheel travels faster at the top than at the bottom when running along the ground? A. See p. 394, issue of December 21 last. 2. What gases have not been liquefied by any means? A. MM. Pictet and Cailletet have recently succeeded in liquefying all of the so-called permanent gases. See pp. 64, 71, 73, 111, 147, and 186, vol. 38, SCIENTIFIC AMERICAN. 3. If sulphuric acid be poured into a jar containing strong nitric acid, will there be an explosion? A. No, the acids should, however, be mixed gradually to avoid overheating, which would otherwise occur. 4. What is the composition of gun cotton? A. According to the best chemical analysis, gun cotton is trinitro-cellulose ($C_6H_7(NO_2)_3O_5$), consequently it is cotton considered in a pure state as cellulose, $C_6H_{10}O_5$, 3 atoms of the hydrogen of which have been replaced by 3 atoms of hyponitric acid. 100 parts of gun cotton contain: Carbon, 24·34; hydrogen, 2·36; oxygen, 59·26; nitrogen, 14·14; total, 100.00.

(3) L. R. asks: What would remove stains of olive oil from glazed printed paper? A. Moisten the spots with benzole and cover immediately with warm, dry pipe clay for a time. Repeat this treatment several times if necessary, using pressure.

(4) L. C. S. asks: What would make a good cement or paste for fastening gum covering on an iron roller? A. Melt together in an iron vessel over a gentle fire, pitch and guttapercha in about equal parts; use hot, but not too hot.

(5) C. S. asks (1) for a good remedy for weak eyes. A. Better consult a good physician. 2. Does wood dust cause the eyes to get weak? A. Yes, under some circumstances.

(6) H. G. C asks for a recipe for making a prepared marking ink, such as is used by the drygoods stores in writing show cards and marking boxes. A. A concentrated solution of the soluble aniline black in water makes an excellent ink for this purpose. Use hot water to make the solution.

(7) S. D. M.—The curious hairlike substance is similar to the mineral wool now largely made from molten blast furnace slag by contact with a jet of hot air or steam.

(8) A. J. L. asks for list of books on both theoretical and practical chemistry, for one who is about to enter the study of chemistry to become an analytical chemist. A. The following are among the best: Theoretical Chemistry—Remsen, Cooke, and Hofmann. Inorganic Chemistry—Wohler, Gorup-Besanez, and Miller. Organic Chemistry—Fittig's edition of Wohler's Organic Chemistry, and A. Butterow. Analytical Chemistry—Fresenius' Qualitative and Quantitative, Eliot and Storer, H. Will, and Thorpe.

(9) F. N. (Beyrout, Syria).—The sample of thread is sized with taploca starch and glazed in the finishing machine. Your other inquiries will be referred to subsequently.

(10) W. P. asks: Can you tell me the object of putting sal ammoniac in the packing, or iron scales, which surround the castings to be annealed in malleable iron? A. The ammonium chloride is added to the castings after annealing and while still hot to rerust the hematite and magnetic oxide of iron used, so that they can be used again. It has nothing to do with the malleability of the castings. The whole process is described in "A Practical Treatise on Casting," pp. 281-289.

(11) A. K. asks: 1. What are the materials used to make oxygen gas by the generator shown on p. 42, vol. 39? A. The apparatus is not used for the manufacture of oxygen. 2. Can carbonic acid gas be made by the same process? A. Use small lumps of marble and hydrochloric or sulphuric acid diluted with two or three volumes of water.

(12) M. S. P.—It is the strained and dried jelly of Irish or Carrageen moss (*Chondrus crispus*). The jelly is prepared by boiling the dry moss in water.

(13) J. Q. asks what are the uses of sodium (metallic) and aluminum, also of the demand for them in the American markets. A. Sodium is chiefly used as a reducing agent in some metallurgical operations, as in the separation of aluminum and magnesium from their ores. It is also used in Crooke's silver amalgamation process, and occasionally in the reduction and purification of zinc, and in certain chemical operations. It is quoted in New York at $0.65 per ounce. Aluminum is principally used for small weight, light tubes for optical instruments, also to some extent for surgical instruments and appliances, and for the production of aluminum bronze, for bells, etc. It sells for $1.30 in New York. The market for both of these metals is very limited.

(14) "Reader" asks what is meant by so many parts of this or that in the receipts given in the SCIENTIFIC AMERICAN. A. A part is a unit of quantity; for example, it may be weight, as so many pounds or ounces, or it may be measure, so many gallons, quarts, pints, or ounces.

(15) H. G. A. writes: Suppose I place an engine in position for the forward stroke, and move it until the crosshead is at half stroke, does the crank stand 90° from the dead center line? If not can you explain why not? A. It does not, on account of the angularity of the connecting rod. You will find the matter fully explained in Auchincloss' "Link and Valve Motions."

(16) W. V. asks (1) for a receipt for reputting files with acid. A. Dip them for a short time in dilute sulphuric acid. 2. Can you tell me what the tolu sold in drugstores is made of? A. Tolu, or balsam of tolu, is an exudation from incisions in the bark of *Myroxylon toluifera;* it closely resembles balsam of Peru, but is more susceptible of resinification. Old hard balsam of tolu is a convenient source of cinnamic acid, which is extracted by the same process as that by which benzoic acid is obtained from benzoin, namely, ebullition with alkali, filtration, and precipitation with hydrochloric acid. 3. How is paraffine extracted from coal tar? A. It would require too much space to describe the process here; you will find a comprehensive article on the subject in Wagner's Chemical Technology, pp. 588-593.

(17) H. W. asks: Would the lenses of a camera answer for an object glass for a telescope? A. Yes, but not so well as lenses of a longer focus.

(18) M. A. N. writes: 1. I am making a phonograph, have made the shaft ¾ inch diameter, thread cut on 5 inches in length, 10 threads to inch; would an iron cylinder give better results than a plaster of Paris one? A. Yes. 2. How deep must the thread be cut on the cylinder? A. 1/16 inch or more.

(19) J. E. F. says: I should like to know of some remedy for the prevention of sweat on show windows, especially visible after the gas has been lighted. A. To prevent the condensation of moisture on show window glasses, the interior of the show window should have free communication, top and bottom, with the external air. If the air within the show window is kept nearly as cold as the external air, no condensation will take place.

(20) T. C. asks: 1. What is the difference between an ordinary induction coil and a Ruhmkorff coil? A. The difference lies in the perfection of the insulation, the employment of a condenser, and a somewhat different mode of winding. See how to make induction coils in SCIENTIFIC AMERICAN SUPPLEMENT, No. 160. 2. How is the coil constructed that is used to increase the current in a telephone, and how is it connected with the telephone? A. The induction coil described on p. 208 (14), vol. 39 of the SCIENTIFIC AMERICAN will answer; place the transmitter in the primary circuit and the receiver in the secondary. 3. Am I right in saying that there is no current induced in the secondary coil unless the primary circuit is broken. A. The current in the primary wire acts inductively on the secondary wire whenever it is opened or closed or varied in intensity or quantity.

(21) W. S. C. asks: How far will water fall in one second? A. About 16 1/12 feet.

(22) J. M. asks: Under the same conditions which of two steam radiators having the same exterior surface, will be the most effective, one having thick or thin sides? A. We think there will be a slight advantage in the case of the thin radiator.

(23) W. S. H.—The fact that a stone falls more rapidly than a feather, is due solely to the unequal resistance opposed by the air to the descent of these bodies. In a vacuum all bodies fall with equa rapidity.

(24) C. W. W. asks: 1. Is it not true that earthquakes are becoming less numerous? A. No. 2. Is it not acknowledged by our best scientists that the earth's crust, as we understand it, is growing thicker as time advances, and if possible give approximate ratio of increase or decrease? A. Savants consider the earth solid. 3. Where can I procure a work that will answer questions of a geological nature (like above)? A. Dana's *Manual*.

(25) "Subscriber" writes: I am building a boat 16 feet long, 30 inches wide at the bottom, is decked all over, but 6 feet long, 1½ feet wide through the middle, and 13 inches high; what I want is a sail that would suit it, and how large should it be? A. If you employ the usual cat rig, a safe sail would be about 12 feet long on the boom and 9 feet hoist.

(26) C. W. J. asks: What is the smallest power, in foot pounds, that will answer for the motor to drive a family sewing machine at work? A. About 1/20 of a horse power.

(27) A. M. asks: What diameter should the piston be for a piston blower for a furnace 6 inches in diameter and 16 inches to the top of the brick, what length of stroke, and at what speed should it be driven? A. Proportion it so that it can deliver about one cubic foot of air per minute.

(28) F. W. P. asks: From which does heat radiate the better, a smooth or a rough surface; in other words, which heats a room the quicker, a highly polished or a rusty, rough stove? A. Melloni's experiments show that a rough metallic plate is a better radiator than a polished one, other things being equal.

(29) M. M. asks: What is good to clean and polish the silver cases of watches? A. Well prepared rouge, or infusorial earth, rotten stone, tripoli, etc., are among the best. Well burnished silver requires no after polishing.

(30) Charley asks for directions for making a small horizontal steam engine. A. It would be well for you to copy some style of large engine, making your selection from the numerous illustrations in the back numbers of the SCIENTIFIC AMERICAN. You can buy nearly all the working parts, ready to put together. See our advertising columns.

(31) C. C. W. and others.—The principal difficulty with phonographs made by amateurs lies in the damping of the diaphragm. In some instances, the diaphragm is so thoroughly damped as to almost entirely prevent vibration; while in other cases the diaphragm is almost as free to vibrate as if no attempt at damping had been made. It is difficult to give directions that would apply in all cases; we therefore recommend experiment. The best size of needle is the common carpet needle, and the needle spring should be fully as heavy as represented in the drawings accompanying the directions for making a phonograph contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 133. Make your needle spring like that in the drawings; if it is a little stronger it will do no harm. Carefully adjust the damping of the diaphragm, and speak very loudly and distinctly into the mouthpiece.

(32) F. W. T. asks: 1. Can I make an electric light with 30 cells of Callaud's gravity battery? A. No. 2. If not, what form of battery is best? A. Grove's or Bunsen's. 3. What lamp is best to use? A. There are a number of lamps which seem to be equally good. 4 I have a chemical laboratory at command as well as machinists' tools. Can I make the lamp illustrated in last SCIENTIFIC AMERICAN, the Sawyer-Man lamp, from drawing and description there given? A. We think so. 5. If not, is there some form of lamp more easily constructed, and where is it described? A. The Werdermann, described on p. 373, vol. 39, of SCIENTIFIC AMERICAN. 6. I have made a phonograph, from drawings in No. 133 of SCIENTIFIC AMERICAN SUPPLEMENT, which is not quite satisfactory. I send needle and sample of foil; can you suggest the difficulty? I have followed drawings given. A. Needle not sharp enough. See reply to C. C. W. and others on this page. 7. In making a microphone I have used carbon that had been used in a battery. Does it make any difference, or must I have new carbons for that purpose? A. We think the carbon will do, but it should be soaked in warm water for a time. 8. Of what material are the carbon holders and diaphragms in the Sawyer-Man lamp? A. Carbon.

(33) G. M. asks how to insulate wire for magnets and other uses? A. A coating of thick shellac varnish will answer if the wire is wound before it becomes so thoroughly dry as to crack on bending the wire; it is better, however, to wind the wire with silk or cotton.

(34) M. G. W.—SCIENTIFIC AMERICAN SUPPLEMENTS Nos. 94 and 98 treat on warming and ventilation.

(35) A. B. asks: 1. How can I make a simple and cheap electric battery? A. See SCIENTIFIC AMERICAN SUPPLEMENT No. 157. 2. Can a galvanic chain or belt be made? If so, how? A. By connecting together alternating plates of zinc and copper.

(36) J. J. F.—For cement recipes, see SCIENTIFIC AMERICAN SUPPLEMENT No. 158.

(37) R. M. asks if emery is porous. A. Emery is corundum of black or grayish black color, and contains magnetite or hematite intimately mixed. There are gradations from the evenly fine grained emery to the kinds in which the corundum is in distinct crystals. It cannot be considered a porous body.

(38) "Dairy."—For description of the process of making artificial butter, see SCIENTIFIC AMERICAN SUPPLEMENTS Nos. 48 and 49.

(39) G. H. L. writes: I am having a sail boat built 32 feet over all, about 26 feet keel, and 12 feet beam, 15 to 18 inches draught of water. 1. Would it be too large for a cat rig? A. We know of cat boats of the size you state. 2. If not too large for a cat rig, what should be the dimensions of the sail, boom, gaff, and hoist? A. Boom, 32 feet, hoist, 23 feet, peak, 35 feet high in a vertical line.

(40) W. B. K. asks: Can you give me the numbers of the SCIENTIFIC AMERICAN that have the receipts for making matches? A. Waterproof matches, vol. xxxiv., p. 251; safety matches, vol. xxxv., p. 379; composition matches, xxxvii., p. 315, of the SCIENTIFIC AMERICAN.

(41) G. M. G. asks: Do the apparent changes in the moon, namely, new moon, first quarter, full moon, and third quarter, produce any visible change in the condition of the weather, such as to cause storms or to prevent them? A. The question has never been absolutely settled: the weight of evidence, however, is rather against the doctrine that the weather is measurably influenced by the phases of the moon.

(42) J. S. asks: 1. What is the horse power of a locomotive boiler having a fire box 36x24 inches, number of flues 28, size of flues, 3 inches, length of same 6 feet, shell outside diameter, 30 inches? A. There is no standard rule for estimating the horse power of a boiler. 2. One of the flues leaked, and the flue sheet appears thin below the lower flues. Size of flue sheet at thin place, one eighth to three sixteenths inch, space 4 inches, tested with cold water hydrostatic pressure to 90 lbs. to the square inch. Am I safe to run from 45 to 50 lbs. per square inch? A. We think so, if you have stopped the leak.

(43) W. E. C. writes: I wish to make a thermometer with an open end. Can I take an ordinary glass tube not blown out into a bulb, fill this with mercury, and use it as a thermometer? I wish the open end for making a register. What makes the difference in different sized thermometers—the size of the tube or height of the mercury? I would like to have the mercury size 1 inch to 5 degrees. A. Yes, but the tube would require to be very long. The mean coefficient of expansion for temperatures between the freezing and boiling points for pure mercury is 0·00010085 for each degree Fahrenheit—that is, it expands about 1-9916 its volume for each degree increase of temperature. From this datum the size of tube and amount of mercury required may be readily ascertained. The rate of expansion in thermometer tubes is increased by making the bulb or reservoir larger, or the bore of the tube smaller in proportion. For large thermometers the bulb reservoirs will not answer, as much time is required for the large body of mercury to assume the temperature of surrounding bodies. In its place the tube is usually wound closely upon itself in the form of a spiral.

(43) D. J. T. O. asks: Is there any way to bore a hole through a circular piece of plate glass, for a plate electrical machine? I have tried a bow drill with no effect. A. Use a copper tube in place of the drill, and keep it charged with emery and water.

(44) F. W. M. asks if increasing the strength of the magnets in a telephone will increase the volume of sound. A. It has been determined that there is a maximum strength for telephone magnets beyond which nothing is gained by using larger or stronger magnets.

(45) A. W. E. asks: 1. How much weight will a permanent magnet, 2 inches x 3-16 inch, hold up? A. It depends much upon its temper, form, and magnetization. 2. Would two fastened together be twice as strong, or should there be a space between? A. As we understand you, no; but a magnet formed by a number of thin magnets joined, like poles together, presents a much stronger magnetic field than a solid bar of the same weight under like conditions. You will find a description of a powerful magnet of this kind, invented by M. Jamin, on pp. 227-232, *Science Record*, 1874. 3. Can an electro-magnet have more power than a permanent magnet of the same size? A. Yes, much greater. 4. How can I make an explosive that will adhere to paper and explode by tearing the paper through it. Would it be better to add a few grains of sand? A. Reduce separately, by trituration, 4 parts of potassium chlorate, and 1 part of amorphous (red) phosphorus to powder. Moisten with water, cautiously mix the ingredients together, in small quantities at a time, and dry at a very gentle heat. Coat the paper with glue and a little sharp quartz sand. Another explosive mixture is prepared in a similar manner from 16 parts potassium chlorate, 8 parts black antimony sulphide, 4 parts flour of sulphur, and 1 part charcoal, moistened with gum or sugar water.

(47) H. C. B. asks for a receipt for making a cheap airtight and waterproof cloth. A. Boiled oil, 5 parts; wax, 1 part; turpentine, q. s., to form a uniform syrupy varnish. Through this slowly pass the cloth, first thoroughly dried and moistened with turpentine. Press out excess between weighted rollers.

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

J. S. L.—The sample of clay is nearly free from iron, but contains a small quantity of lime, magnesia, and silica. If properly washed it may prove of some value for the manufacture of fine pottery, etc.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

COMMUNICATIONS RECEIVED.

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

On Small Steamboats. By D. L.
Secret of the Whitehead Torpedo. By I. H. D.
On Flour Mill Explosions. By G. M.
On Electric Light. By A. G. B.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Many of our correspondents make inquiries which cannot properly be answered in these columns. Such inquiries, if signed by initials only, are liable to be cast into the waste basket.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

[OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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

November 26, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city

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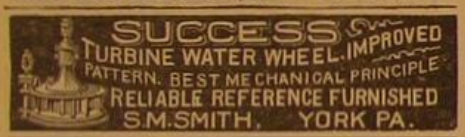

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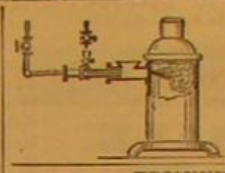

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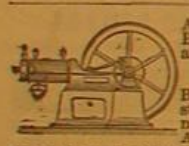

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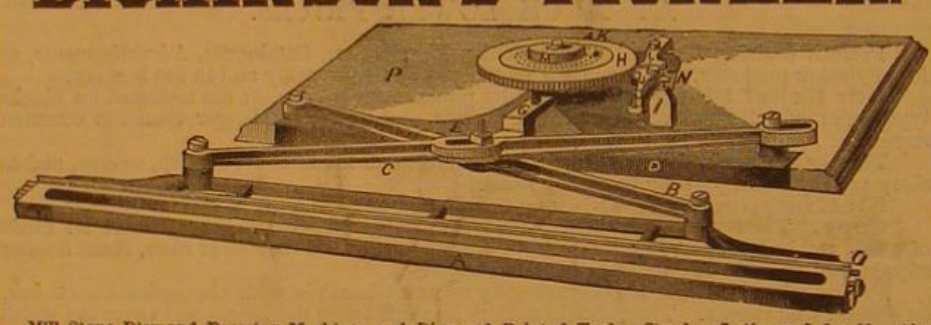

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