SCIENTIFIC AMERICAN

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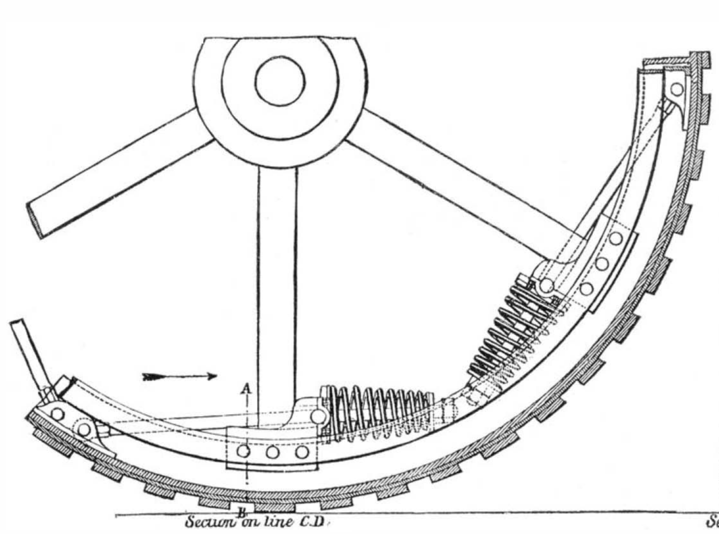
TRACTION ENGINE WITH SPRING WHEELS.

The object of these improvements is to provide the engines with means for relieving them from some of the shocks and strains to which they are subjected, particularly when working on hard and uneven roads.

Our engravings illustrate the latest improvements by Aveling & Porter, devised to give not only radial elasticity, but also a yielding in a circumferential direction, so as to enable the pull of the engine to be exerted through an elastic medium. The engine has been employed on the paved streets of the town and on country roads, and has run no less than 2,000 miles on these spring wheels, doing very heavy work most satisfactorily and without failure, so that the arrangement may be considered to have passed beyond the experimental stage.

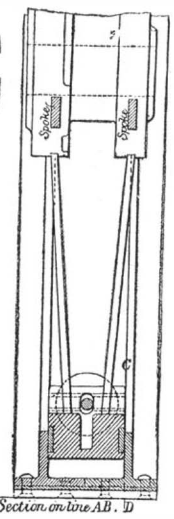
We give from *Engineering* a perspective view of a six-horse road locomotive fitted with these wheels, and two sections of the wheels showing the details of their construction. In the case of the engine illustrated, the driving wheels are 7 feet in diameter, and the outer rim is, as shown in Fig. 3, composed of two T-iron rings of very substantial section, united by an external ring of plate iron 14 inches wide. The inner part of the wheel, on the other hand, consists of a cast iron boss of the usual form, carrying six pairs of spokes, the outer ends of each pair of spokes being terminated by a cast iron block cast on them. To these blocks are riveted two rings of flat bar iron, which serve to connect the outer ends of the six pairs of spokes as shown. The blocks at the outer ends of the spokes are of such dimensions that they, with their connecting rings, just work freely within the webs of the two T-iron rings of the outer tire, as represented in Fig. 3.

At three points in the inner circumference of the outer tire there are riveted to the latter pairs of angle irons, to which are jointed the links or bars on which the springs act. There are six of these links, which are coupled by pins to the three pairs of angle irons just mentioned, and each of which passes through the block at the end of the adjacent pair of spokes, and has threaded on it one of Timmis' helical springs, as shown. Each spring exerts its thrust on a base plate which is pivoted to the corresponding block at the end of the spokes, while the compression of each spring can be adjusted by means of the nuts at the end of the bar on which it is threaded. The whole arrangement, which is very simple and workmanlike, will be readily understood on examination of the perspective view of the engine and



Section on line C.D.

Fig. 2

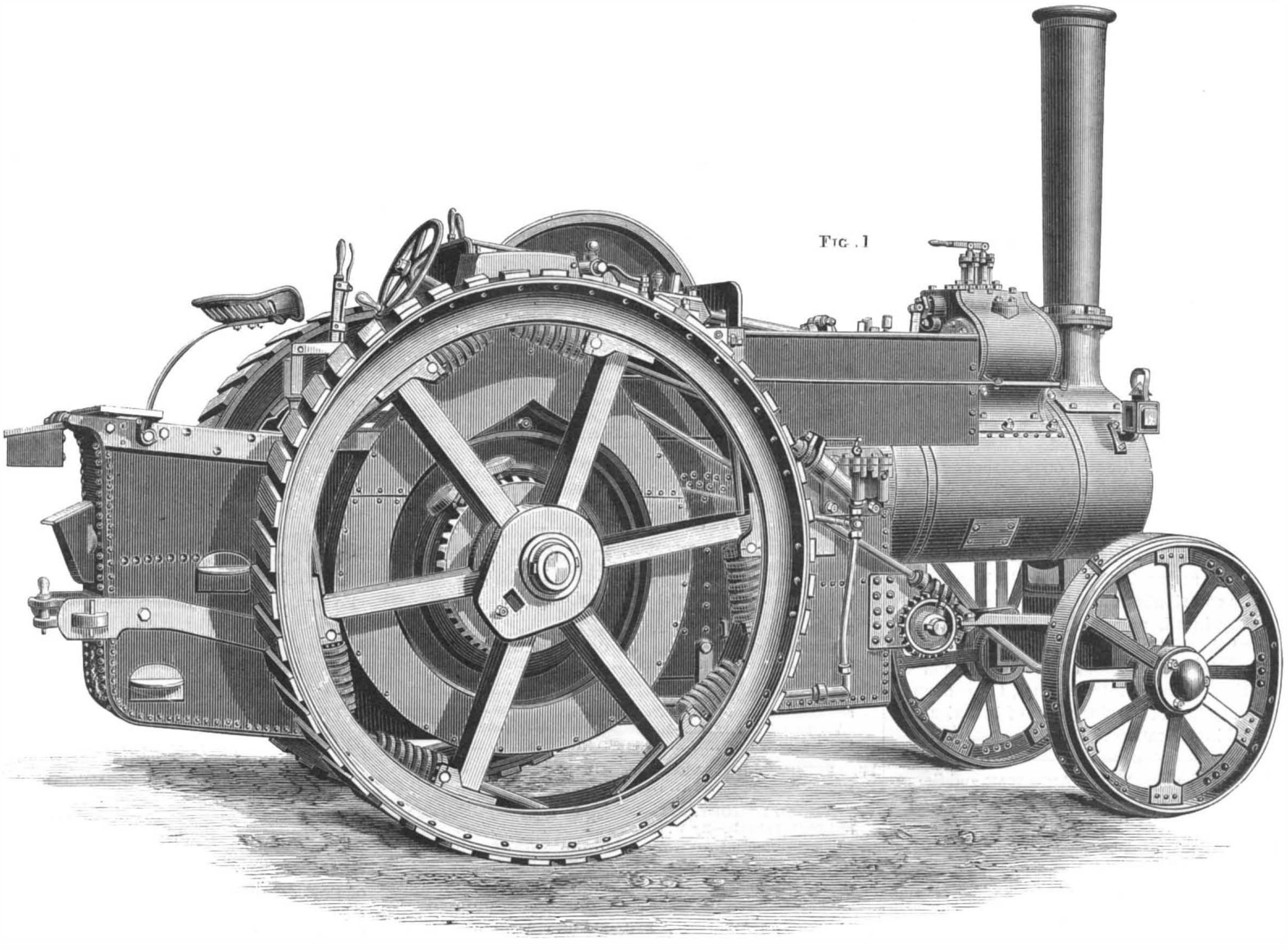


Section on line AB. D

Fig. 3.

the sectional views of the wheel already referred to. We have had, says our contemporary, an opportunity of witnessing some interesting trials of the engine from which our perspective view has been prepared. As we have said, it is rated by Messrs. Aveling & Porter as a six-horse, and it weighs in working order a little over 10 tons. On the day to which we refer a trip was made with this engine and three traction wagons loaded with scrap iron, the three wagons with their contents weighing 23½ tons, making the gross load, including engine, over 33½ tons. With this load the engine was taken through the city of Rochester and up Star Hill—a hill which nature has kindly provided at a convenient distance from Messrs. Aveling & Porter's works, apparently to facilitate the testing of traction engines. This hill commences with a short gradient of 1 in 75, followed by 110 feet of 1 in 22, then 110 feet of 1 in 14, then 114 feet of 1 in 16, then 135 feet of 1 in 14, then 264 feet of 1 in 16, then 107 feet of 1 in 11, and finally 221 feet of 1 in 55. Altogether the hill is 1,137 feet in length, and rises 63 feet, giving an average gradient of almost exactly 1 in 18; but of the total rise 58 feet is effected in a distance of but 841 feet, so that for this length the average gradient is 1 in 14½. Up this severe hill the engine took its load without hitch or trouble of any kind. Both when hauling this load up Star Hill and in passing over paved streets in Rochester, the action of the spring wheels was highly satisfactory.

On the return of the engine the wheels were severely tested by running the engine over timber laid across the road, "jumps" 8 inches to 9 inches high being thus repeatedly taken, and notwithstanding that the wheels after passing over the timber dropped the full height on the hard road, they sustained no injury whatever. Further experiments were then made to ascertain the extent to which the springs yielded under different conditions of working. For this purpose an iron pointer was securely clipped to one of the spokes and made to bear with its point on the web of one of the T-irons of the outer tire, so as to scratch on this web a diagram showing the amount of movement of the inner wheel within the outer tire. With the engine moving alone over a fairly good road it was found that this diagram showed a radial and circumferential elasticity of ½ inch, the curve traced by the point being almost a perfect circle. The engine was then coupled to one of Messrs. Aveling & Porter's 15 ton steam road rollers, and the brake of the latter was put hard on, while its engine was partially reversed so as to make the resistance just as much as the



IMPROVED TRACTION ENGINE WITH SPRING WHEELS.

traction engine could overcome. Under these circumstances the diagram traced on the outer tire became nearly triangular, the form being that of a triangle with curved sides, while the radial and circumferential elasticity increased to slightly over 1 inch.

Altogether, the action of Messrs. Aveling & Porter's spring wheels was throughout the experiments most satisfactory in every way, and the arrangement is one well fulfilling the requirements of the problem to be dealt with. One special feature in the wheels worth notice is the ease with which the springs can be adjusted so as to put them in a greater or less state of compression—thus making the whole wheel more or less rigid, as may be desired.

The Weather.

It is so common to judge the weather we have most recently experienced, or are just passing through, as a great deal more remarkable than any we have before known, that it is sometimes profitable to look over the records giving the exact data. The past winter, in the neighborhood of New York city at least, has called forth a great deal of comment from the number of its unpleasant days. On comparing the figures with those of a year ago, we find that of the first seventy days of 1883 there were forty-four in which either snow, rain, or sleet was precipitated, while during the same period of 1884 there were only forty-one days. What, then, is the cause for the popular verdict against the present season? There are several explanations. In the first place, there was greater variety last year. Rain was varied by snow, then by freezing cold, and pleasant weather came in at intervals, so that the spells of bad weather were not long and tedious. This year rain has predominated, and snow was incidental. From February 4 to 9 inclusive, there were six consecutive rainy days, and from March 1 to March 21 there were only five days without rain, and all were cloudy. The water precipitated this year has been largely in excess of last year's figures, and there has undoubtedly been more of it in the atmosphere on those days when there has been no actual rainfall at all. The precipitation of water in January and February, 1884, was 9·97 inches, against 7·80 inches during a like period a year ago. From March 1 to 21, 1883, the precipitation was 0·98 inch, against 3·44 inches for the corresponding time this year, making the total rainfall to March 21, 1884, 13·41 inches, as compared with 8·78 inches for the like time last year. It is a fact that since January 1 the sidewalks in New York city have not been dry for twenty-four consecutive hours. For these reasons the Signal Office figures and the oldest inhabitant's surmises, though apparently contradictory, are not so far apart as they would seem at first sight.

Atmospheric Waves.

Professor Soerster, director of the observatory of Berlin, and others, have remarked the existence of sudden barometric changes in calm, steady weather occurring during the month of August last, and have traced their connection with the eruption of Krakatoa on August 27. The chief shock of this eruption was felt about 7 A. M. on that day, and the resulting atmospheric wave appears to have traveled over the world. The first wave was felt at Berlin about ten hours later, giving a velocity of propagation of 1,000 kilometers per hour, or nearly the speed of sound. About sixteen hours later a second disturbance was felt, probably due to the wave which did not come direct, but round the other side of the world, by America. For the same speed of propagation the time would correspond to the distance in this case. Moreover, thirty-six hours after the first disturbance at Berlin, a third was felt of a weaker sort, and this corresponds again in point of speed. Lastly, a fourth and weaker disturbance was observed thirty-four hours after the second wave, the acceleration in this case being due, perhaps, to atmospheric currents from east to west.

William Sturgeon.

A most remarkable man was the electrician William Sturgeon, whose discoveries and inventions in electricity may be traced under modified forms in many of the principle electrical apparatus now in use, but whose claims to honor are well nigh if not quite ignored. He was born in 1783, and from first to last his life was one of labor and poverty, yet it is marvelous how much excellent work he performed in the trying circumstances. Beginning life as a private soldier, in spite of all the difficulties inherent in such an existence, by great industry he acquired considerable proficiency in science, not neglecting either the literary side of education. His contributions to science, commencing in 1823, are about fifty in all, published in the *Philosophical Magazine* and the "Annals of Electricity," all bearing on his favorite study—electrical phenomena. To Sturgeon we are indebted for the soft iron electro magnet, the commutator, and the amalgamation of the zinc plates of batteries, and numerous electrical investigations.

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NEW YORK, SATURDAY, MARCH 29, 1884.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 430,

For the Week ending March 29, 1884.

Price 10 cents. For sale by all newsdealers.

THE PATENT BILLS BEFORE CONGRESS.

The efforts lately made by manufacturers and inventors to arrest the further progress of the destructive legislation concerning patents, have had this much of good effect in the Senate, namely: instead of rushing through the bills with railroad speed, as did the House, the senators have held back; instead of precipitate action they have wisely given a hearing to some of those whose property rights are endangered; still another hearing, it is believed, will be given. This concession has been gained chiefly in consequence of criticisms of the press and the receipt by senators of personal letters and protests from many different parts of the country.

In an emergency of this kind members of Congress are very greatly influenced by the appeals and information received directly from individuals.

We again entreat the friends of home industries, editors, manufacturers, patentees, inventors—all who favor the progress of the useful arts and the maintenance of the patent laws—to persevere with their efforts.

We urge them to adopt all proper methods they can command; especially to write protesting letters, without delay, first to their Senators, and next to their Representatives in the House. Each individual should consider it a personal matter, and not wait for some one else to write or act. Every letter, every telegram sent, every effort made, will help, and may prove of importance.

For the convenience of readers we republish the numbers and general nature of some of the bills before the Senate.

House bill 3,925, introduced by Hon. Mr. Calkins, of Indiana, provides substantially that if the inventor or owner of a patent shall dare to attempt to sustain his rights by bringing a suit against infringers, he shall recover no costs, and shall pay to the infringer's lawyer a counsel fee of $50. This bill was passed in the House of Representatives by an enormous majority, on January 21, and is now before the Senate for concurrence. The members who voted for it apparently regard it as a very upright proceeding to encourage the inventor to reveal his invention by passing laws to give him a patent, and then passing other laws to deprive him of the benefit of said patent. This is the way Congress exemplifies integrity and fair dealing before the people.

House bill 3,934, introduced by Mr. Vance, of N. C., provides substantially that any person may use any patented article he pleases without liability, but shall become liable after receiving notice that a patent exists; and may then require the patentee to give him the use of the patent for a royalty to be named by the courts, thus robbing the patentee in the first instance and then depriving him of the control of his patent. This bill was passed by the House, January 22, 1884, by a vote of 114 ayes to 6 noes.

The full texts of the foregoing bills will be found on page 73 of the SCIENTIFIC AMERICAN for February 2.

House bill 3,617, introduced by Mr. Anderson, of Kansas, is as follows:

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That section forty-eight hundred and eighty-four of the Revised Statutes is hereby amended by striking out the word 'seventeen' and inserting in lieu thereof the word 'five;' and that all acts or parts of acts inconsistent herewith are hereby so modified as to be made consistent."

This bill has not yet passed, but perhaps soon will be by a great majority, as there is no member in the House who has so far ventured to say a word in protest or speak in favor of inventors or the present patent system.

In the Senate the bill introduced by Mr. Voorhees, of Indiana (S. 1,558), provides in effect that all patents shall be free to the public. This bill caps the climax; it has not yet passed; but soon will be if the members of the Senate share in the views of the House majority.

The following is the text of Senator Voorhees' bill:

S. 1,558. "*Be it enacted, etc.*—That it shall be a valid defense to any action for an infringement of any patent, or any suit or proceeding to enjoin any person from the use of a patented article, that the defendant therein, or his assignor, purchased the patented article for use or consumption, and not for sale or exchange, in good faith and in the usual course of trade, without notice that the same was covered by a patent, or without notice that the seller had no right to sell such article; and in all such cases notice received after such purchase shall not have the effect to impair in any way the right of such purchaser as absolute owner."

Let no one be backward in expressing, in a decisive way to Senators, their views upon these obnoxious bills.

In addition to personal writing to members, individual effort might accomplish much by securing the passage by associations, societies, municipal governments, and State Legislatures, of resolutions appealing to Congress not to enact these suicidal measures.

On the 20th inst., the Chamber of Commerce of the city of Pittsburg, Pa., passed resolutions protesting against the passage of various hostile patent bills now before Congress, and requested Senators and Representatives to give them careful consideration, and endeavor to prevent legislation which will discourage invention.

We give these resolutions elsewhere. In another column we also publish a very interesting article from the *Kansas City Centropolis.* This contribution, we learn, is from the pen of Prof. John D. Parker, the well known lecturer on science.

Before this number reaches our subscribers a convention of inventors and all who are interested in the development of the useful arts will be in session at Cincinnati. From their deliberations we hope for good results.

ITEMS CONCERNING THE PATENT BILLS.

The first meeting of the Senate Committee on Patents since the passage of House bill 3,925 was held on Monday, March 17, at which were present, among others, W. D. Andrews, of New York City; S. J. Houck, of the Champion Works, of Springfield, Ohio; Thos. K. Kays, celluloid manufacturer, of Newark, N. J.; A. J. Nellis, of Pittsburg, Pa.; Andrew Allbright, of Newark, N. J., a number of other manufacturers and inventors, and several patent attorneys. Ex-Senator Norwood made a strong argument against the passage of the House bill, first taking the broad ground that the Constitution prohibited the passage of such a bill, and then opposing it upon the ground of public policy. Its passage, he said, would eventually destroy four-fifths of the patents in the country.

"He that asks for equity," continued the senator, "must do equity. He that asks for another man's property should offer to pay its value. If he does not, he should surrender the property. Who, of all the users of the driven well, for instance, has ever ceased to use it, when asked to pay for it? Any one can have it for life on payment of $10. And when it is offered for $5, many refuse to pay, though they would not do without it for hundreds of dollars. And this is the class who are asking Congress to compel the owners of that property to '*buy justice*, or to submit to conditions not imposed upon their *fellows* (themselves) as a means of obtaining it.' And that, says Judge Cooley, is in violation of the Constitution.

"This bill would divide our citizens into two classes—owners of patents and non-owners. Then, it says to non-owners: 'You can have justice without buying it;' and to patent owners: 'You can have justice, provided you first give bond for $50, and take the chances of buying it or not buying it, as you may make proof or not of $20 damages, and as you may prove guilty knowledge by relying on the defendant's conscience. Then, it subdivides patent owners into two classes, and says to one, if you have a demand for over $20 you need not pay costs, but if your claim is under $20, you must pay your own way, that is, *buy justice*."

Mr. Thos. K. Kays then argued against the bill from an inventor's and manufacturer's standpoint, saying that he had spent $20,000 in inventing and perfecting a certain invention, which had been patented, both as to the process and manufacture, and that the proposition was now to take away from him the protection that was guaranteed him by his patents. He showed how his invention had benefited the community by reducing the cost of the article over one hundred per cent, and giving a better article than was used before his invention. He referred to other patented articles where the public benefit had been equally as great, and then denounced the bill as a breach of faith between the Government and the inventors.

Mr. Allbright also spoke as an inventor, and urged the committee to pause before they committed a great wrong in the passage of the bill under consideration. He believed it was but an entering wedge, which, if passed, would be followed by other bills, until the entire patent industry of the country would be destroyed. He urged that, instead of passing a bill of this character, they should pass one punishing the piracy of an invention with fine and imprisonment just the same as the theft of a horse or a watch.

Mr. Nellis pursued the same line of argument, and then Mr. Andrews spoke in reference to the scope of the bill and its injustice, and illustrated it by showing the course adopted by the customs officers of the government. If goods are brought to the custom house, the duties paid, and they are taken out of bond and sold to other parties, and it is then discovered that insufficient duty has been paid, the government will promptly proceed against the innocent purchaser. The inventor or manufacturer is granted no more power under his patent in defending his rights than has the government in collecting its just revenue; but he is entitled to an equal protection.

Mr. Winans, of Wisconsin, said his people have been harassed by the operation of patents. When pinned down to the character of the patents that caused the annoyance, he admitted that they were mostly in regard to the drive well or barbed wire fence.

Mr. Platt, the chairman of the Senate Committee on Patents, admitted that since the passage of the bill 3,925 by the House, he had received two protests by large manufacturing firms in his State.

Senator Mitchell, of Pennsylvania, also said he had received numerous telegrams and letters from manufacturers in his State, protesting against the passage of the bill, and that these protests were such that they could not be ignored or lightly treated.

Other senators and members have been seen, but who are unwilling at present to be quoted, many of whom are surprised at the storm that has been raised by the passage of House bills 3,925 and 3,934, and who are now beginning to look up statistics and to realize how widespread an interest is the patent industry and how closely it is interwoven with almost every other industry. Those who voted for the measures in the House do not believe that they are right but think, as one of them expressed it, that "it is a sop to the people who have suffered from suits on account of the drive well and the barbed wire fence."

How seriously the Western farmers and railroad people have "suffered" from the barbed fence patents will be understood when we state that prior to the introduction of the patent the cheapest fence that could be had—boards—cost the farmers one dollar a rod, against fifty cents a rod for barbed wire fencing. Statistics show that from 1874 to 1882, a period of only 8 years, the railways and farmers have saved a little over *eight hundred millions of dollars* by the use of the improved wire fencing. Now they begrudge the patentees their slight royalty, want Congress to change the patent laws and destroy all patent property.

The press of the country is doing noble service in opposing this communistic legislation. We have upon our table copies of many influential papers containing vigorous editorials upon the subject. We regret that our limited space precludes extensive quotation.

The whole subject is covered in a very amusing way in the following, which is from the *Spike*, of Prophetstown, Ill. The editor says:

The following has been handed us as a substitute for the amendment to the patent laws lately passed by the House of Representatives: "Now, therefore, these letters patent are to grant unto John Smith, his heirs or assigns, for the term of five years the *exclusive* right to make, use, and vend the said invention throughout the United States and Territories thereof, provided that the said John Smith shall send written notice to each and all persons, throughout the United States and Territories thereof, that might wish to manufacture the articles, that the same is patented. And be it further understood that the *exclusive* right of the patentee does not hold as against persons who may wish to manufacture the said patented article for themselves or for their employers, and not for sale or profit. All such persons shall have equal rights to the invention with the patentee, and the patentee must not under any circumstances harass or annoy the last named persons by letters, protests, or threats, under penalty of forfeiture of the aforesaid *exclusive* right."

FINISHING BY PRESSURE.

Articles of wrought iron and steel, as parts of machines, guns, and small tools, are largely made by the process of drop forging. Thus shaped in dies they require only surface finishing, as their forms are secure and nearly perfect. Many of these articles require, however, the milling machine or hand filing to dress them previous to polishing. This work can be saved in many instances by compression finishing. Sewing machine shuttles and small gun parts, pistol frames, fork wrenches, and many other small pieces, are subjected to pressure while cold, with the result of producing a very clean and even surface. Under a pressure of 800 tons a small piece, like the hammer of a percussion lock gun, comes out of the compression dies as clean and smooth as the faces of the dies themselves will permit. In fact, the process is exactly like that of minting gold, silver, nickel, and copper blanks; the cold metal is compelled to flow and fill the dies. Under such a pressure drop forged Norway iron, after been subjected to the tremendous impact of the drop forging hammer, will yield to a permanent compression of one four-hundredths of an inch.

A LONG STRAIGHT EDGE.

An absolutely exact straight edge of more than thirty-six inches is a wonder of mechanism. One of six feet was not recently believed possible, although several had been made on different plans of web-like and truss construction. It has been claimed, however, that almost absolute exactness has been secured by a straight edge twelve feet long. The appliance looks like an arched truss, the highest spring of the arch being only twenty inches in a length of twelve feet. The space between the chord and the spring is filled with diagonal lattice work; the whole is a casting on which no peening with the hammer is allowed. Three of these straight edges have been made, one remaining in the establishment where built and two going to technical colleges. Each of them has been tested by each other, and proved to be practically perfect. Such a tool is invaluable in testing lathe and planer beds.

Hostility to the Patent Laws.

The present House seems prolific of measures dangerous to the interests of the people, and if the Senate does not hold a steady check upon the vicious tendencies exhibited in the House, we may expect a batch of most pernicious laws. The wholesale attack made upon the Homestead and kindred acts has been followed by the introduction of no less than fifteen different bills intended to cure defects in the patent laws and protect the farmers of the West against impositions practiced upon them by patentees and their agents.

There should be no objection to a judicious amendment of any law which experience has shown to be defective, but the various measures proposed are so radical and sweeping that they overturn the existing order of things, unsettle long recognized principles, and deal very harshly with the rights of individuals.

Taken as a whole, the tendency of these bills is to lessen the rights of the inventor and facilitate infringements on the part of those who feel disposed to deprive patentees of the profits resulting from their inventive skill. Should the bills pass in the form proposed, hundreds of patents which have cost their owners much labor and many thousands of dollars will become practically useless because they cannot be successfully protected against infringements.

America has become renowned as the home of inventive genius, and it would be impossible to estimate the advantages which have resulted, not only to the United States but to the whole civilized world, from what is generally known as our "Yankee ingenuity." Our patent laws are essential to our prosperity and development, and unless it can be clearly shown that they are something more than just and equitable, they should not be nullified and thrown into hopeless confusion. There is not much prospect that the House will stop short of the most radical changes, but the Senate should give the matter their most careful and deliberate consideration.—*Pittsburg Commercial Gazette.*

Protest by Pennsylvania People.

A meeting of inventors and manufacturers, owners of 500 active patents, and representing a million dollars capital, met in Erie, Pa., March 20, at the Board of Trade rooms, to enter a protest against the bills pending in regard to patent rights. A memorial will be sent to the Senate at once. Great indignation was expressed at the hasty action taken in this important matter in Congress.

The Cincinnati Convention.

The convention announced to meet on the 25th of March will assemble while this number of our paper is going through the press. Reports will be given in our next. Delegates are expected from all the States, and from Canada.

The address says: "The time has arrived when it becomes necessary for inventors and patentees to assert and maintain their rights against the encroachments of the large corporations and certain individuals who for selfish ends have made strenuous efforts to subvert the present wise and beneficent patent laws, and engraft such legislation on our statute books as will make every inventor, present and prospective, a prey to greed and rapacity."

Resolutions of the Pittsburg Chamber of Commerce.

A special meeting of the Chamber of Commerce was held March 20, 1884, President John F. Dravo in the chair. After some discussion, the following protest and resolution was adopted unanimously:

PROTEST OF CHAMBER OF COMMERCE OF PITTSBURG AGAINST THE PASSAGE OF HOSTILE PATENT BILLS BY CONGRESS.

The Chamber of Commerce of Pittsburg earnestly requests our Senators and Representatives to give the various bills before the Committee of Patents careful consideration, and endeavor to prevent legislation which in effect will discourage active minds from engaging in the development of machinery and appliances such as have been and are of so great benefit to all our agricultural and mechanical interests.

We call special attention to House bills 3,617, 3,925, 3,934, and Senate bill 1,558, and all others of like import, proposing legislation of a mischievous character, of wrong to inventors and injury to our manufacturing interests.

Resolved: That copies of these proceedings be forwarded to our Senators and Representatives.

JOHN F. DRAVO, Prest.

Utilizing Factory Waste Liquors.

The waste liquors flowing from woolen mill works, although at one time deemed of very little use, are now converted into various articles of considerable commercial value. Messrs. Donaldson & Co., oil distillers and refiners, of Hawick, Scotland, have succeeded in turning to good account the greater part of this waste.

The liquid in the original state is the waste arising from the scouring of woolen goods and yarns, the technical designation of the recovered product being "magma." This material, which has a soft, spongy appearance, is put into canvas bags and subjected in hydraulic presses to a pressure of about two tons to the square inch. The oily matter finds its way from the canvas, leaving a black-looking refuse which is used afterward for top dressing and hop growing. The oil is then distilled, and a combination of cloth-oil and stearine produced. This distillate is afterward separated by being enveloped in sailcloth sheets, the oil, as before, coming through the sheets, and the stearine remaining in them. The oil is largely used in wool and jute spinning, and the stearine in the manufacture of composite candles. The stearine itself, if wanted of a very high quality, is again repressed between sheets of sailcloth and hot iron plates, and then becomes the beautiful product known as hot-pressed stearine, used in the making of tapers. In the process of distillation a hard black pitch is left in the stills, and this, it has been found, is invaluable as a lubricator in iron rolling mills, it cases where the journals get so hot that an ordinary oil would evaporate and take fire. A light spirit oil is also got in the course of distillation, and this is serviceable for dissolving India-rubber. The cloth-oil is also converted into soft soap. When all these processes are completed, the only remnant of the spongy "magma" is a pure liquid, as clear as the clearest water, and this is the sole part of the original refuse for which a purpose has not as yet been found.

Not the least of the benefits accruing from these operations would be the freedom from pollution of these streams which now carry off this waste, and the consequent ceasing of the complaints now made by riparian proprietors. But in order to accomplish this most desirable end, the process must be simple, effective, and cheap.

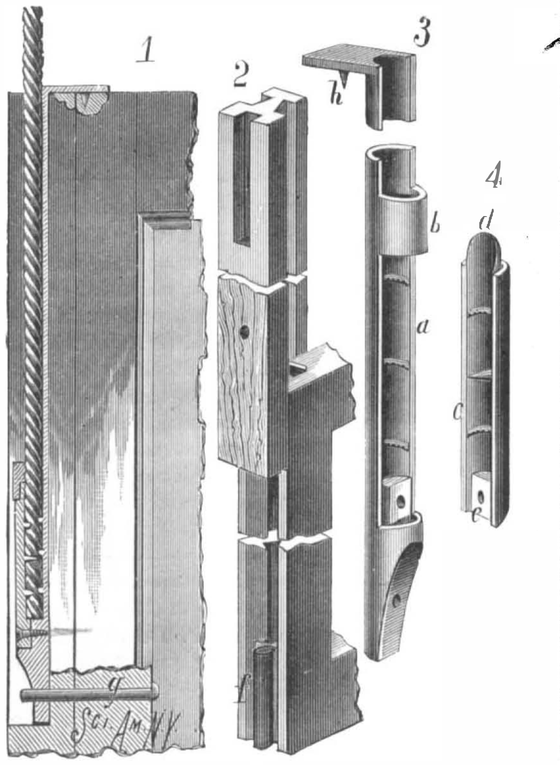
Ganomite—a New Lead Mineral.

Sjoergen has analyzed a new mineral from Nordenskjold called *ganomite*, and finds that it is a double silicate of lime and lead, having the formula

$$2\left\{\begin{matrix} CaO \\ PbO \end{matrix}\right\}(SiO_2)_2.$$

SASH-CORD FASTENER AND WINDOW SASH.

Inventions recently patented by Mr. W. A. Sinsel, of Waukesha, Wisconsin, relating to window sash and method of fastening cord, are shown in the accompanying engraving. The main portion of the fastener, cast of metal in the form of a ribbed trough, is bridged over at *b*, Fig. 3. The end of the cord, being inserted beneath the bridge from its outer end, is drawn in and placed against the ledge at the lower end of the trough. The cap, *c*, Fig. 4, is now placed in position by first inserting the lip, *d*, beneath the bridge,



SASH CORD FASTENER AND WINDOW SASH.

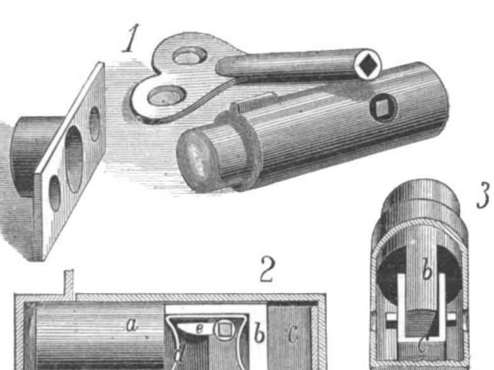
and then pressing the lower end against the body and turning in a screw at *e*. About the center of the trough of the detached part is a spur. The ribs are embedded in the upper and under sides of the cord, and the spur is forced through it, thus firmly securing it without knotting.

In order that the fastener (shown in section in Fig. 1) may be placed in position when the sash is in the window, the shank is made long, and at its top is bent at a right angle to rest on or be mortised into the top of the sash. This offset is provided with a spur which enters the sash. At the lower end of the device is a hole to receive a pin, inserted through the sash from its inner edge inside of the glass.

This device is attached to one side of the sash. A second device, similar to the one described except that the shank is left off and a hole made in the piece just above the bridge for the reception of a screw, is secured to a movable section forming part of one side of the sash, by means of the screw through the upper end and pin through the lower. The movable section is shown in Fig. 2. It may be attached by a tongue and groove, or by a dovetailed joint. To remove the sash from the window it is only necessary to withdraw the lower pins, when the weights will lift the removable cord fastener and the sliding section, leaving the sash free to be taken out of the window frame.

AN IMPROVED LOCK.

In the accompanying cuts representing a lock recently patented by Mr. David Morris, Fig. 1 is a perspective view of the lock, key, and catch; Fig. 2 is a longitudinal section,



MORRIS' IMPROVED LOCK.

and Fig. 3 a view on a plane perpendicular to that of Fig. 2. A portion of the sides of the bolt, *a*, inside of the case is cut away in order to form a flat section, *b*, in which is made a deep and wide notch wherein the wiper, *e*, works to throw and lock the bolt. The wiper is provided with a pivot and key studs, by which it is mounted for support on the stand, *c*, which is attached to the inner end of the lock case. The stand has two upright arms in which the pivots projecting from one end of the wiper work. The wiper swings along the top or open side of the notch in the bolt between the ends. Within the notch is placed the U-shaped spring, *d*, the shanks of which rest against the top and bottom of the notch. It will be readily seen that after the wiper has moved so as to shift the bolt to either the forward or backward position (as in Fig. 2) the spring, *d*, holds the wiper in place against all jarring and prevents it from being turned out by any instrument except the key. The device is simple in construction and effective in operation.

Further information may be obtained by addressing Mr. N. Wright, of Mountville, Ohio.

Underground Telephone Wires.

In an article in a late issue of the *Popular Science Monthly*, by Dr. W. W. Jacques, the author, says: "The American Bell Telephone Company has recently constructed two short lines of underground wires in the business section of Boston, and these give us excellent data from which to judge of the extent of technical practicability and the expense of putting all wires undergound. We have seen that in Paris the retardation and induction are both obviated by the use of double and twisted wires in metallic circuit; it is necessary that all of the wires be in metallic circuit, for, if a metallic circuit be connected with a single line circuit, the disturbances are not removed. If a subscriber in one city wishes to talk with a subscriber in a neighboring city, both cities must have metallic circuit systems and metallic circuits between the two cities. As the two lines constructed in Boston are short, only about one-quarter of a mile each, it was deemed best to use single line circuits, hoping that the induction and retardation on so short lines would not be serious. The system is constructed as follows: Eight wrought iron pipes, 3 inches in diameter, are laid side by side in two rows about 4 feet below the surface. At each street corner is built a brick chamber, large enough to admit a man, and with a cover flush with the street. The cables, of which several kinds are in use, run out from the basement of the central office through these pipes and up the side of buildings to roofs, from which they spread out to the subscribers by means of ordinary overhead lines. Conversation over these lines is not so easily carried on as by means of overhead wires, and it is frequently possible to overhear other conversation. This prohibits further extension of the single wire system underground, for technical reasons. The cost of the piping and chambers is, in round numbers, $50,000 a mile, and these pipes are intended to accommodate one thousand wires. The cost of the cables is from $60 to $150 a mile for each circuit, according to the kind of cable used. In round numbers, we may estimate the total cost for one thousand wires at $150,000 a mile, or $150 a mile per circuit. The cost of piping and chambers would be nearly as great for one hundred circuits as for one thousand, as the cost of chambers and the labor of excavating and filling would be the same; so that the cost for one hundred wires may be estimated at $50,000 a mile, or $500 a mile per conductor. The cost per conductor thus increases enormously as the number of conductors diminishes, so that it would be clearly impossible to follow out the wires of an exchange system in all of their bifurcations."

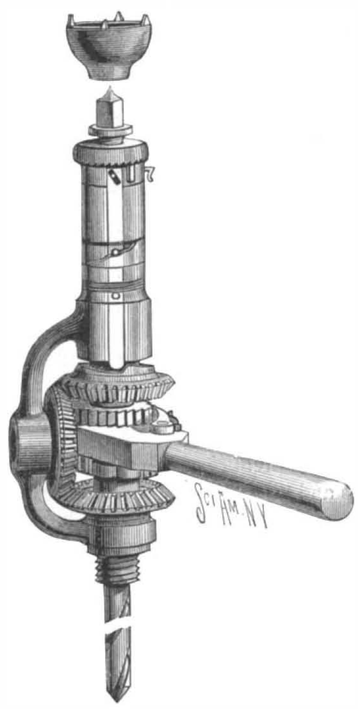
The Supply of Doctors.

The spring graduation exercises at our educational institutions invariably show a full quota of would-be doctors. The "output," if we may so style it, is sufficient to prevent any diminution in the ranks of a profession already well filled, and is quite large enough, even, to provide ample attendance should the nation be so unfortunate as to be visited by a series of plagues. At two New York city colleges there were 202 new doctors sent out on the same day—March 13—of whom 149 were allopathic and 53 homœopathic. Daniel Webster used to say that in the profession of the law there was always "room at the top," but what proportion of these graduates will thus find themselves assured of a lucrative practice, compared with the number that will not do as well as an educated mechanic is likely to do? The latter are always scarce, but the doctors and lawyers seem to be increasing as though the sickness and quarreling of mankind were to be indefinitely multiplied.

IMPROVED RATCHET DRILL.

A continuous rotary motion of the drill is obtained by a forward and backward movement of the lever of the ratchet, and the drill fed automatically at the same time.

The spindle extends through the lower and into the upper bearing of the frame. A screw stem fits loosely in the upper bearing, and its lower end fits into the spindle, whose upper end is formed hollow. The screw stem is prevented from turning by a feather on the frame entering a slot cut in the screw. On the top of the frame is a loose collar, beneath a nut that is formed with ratchet teeth on its under side. A pawl fitted in a recess in this collar is forced upward by a spring so as to engage with the teeth on the nut. Fixed to the spindle above the lower bearing is a bevel pinion, fast to whose hub is a ratchet wheel. Loose on the spindle below the upper bearing is a second bevel pinion having a ratchet wheel on its hub. On the spindle between the ratchet wheels is hung an operating lever, provided with pawls engaging the ratchet wheels, the teeth of which are reversed. A third bevel pinion fitted loosely in the frame engages with the pinions already described, as shown in the engraving. On the frame slides a bar, having its lower end engaging with a cam on the upper side of the upper pinion. The upper end of this bar is furnished with an inclined slot engaging with a pin projecting from the loose collar. The movement of the bar is regulated by a cam sleeve loose on the frame. In the operation of the drill, the lever being moved in one direction, the pawl rotates the upper pinion, and motion is transmitted through the side and lower pinions to the spindle. On its return it operates the lower pinion, keeping up the movement of the spindle in the same direction as before. As the upper pinion moves, the sliding bar is raised, the loose collar turned, and the screw forced up a little. The upper end of the screw is squared to receive a cap for holding the drill.



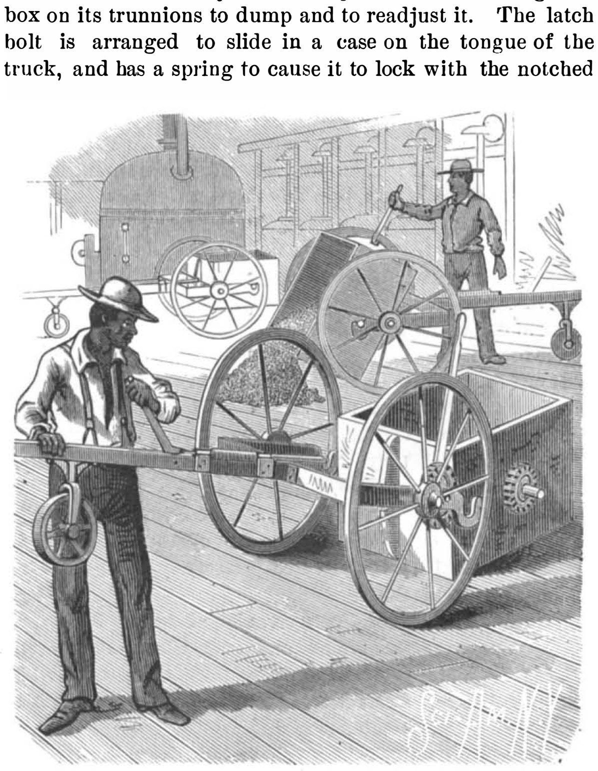
BREDE'S IMPROVED RATCHET DRILL.

This construction makes a compact and strong tool, in which there is no lost motion, and in which the feed can be easily adjusted.

This invention has been patented by Mr. William Brede, of Honolulu, Oahu, Hawaiian Islands.

IMPROVED TRUCK FOR SUGAR REFINERIES.

The frame of the truck is forked, the two side bars being connected at the front by a cross bar. The sides have short axles for the wheels, and they project back nearly half the length of the box, and terminate in hooked bearings adapted to lift up and hold the box, as shown in the engraving. The box is of rectangular form, and is provided with trunnions at the center of its sides, and with a notched cleat attached to the front end, in which a sliding latch bolt engages. On one of the side bars of the frame there is a toothed wheel pivoted so as to gear with the wheel on the box when the box is resting in the hooked bearings. The wheel on the side bar has a lever by which to operate it for turning the box on its trunnions to dump and to readjust it. The latch bolt is arranged to slide in a case on the tongue of the truck, and has a spring to cause it to lock with the notched



MAVOR'S TRUCK FOR SUGAR REFINERIES.

cleat when the box swings into position, and a lever to detach it when the box is required to dump.

In the usual way of using sugar wagons the boxes have three small rollers upon which they are rolled along the floor; but when they are to be emptied they have to be lifted up, and as the box and its load weigh about nine hundred pounds the services of three or four men are required. But with the truck here shown one man can load the filled box on his truck, roll it to the dumping place, and dump it with less labor than when assisting in the old process.

This invention has been patented by Mr. W. C. Mavor, of Forlorn Hope, La.

SCIENCE IN ANTIQUITY.

MIRACULOUS VESSELS.

Ctesias, the Greek, who was physician to the Court of Persia at the beginning of the fourth century of our era, and who has written a history of that country, narrates the following fact: Xerxes, having caused the tomb of Belus to be opened, found the body of the Assyrian monarch in a glass coffin which was nearly full of oil. "Woe to him," said an inscription at the side, "who, having violated this tomb, does not at once finish the filling of the coffin."

Xerxes, therefore, at once gave orders to have oil poured into it; but whatever the quantity was that was put in, the coffin could not be filled. This miracle must have been effected by means of a siphon, analogous to the one found in the Tantalus cup, and which becomes primed as soon as the level rises in the vessel above the horizontal; that is, on a line with the upper part of the tube's curve. In fact, proof has been found of the use of the siphon among the Egyptians as far back as the eighteenth dynasty, and Heron, in his *Pneumatics* (book xii., chapt. iii.), describes a very large number of vessels that are founded upon its use.

The ancients, likewise, solved a problem contrary to that of the tomb of Belus, and that was one connected with the construction of a vessel that should always remain full, whatever was the quantity of water that was removed from it; or, at least, which should remain full even when a large quantity of water was taken from it.

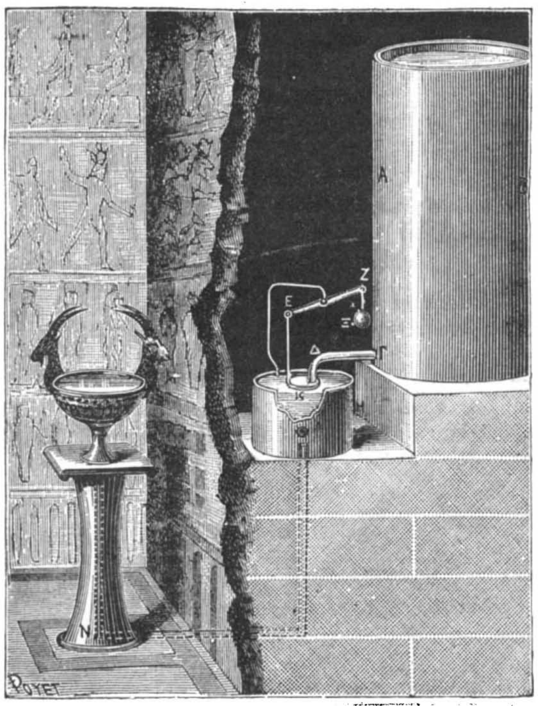


Fig. 1.—A MIRACULOUS VESSEL OF HERON.

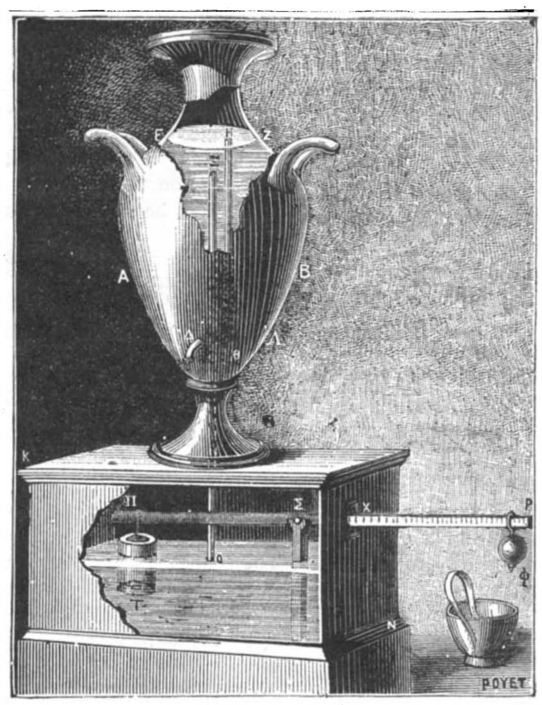


Fig. 2.—MIRACULOUS VESSEL OF HERON.

The annexed engraving (Fig. 1) shows one of the arrangements employed.

"Let $A B$ be a vessel containing a quantity of water equal to that which may be demanded, and $\Gamma \Delta$ a tube that puts it in communication with a reservior, $H \Theta$, lower down. Near this tube there is fixed a lever, $E Z$, from whose extremity, E, is suspended a cork float, K, and to whose other extremity, Z, there is hooked a chain that carries a leaden weight, Ξ.

"The whole should be so arranged that the cork, K, which floats on the water, shall close the tube's orifice, that when the water flows out the cork, in falling, shall leave such aperture free; and, finally, that, when a new supply of water enters, the cork shall rise with it and close the orifice anew. To effect this the cork must be heavier than the leaden-weight suspended at Ξ. Now, let ΔM be a vessel whose edges should be at the same height as the level of the water in the reservoir when there is no flow through the tube because of the cork float. Again, let ΘN be a tube that connects the reservoir with the base of the vessel, ΔM.

"So, then, when we remove water from the vessel, ΔM, after it has once been filled, we shall at the same time lower the level of the water in the reservoir, and the cork, in falling, will open the tube. The water thereupon running into the lower reservoir, and from thence into the external vessel, will cause the cork to rise and the flow to cease, and this will occur every time that we remove water from the tazza." There were, also, vessels which discharged but a certain definite quantity of the liquid that they contained. We have already described one of these, but here is another that is more complicated, wherein the quantity of liquid that it measures out may be caused to vary in the same vessel.

A vessel containing wine, and provided with a spout, being placed upon a pedestal, to cause the spout, by the simple moving of a weight, to allow a given quantity of wine to flow; now, for example, half a cotyle (0·13 *liter*), *and now a whole cotyle; or, briefly, any quantity that may be desired.*

"Let $A B$ be the vessel into which the wine is to be put (Fig. 2). Near its bottom there is a spout, Δ. Its neck is closed by a partition, $E Z$, through which passes a tube that runs to the bottom, but leaving, however, sufficient space for the passage of the water. Let $K \Lambda M N$ be the pedestal upon which the vessel stands, and ΞO another tube that reaches as far as to the partition and enters the pedestal. In the latter there is sufficient water to stop up the orifice of the tube, ΞO. Finally, let ΠP be a lever, half of which is in the interior of the pedestal and the other half external to it, and which pivots on the point Σ and carries suspended from its extremity, Π, a clepsydra having an aperture, T, in the bottom.

"The spout being closed, the vessel is filled through the tube, $H\Theta$, before putting water into the pedestal, so that the air may escape through the tube, ΞO. Then through any aperture whatever, water is poured into the pedestal in such a way as to close the orifice, O; and, after this, the spout, Δ, is opened. It is clear that the wine will not flow, since the air cannot enter anywhere. But, if we depress the extremity, P, of the lever, a part of the clepsydra will rise from the water, and the orifice, O, being freed, the spout will flow until the water lifted up in the clepsydra has, on running out, closed this same orifice again. If, when the clepsydra has become full again, we still further depress the extremity, P, the liquid in the clepsydra will take longer to flow out, and more wine will consequently be discharged from the spout. If the clepsydra rises entirely from out the water, the flow will last still longer yet. Instead of depressing the extremity, P, by hand, we may use a weight, Φ, which is movable on the external part of the lever and capable of lifting the whole of the clepsydra out of water when it is placed near P. This weight, then, will lift a portion only when it is farther away from such point. We must proceed, therefore, with a certain number of experiments upon the flow through the spout, and make notches on the lever arm, $P X$, and register the quantities of wine that correspond thereto, so that, when we desire to cause a definite quantity to flow, we shall only have to put the weight on the corresponding notch and leave it."

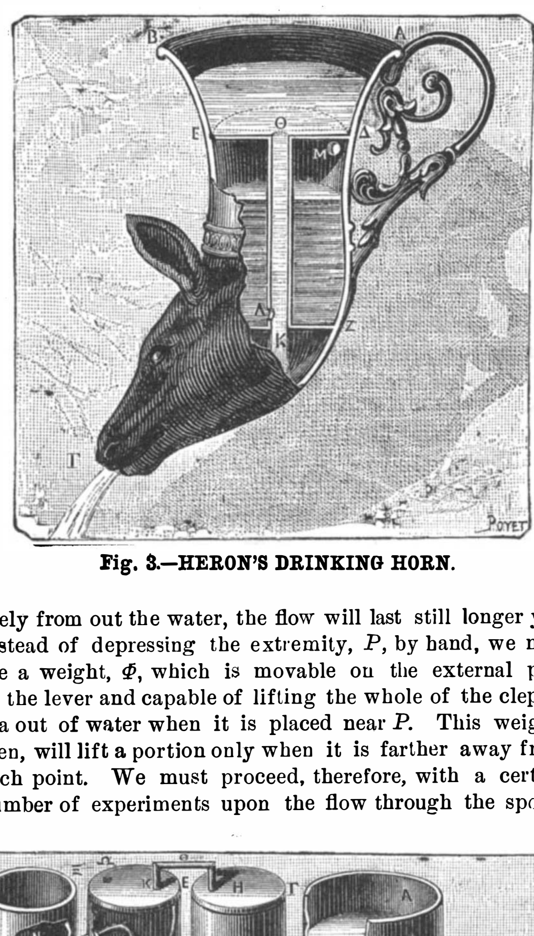


Fig. 3.—HERON'S DRINKING HORN.

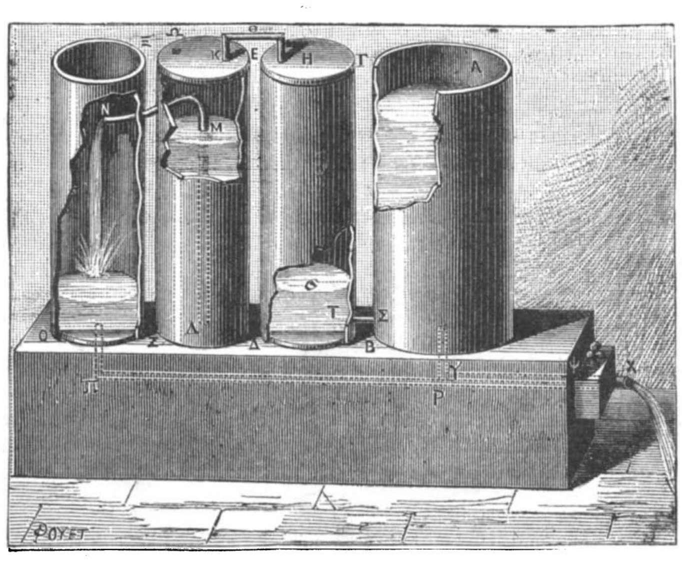


Fig. 4.—AN APPARATUS OF HERON PERMITTING OF MIXING WINE AND WATER IN DEFINITE PROPORTIONS.

WATER CHANGED INTO WINE.

The miracle of changing water into wine is one of those upon which the ancients exercised their imaginations most. Heron and Philo describe fifteen apparatus designed for effecting this, and more generally for causing different liquors to flow at will from the same vessel.

Here is one of the simplest of them (Fig. 3): "There are," says Heron, "certain drinking horns which, after wine has been put into them, allow of the flow, when water is introduced into them, now of pure wine, and now of pure water.

"They are constructed as follows: Let $A B \Gamma \Delta$ be a drinking horn provided with two diaphragms, ΔE and $Z H$, through which passes a tube, ΘK, this being soldered to them and containing an aperture, Δ, slightly above the diaphragm, $Z H$. Beneath the diaphragm, ΔE, there is a vent, M, in the side of the vessel.

"Such arrangements having been made, if any one, on stopping the orifice, Γ, pours wine into the horn, the liquor will flow through the aperture, Δ, into the compartment, $\Delta E Z H$, since the air contained therein can escape through the vent, M. If, now, we close the vent, the wine in the compartment, $\Delta E Z H$, will be held there. Consequently, if, on closing the vent, M, we pour water into the part, $AB\Delta E$, of the vessel, pure water will flow out through the orifice, Γ; and if, afterward, we open the vent, M, while there is yet water above the upper diaphragm, a mixture of wine and water will flow out. Then, when all the water has been discharged, pure wine will flow.*

"On opening and closing the vent, M, oftener, the nature of the flow may be made to vary; or, what is better still, we may begin by filling the compartment, $\Delta E Z H$, with water, and then, closing M, pour out the wine from above. Then we shall see a successive flow of pure wine and of wine and water mixed when we open the vent, M, and then, again, of pure wine when the vent is closed anew; and this will occur as many times as we desire it."

The apparatus represented in Fig. 4 is very curious, and might be put to some useful application, without mentioning that which wine merchants might make of it by changing the order of the liquids and leaving in view only the vessel, $A B$, and the cock.

"Being given," says Heron again, "two vessels, one of them containing wine, it is required that whatever be the quantity of water poured into the empty one, the same quantity of a mixture of wine and water, in any proportion whatever (two parts of water to one of wine, for example), shall flow out through a pipe.

"Let $A B$ be a vessel in the form of a cylinder, or of a rectangular parallelopipedon. At the side of it, and upon the same base, we place another vessel, $\Gamma\Delta$, which is hermetically closed, and of cylindrical or parallelopipedal form, like $A B$. But the base of $A B$ must be double that of $\Gamma \Delta$ if we desire that the quantity of water shall be double that of the wine in the mixture. Near $\Gamma \Delta$ we place another vessel, $E Z$, which is likewise closed, and into which we have poured wine. The vessels, $\Gamma \Delta$ and $E Z$, are connected by a tube, $H \Theta K$, which traverses the diaphragms that close them at their upper part, and which is soldered to these. In the vessel, $E Z$, we place a bent siphon, $\Lambda M N$, whose inner leg should come so near to the bottom of the vessel as to leave just enough space for the liquid to pass, while the other leg runs into a neighboring vessel, ΞO. From this latter there starts a tube, ΠP, which passes through all the vessels, or the pedestal that supports them, in such a way that it can be easily carried under and very near the bottom of the vessel, $A B$. Another tube, ΣT, traverses the partitions in the vessels, $A B$ and $\Gamma \Delta$. Finally, near the bottom of $A B$ we adjust a small tube, Υ, which we inclose, with the tube $H\Upsilon$, in a pipe, ΦX, that is provided with a key for opening or closing it at will. Into the vessel, $E Z$, we pour wine through an aperture, Ω, which we close after the liquor has been introduced.

"These arrangements having been made, we close the pipe, $X \Phi$, and pour water into the vessel, $A B$. A portion, that is to say one-half, will pass into the vessel, $\Gamma \Delta$, through the tube, ΣT, and the water that enters $\Gamma \Delta$ will drive therefrom a quantity of air equal to itself into $E Z$ through the tube, $H\Theta K$. In the same way this air will drive an equal quantity of wine into the vessel, $O \Xi$, through the siphon, $\Lambda M N$. Now, upon opening the pipe, ΦX, the water poured into the vessel, $A B$, and the wine issuing from the vessel, $O \Xi$, through the tube, ΠP, will flow together, and this is just what it was proposed to effect."—*A. De Rochas, in La Nature.*

A TABLESPOONFUL of turpentine boiled with white clothes will greatly aid the whitening process.

* As may be seen, this is, under another form, the apparatus known in cabinets of physics as the "Magic Funnel."

ASPECTS OF THE PLANETS FOR APRIL.

MERCURY

is evening star, and holds a front rank among the sun's family during the month; for he deigns to appear in a position where he may easily be picked up by the pains-taking observer. He not only reaches his greatest eastern elongation, but is high in the north at the same time, thus presenting the most favorable conditions for visibility as evening star to the unaided eye that will occur during the year.

Mercury reaches his eastern elongation, or most distant point from the sun, on the 25th at 9 o'clock in the evening, being then 20° 32' east of the sun. At that time, and for a week or ten days before and after the epoch, he is visible to the naked eye. He sets on the 25th an hour and three-quarters after the sun. Those who wish to behold this interesting planet will find the present an unusually favorable opportunity for the purpose. They should, about the 25th, commence the quest three-quarters of an hour after sunset, and, first finding the familiar cluster of the Pleiades in the northwest, scan the sky a degree and three-quarters south of the cluster and a very slight distance west. "The Sparkling One," as the planet was called by ancient observers, from the wondrous brilliancy of his light, will suddenly dart into being, shining with a peculiar luster on the glowing twilight sky. When once found, the observer will be surprised that he could ever fail in his search, and will be able to follow the planet's course till his approach to the sun hides him from view. Astronomers of the present day devote little attention to this member of the planetary family, for his nearness to the sun renders him a very difficult object to observe with accuracy. The time of his rotation on his axis, his lofty mountains, his supposed atmosphere, his deviation from a spherical form, and other phenomena described by observers are now considered as doubtful, at least as "not proven." The great Copernicus never succeeded in finding Mercury, though he often looked for him. But in this locality, he may always be found as evening star at the spring elongation if the observer knows where to look. The Pleiades will point the way at the present elongation, while Venus and Saturn will be in the vicinity.

On the 21st, at two o'clock in the morning, Mercury is in conjunction with Neptune, but as both planets are then below the horizon, the event is without interest except as an illustration of the movements of the two planets, the former traveling eastward toward elongation, and the latter westward toward conjunction with the sun.

On the 10th, at 9 o'clock in the morning, Mercury is in perihelion, or at his nearest point to the sun.

The eccentricity of his orbit is greater than that of any other of the large planets, as he is 15,000,000 miles nearer the sun at perihelion than at aphelion. When he is nearest the sun he is farthest from the earth, and the great variations in distance produce a corresponding variation in brilliance. Therefore Mercury must be in aphelion to take on his brightest aspect as seen from the earth.

This swift-footed brother planet has a busy time during April, in the number of incidents he contributes to the monthly record. He is in his ascending node on the 5th; in perihelion on the 10th; in his greatest heliocentric latitude north on the 20th; in conjunction with Neptune on the 21st; at his greatest eastern elongation on the 25th; and in conjunction with the moon on the 26th.

The right ascension of Mercury on the 1st is 0 h. 56 m.; his declination is 5° 13' north; and his diameter is 5".

Mercury sets on the 1st at half past 6 o'clock in the evening; on the 30th, he sets not far from half past 8 o'clock.

SATURN

is evening star, and honors the month by appearing with Venus in a charming tableau. On the 12th, at 11 o'clock in the evening, the two planets are in conjunction, Saturn being 4° 13' south. At the time of nearest approach, Saturn and Venus will be below the horizon, but they will be near enough together in the early evening to form a lovely picture.

No directions will be needed to point out the chief actors in the scene. Venus will be known at a glance, and four degrees south of her beaming presence a bright star of a pale, golden hue serenely shining amid the twinkling mysteries around will point out the presence of Saturn. Aldebaran will be about four degrees south of Saturn, and the Pleiades will be less than half a degree west of Venus; planets, star, and cluster combining as elements in the celestial picture. Before the conjunction, Saturn will be east of Venus; on the evening of the 13th, he will be west of Venus, showing that the planets have changed places.

The right ascension of Saturn on the 1st is 4 h. 18 m.; his declination is 19° 48' north; and his diameter is 16·2".

Saturn sets on the 1st a few minutes before 11 o'clock in the evening; on the 30th, he sets shortly after 9 o'clock.

JUPITER

is evening star, and does not fail to contribute his quota to the events of the month. On the 14th, at 7 o'clock in the evening, he is in quadrature on the sun's eastern side. There is always something majestic in this aspect of the regal planet. Rising at noonday, looking down from the zenith at 6 o'clock, and sinking below the horizon at midnight, he is even more glorious than when at opposition he comes darting above the horizon at sunset, while his brilliancy seems scarcely to have diminished. He will be splendid to behold throughout the month, outrivaling every other shining point except Venus, to whom he is unwillingly obliged to yield the supremacy, though he holds the scepter of sovereignty for a short time after her setting.

The right ascension of Jupiter on the 1st is 7 h. 47 m.; his declination is 21° 47' north; and his diameter is 37·8".

Jupiter sets on the 1st at half past 2 o'clock in the morning; on the 30th, he sets about a quarter before 1 o'clock.

MARS

is evening star, and follows closely in Jupiter's train, rising about three-quarters of an hour later, and affording by his proximity a fine study of the contrast in color and general appearance of two of the major planets. The telescopists have been diligently observing this planet both before and since his opposition, though no noteworthy results have yet been recorded. Probably the tiny moons have refused to appear under present unfavorable conditions, and Schiaparelli's "canals" have shared the same fate.

The right ascension of Mars on the 1st is 8 h. 31 m.; his declination is 21° 54' north; and his diameter is 9·8".

Mars sets on the 1st soon after 3 o'clock in the morning; on the 30th, he sets about a quarter before 2 o'clock.

NEPTUNE

is evening star, and performs his part on the planetary record by coming into conjunction with Mercury on the 21st, when the nearest and the most distant of the sun's family seem to hang side by side.

The right ascension of Neptune on the 1st is 3 h. 9 m.; his declination is 15° 56' north; and his diameter is 2·5".

Neptune sets on the 1st about half past 9 o'clock in the evening; on the 30th, he sets at half past 7 o'clock.

URANUS

is evening star, and is nearly stationary during the month.

The right ascension of Uranus on the 1st is 11 h. 44 m.; his declination is 2° 33' north; and his diameter is 3·8".

Uranus sets on the 1st soon after 5 o'clock in the morning; on the 30th, he sets about 3 o'clock.

VENUS

is evening star. Though last on the list, she is the largest, fairest, and most brilliant in the grand array of planets playing the same role, that of evening star. All the planets are on the 1st grouped on the sun's eastern side in the following order of nearness to the great luminary—Mercury, Neptune, Venus, Saturn, Jupiter, Mars, and Uranus. Before the month closes, the order will be changed, for Mercury meets and passes Uranus, and Venus changes places with Saturn. It is unusual that all the planets should continue to be evening stars through the entire month; but planetary movements, like those of a kaleidoscope, forever present aspects, and never repeat the programme. The exact configuration of stars that this night sparkle in the firmament can never be reproduced.

Well do the planets deserve the name of wanderers, from their unceasing movement over the celestial track, a blind mark to the unscientific observer, a wondrous exemplification of harmony and obedience to physical law, clear as the daylight to those who hold the key of the forces that rule the solar family. Little do the stars deserve to be called fixed stars. Though they look motionless and imperturbable, they are in a state of constant change. Some of them are rushing toward us; some are receding from us. Stars are dying, stars are being born. Nebulæ are quickening into life; systems are passing away, their mission ended, their work accomplished. The sun with his attendant worlds is speeding through space around some unknown center. A few thousand years hence, the familiar constellations will have changed their forms, and the present polar star will no longer hang above the pole of the earth. And yet how peaceful is the picture that on starlit nights is unrolled before our eyes! How fixed and immovable the stars appear! How serenely in her present aspect the fairest of the stars treads her mazy path, just now so rarely beautiful, as she oscillates eastward of the sun, while so accurately have the men of science mapped her course that the moment when she turns her steps toward the sun is as reliably computed as the increase of the days or the changes of the moon.

The right ascension of Venus on the 1st is 3 h. 29 m.; her declination is 20° 59' north; and her diameter is 18·4".

Venus sets on the 1st a few minutes after 10 o'clock in the evening; on the 30th, she sets about 11 o'clock.

THE MOON.

The April moon fulls on the 10th at 44 minutes after 6 o'clock in the morning, standard time. On the 3d, the day after the first quarter, she is in conjunction with Jupiter, on the 4th she is at her nearest point to Mars, and on the 8th to Uranus. She then proceeds on her way without encountering a single planet until the 26th, the day after her change, when she is in conjunction with Neptune and Mercury. On the 27th she is in conjunction with Saturn and on the 28th with Venus.

TOTAL ECLIPSE OF THE MOON.

A total eclipse of the moon will occur on the 10th, partly visible in this vicinity, and visible as a total eclipse in portions of North America, the Pacific Ocean, and Asia. The eclipse begins at 4 h. 3 m. standard time. The total phase commences at 5 h. 11 m., about the time the moon sets, when the exhibition closes for this longitude, and observers farther west enjoy the total obscuration.

ECLIPSE OF THE SUN.

A partial eclipse of the sun occurs on the 25th, invisible in the United States, but visible in the Southern Pacific Ocean. The greatest magnitude of the eclipse is 0.754 of the sun's diameter.

Fire Risks and Underwriters' Watchfulness.

The underwriters nowadays have a good deal of authority in determining the kind of buildings which shall be erected. In any structure that is to be leased—for offices, store, factory, or other business purposes, or for dwellings—the rate of insurance that the companies will fix for the lessees has much to do in governing the rent to be obtained. Their standards as to safety make a law which, with few exceptions, is now generally recognized, and the insurance companies must, for their own protection, make the most careful study and the closest analysis of all causes which increase fire risk, or give comparative immunity therefrom. The old ideas about safety in building were greatly changed by the Chicago and Boston fires. The modern five and six story store, with marble or granite front, a flimsy roof, and an inside full of combustibles, proved a great deal worse fire risk than the two or three story brick warehouses of fifty years ago, and the ruin which those fires caused to the insurance companies has made them exceedingly careful ever since. For this reason, in all our recently erected high buildings, lath and plaster partitions, wood joists and floors, stairs and roof, are invariably ruled out, stone, brick, and iron being used instead, with as little wood veneering as possible. The insurance companies also keep very close watch of the means provided for the extinguishing of fires, the abundance and convenience of the water supply, the equipment of the fire department, etc., and, with all this care, it is said that the fire insurance business, as a whole, has been unprofitable for the past two years.

For factory insurance, the leading mutual company of the country has formulated a very complete system of what might almost be called self-protection, to be adopted in any establishment to be insured, before it will issue a policy thereon. The water supply must be abundant, and pumps, pipes, hydrants, and sprinklers supplied *ad libitum*. In this way the actual cost of insurance to its members has been reduced to a minimum, or about 20 cents on each $100 for 1883. Against this saving in the cost of insurance should be placed the expense to which the insured were put for changes of construction and fire extinguishing apparatus, but such expense has been incurred mainly within the past six years, and constitutes of itself a permanent investment for safety. Under such conditions, the average of *unavoidable* losses on factory property insured by this company is given as less than one-tenth of one per cent upon the risks taken, although they actually were $123,137 on $69,000,000 of risks written. These losses were occasioned by 94 fires, attributed to the following causes: Friction, 21; unknown, or not reported, 17; spontaneous, 13; foreign matter in stock, 13; gas, 7; matches, 6; steam pipes, 3; lamps, 2; defective chimneys, 2; boiler furnaces, 1; mice, 1; sparks, 3; spark from emery wheel, 1; petroleum, 1; gasoline vapor, 1; lamp dropped from lantern, 1; flashing powder, 1. In 18 of these cases the automatic sprinklers—made to sprinkle a room or apartment on a very slight rise in the temperature—put out the fires entirely, or held them in check.

Keely Nearing the End.

It was announced from Philadelphia on the 17th of March that the Keely motor was practically completed. All the workmen had been discharged, and Mr. Keely was immediately to begin "focalizing and adjusting the vibrators"—a delicate operation, but easy for him—and as soon as he obtained "one perfect revolution, though ever so slow," the great invention would be complete. The news called forth several funny paragraphs in the newspapers and quite a flutter among the stock holders and directors, who have been for several years investing money to back up this nineteenth century discoverer of "perpetual motion." It is difficult, indeed, to consider seriously this alleged invention, or justly characterize the inventor, who, in this age, not only assumes to get something out of nothing, but would hide all his methods and processes and affect more than the mystery of the alchemists of the early ages. Yet it is a serious matter to those who have been sinking their money therein. Now, however, we seem at last to have reached the "beginning of the end," and the attention of the investors can, at an early day, be "focalized" on their profit and loss accounts.

Ice on the Trees.

We seldom have a winter in which rain, freezing as it falls on the trees, loads them with such a weight of ice as was the case from the 8th to the 10th of March this year. Great numbers of fruit and shade trees in New England and New York and New Jersey were thus broken down or badly damaged, but the glistening of the silvery lace-work of the frost was, while it lasted, indescribably beautiful. Prof. Hall, of Trinity College, Hartford, in order to gain something like an accurate idea of the amount of ice which had frozen on the trees, made measurements of a number of twigs taken from the extremities of branches, in order to compare their diameter in their natural state with that they had when covered with ice. One twig 0·11 of an inch in diameter was enlarged to 0·73; another of the same size to 0·84; one of 0·12 inch diameter measured 0·84 with its ice-covering, and another of 0·12 inch measured 1·03; one of 0·18 diameter had become 1·21; and one of 0·31 had become 1·07. He made another estimate of the quantity of ice on the trees by breaking the ends of some branches from an apple tree and weighing them with and without the ice that coated them, when it appeared that wood which weighed ten ounces was carrying ice which weighed sixty-nine ounces.

Correspondence.

Frozen Fish.

To the Editor of the Scientific American:

We have several times caught, on the Kennebecasis River, smelt and codfish that have become frozen (wholly or partly) after leaving the water, and have come again to active life several hours later when thawed out in water.

I have not known or heard of trout coming to life under similar conditions. G. F. F.

St. John, N. B.

A Letter from Alaska.

To the Editor of the Scientific American:

The brilliant red appearance of the sky after sunset was plainly visible here. On the 28th of January it was remarkably brilliant, casting a reflection on the houses situated on the hill 50 feet above salt water, in the rear of the town. The islands lying to the westward of us, about 8 miles distant, are covered with a range of mountains, some 2,000 feet high; you can thus form an estimate as to the height of the display above the horizon.

You can form some idea of our winter from the fact that the coldest night we have had the thermometer registered —1°. We have had but little snow so far. Last night it rained, and to-day we have a warm rain and thawing.

Persons living in the East seem to forget, or are ignorant of the fact, that the coast of Southeastern Alaska is under the influence of the Japan Ocean current. As a matter of course, the same latitude in the interior—56°—is cold enough for an Esquimau. The clothing worn here is about the same summer and winter; though a good crop can be raised of all kinds of root vegetables grown in a temperate zone, except those of a semi-tropic kind.

A few months ago I read of the wonderful journey made by Lieutenant Schwatka, from the coast to the tributary of the Yukon, and thence down that stream to its mouth on a raft. For several years past companies of miners have crossed over the same route, loaded with packs of over one hundred pounds each, containing their provisions and tools, through to the watershed of the Yukon, prospecting for gold. When arriving at the tributary of the Yukon they build boats, packing a rip-saw for that purpose, and proceed on their journey. It is reported that a company have found bar diggings on a tributary of the Yukon just west of the Rocky Mountains and on the north side of the river; the average is said to be $15 a day to the man.

Others will go in the spring, before the snow melts, sled their supplies across the divide and up to the tributary of the Yukon, when they will construct boats, and, so soon as the river is free from ice, will continue their journey to Stewart's River, their destination.

The men do not consider it a wonderful trip, and, in fact, scarcely ever make mention of it, unless in general conversation as to their future intentions.

W. H. WOODCOCK.

Fort Wrangell, February 24, 1884.

Electricity, its Effect on Vital Power.

To the Editor of the Scientific American:

In your paper of March 15 is an article on "Beer soured by Thunder," taken from the *Brewers' Gazette.* The writer advances the idea, following the paper of Mr. Allen before the Royal Society at Edinburgh, that it might be (the souring) because of "the electrical conditions leading to the deposition of a greater number of bacteria in a given time. This explanation would apply to beer exposed to the air in open vessels, but scarcely to beer in casks, which is practically protected from the atmosphere." Now this matter is well worth our study, in the light to which the title we have written above directs us. We recognize fermentation as a biogenic act, and that the chemical changes produced by it are due to vital power. We have "beer soured by thunder" because of electrical action on vital power, and no better point can be found for initiating an investigation of this action than this very point where the electrical power is brought to bear on vital power of the lowest and most simple rank.

The article quoted says, "it has been somewhat difficult to reconcile the modern theory of fermentation by germ" with the souring of beer by thunder-storms, and goes on to refer favorably to Liebig's theory of catalytic action; but properly considered we shall find that the biogenic action of electricity gives us a much easier explanation than any other.

Of the almost infinite richness in numbers of the micro-organisms which, in their various forms, we group under the general name *bacteria* swarm in the atmosphere it appears probable that even our imaginations can scarcely get an idea. At all events, we know that the very slightest exposure to the air, the admission for instance of merely a tiny bubble, is sure to supply them to any fluid where we seek their presence, and it is therefore perfectly sure that a vegetable infusion like beer must be fully stocked with them at any moment; and if there comes a cause to give them a sudden and urgent impulse of vitality, there will come an overpowering growth in their numbers, and we shall call it a fermentation. If it is beer at the right stage, this will be an acetous fermentation, and the beer will turn sour. This has been done not by "leading to the deposition of a a greater number of bacteria" from the atmosphere, but by hastening the maturity of development of the myriads of spores which were already present. And taking this view, we see readily that we have no trouble in setting aside the difficulty suggested as to the fact of beer which is in casks becoming sour almost as quickly as that which is open to the air. Why should it not be so? The spores are present in the one as fully perhaps as in the other, and the electrical condition of the atmosphere can probably act as freely on the beer inside the cask as though the cask were not there. The manner in which the difference of electrical tension chemically affects the beer at all is, as yet, a mystery to us, and the fact that the air rests upon its surface seems little likely to have much to do with it. A thin plate of iron is opaque to the rays or vibrations of light, but it is transparent to those of heat, presenting scarcely any resistance to their free passage and action. In the same manner the rays of vibrations of electrical energy may find the wood of the cask *transparent* for their passage.

The question then arises, Are there any facts which give us reason to believe that the effects of electricity on vital power can be such as to develop fermentation? A.

Steel Fire Boxes.

To the Editor of the Scientific American:

An acquaintance of mine who has charge of the locomotive department of a large road informed me lately that he had had so much trouble with steel fire boxes that he had returned to iron. Many of his engines with steel fire boxes had developed large cracks after the engine had had the fire pulled out and had stood for a few hours in the roundhouse. They were sure to crack if the engine was cold and any work was then done on the fire box. An engine that had stood over night required that the stay bolts which were leaking some be headed over or calked. The first blow struck developed a crack 33 inches long in the side sheet. The M. M. tested this sheet and found that it broke like cast iron. One of the pieces thus broken from the sheet was thrown into a blacksmith fire, and a few drops of water dripped on to it. When the water showed signs of boiling, the piece was removed from the fire, grasped in a vise and bent with a hammer. It was found to be as pliable as lead. This led the M. M. to order that, when work on a steel fire box was to be done, a fire of shavings should first be lighted in the fire box, heating it so that a man could just stand it to work inside the fire box. The result was that no more cracked sheets occurred. The same M. M. had tried cast iron guide bars and found that they acted nicely until through carelessness they were allowed to cut, when they very rapidly destroyed themselves. He replaced them with case hardened wrought iron, and let into the wings of the crosshead three disks of chilled cast iron retained in place by running Babbitt metal around them.

I saw several engines fitted up this way which had been running four years, or about 200,000 miles, and the wear was so slight that a piece of writing paper could be just slipped between the crosshead and guide.

FRANK C. SMITH.

To the Friends of the Patent Laws.

To the Editor of the Scientific American:

The series of articles published by you within the last few weeks in regard to the numerous bills affecting the rights of patentees and inventors, introduced during the present session of Congress, and which, under the guise of protecting innocent purchasers and the public generally, aim to undermine the very foundation of our patent laws, I have read with a great deal of interest, and am glad you are giving this matter the attention it deserves.

As a general thing, the patent laws are regarded by those not directly interested in them, as a dry and unimportant subject. It is not surprising, therefore, that such bills as those recently passed by the House (H.R. 3,925 and H.R. 3,934) should have met with such little opposition in that body. It would be unfair to say that our representatives in Congress are not aware of the importance of our patent laws as a whole; they fully understand the value and importance of some of the more prominent inventions of the present day with which they come in contact, such as the railway, steamboat, telegraph, telephone, electric light, etc., and recognize the fact that it would be disadvantageous to the best interests of the country to repeal the law to which they owe their existence. The trouble is that the bills in question are so framed as to make them appear to be in the interest of the general public, for the purpose of curing certain real or imaginary defects in the present system, and it is to this feature of the bills that their passage may be attributed.

Had the members who voted for the bills known their real import, it is doubtful if the bills would have passed the House even with the indorsement of the Patent Committee. These bills have not as yet been acted upon by the Senate, and to guard against any recurrence of the mistake made by the House, the Senators in Congress ought to be promptly put in possession of facts which will enable them to see the dangerous ground they are treading; and it is to the interest of every patentee or owner of patent rights to see that this is done.

That there are evils of the nature complained of connected with our present patent system is not denied, but it does not follow that the entire system should be condemned for this reason. It is about time that inventors should stand up for their rights and meet their opponents, whoever they may be, upon an equal footing. Thus far nearly all the bills introduced lately have been against the inventor. Why cannot the inventors of the country unite to protect their interests, and, if necessary, introduce bills to accomplish that end? Just at the present time it might be advisable to frame a suitable bill which may be introduced into the next Congress, which shall do away with the objections urged by the promoters of the obnoxious bills before referred to, and at the same time protect the inventor and patentee. Until this is done, the opponents of our patent laws will continue introducing bills of the character described, to the imminent peril of overthrowing what is probably the most valuable provision of our Constitution. ELIAS E. RIES.

Baltimore, Md., March 13, 1884.

How to Prevent Fires.

The following simple precautions suggested by the New York *Independent,* if strictly followed, would prevent a great many destructive fires. The rules might be posted in every store, dwelling, and factory with good results:

The leading causes of fires are kerosene oil, matches, and furnaces.

1. Always buy the best quality of oil.
2. Never make a sudden motion with a lamp, either in lifting it or setting it down.
3. Never place a lamp on the edge of a table or mantel.
4. Never fill a lamp after dark, even if you should have to go without a light.
5. See that the lamp wicks are always clean and that they work freely in the tube.
6. Never blow out a lamp from the top.
7. Never take a light to a closet where there are clothes. If necessary to go to the closet, place the light at a distance.
8. Use candles just as much as possible in going about the house and in bedrooms. They are cheaper, can't explode, and for very many purposes are just as good as lamps.
9. Matches should always be kept in earthen jars, or in tin.
10. They should never be left where rats or mice can get hold of them. There is nothing more to the taste of a rat than phosphorus. They will eat it if they can get at it. A bunch of matches is almost certain to be set fire if a rat gets at it.
11. Have good safes in every place where matches are to be used, and never let a match be left on the floor.
12. Never let a match go out of your hand after lighting it until you are sure the fire is out, and then it is better to put it in a stove or an earthen dish.
13. It is far better to use the safety matches, which can only be lighted upon the box which contains them.
14. Have your furnaces examined carefully in the fall, and at least once during the winter by a competent person. All of the pipes and flues should be carefully looked to.
15. If there are any closets in the house near chimneys or flues, which there ought not to be, put nothing of a combustible nature into them.
16. Never leave any wood near a furnace, range, or stove to dry.
17. Have your stove looked to frequently, to see that there are no holes for coal to drop out.
18. Never put any hot ashes or coal in a wooden receptacle.
19. Be sure that there are no curtains or shades that can be blown into a gaslight.
20. Never examine a gas meter after dark.

Fires, of course, arise from other causes than those we have stated. Smokers burn up much valuable property which is not in the shape of cigars. Bunches of oiled rags of the most inanimate nature in themselves still perform the most wonderful feats in the destruction of property. Tramps, with their old pipes, will creep into barns and haymows, and servants will be careless in thousands of ways, but if every person who owns property will give the subject attention, and see that those around him are posted, and see that reasonable rules are always obeyed, many thousands of dollars could be saved annually which are now burned out of existence.

Microscopic Examination of Water.

The detection of micro-organisms in potable waters is of considerable hygienic importance. When they are present, yet in relatively small numbers, their detection is difficult unless they can be concentrated in a small volume, which cannot, of course, be accomplished by evaporation. This may be effected by precipitating them in a precipitate that dissolves readily in acids. Brautlecht makes use of a solution of one part of aluminum sulphate in eight parts of water and one part of hydrochloric acid. He puts five drops of this solution in the water to be tested, then adds three drops of the officinal aqua ammonia, which precipitates the alumina, and with it any organic matter. This he collects upon a smooth filter, and while still soft scrapes it off with a glass rod and dissolves it in ten drops of acetic acid. In these ten drops are to be found all the micro-organisms previously distributed through a large quantity of water, and this is used for microscopical examination. If necessary they may be stained with a suitable dye.—*Pharm. Zeitung.*

A GENTLEMAN stepped up to the counter at the Astor House the other day, and asked for a telephone cigar.

"What kind of a cigar is that?" inquired the unsuspicious proprietor.

"One of the kind that you smoke in New York and they can smell in Brooklyn," was the answer.—*Electric Review.*

[We think this new brand must be a favorite one with smokers. This conclusion is predicated by the fact that a good many visitors at this office smoke cigars answering the above description.—ED. S. A.]

AN IMPROVED ELECTRIC RAILWAY SIGNAL.

The rails of the track serve as continuous electric conductors, and between them are the electrical conductors, *c c*, which may be wires, metal rods, or straps of metal, and which are insulated from the ties. Fig. 5 shows the conductor made of wire, secured to a strip of wood by staples. At certain intervals, which may be any distance desired, the continuity of the separate conductors is broken, and they are connected by cross communications as shown in Fig. 2, which is a plan view of the track. Fig. 3 is a cross section through the locomotive cab. Each engine carries a battery and two electro-magnetic signaling instruments, *a b*, one of which is provided with an attachment for giving a special additional signal when acted upon by the combined power of the batteries. There is also upon the engine an arrangement for making contact with the conductors. Figs. 3 and 4 are contact devices, the latter being made in the form of a deeply serrated wheel, the edges being sharp so as to cut through any light coating of snow, ice, or dirt. These wheels are supported by arms which are hinged to and insulated from upper frames.

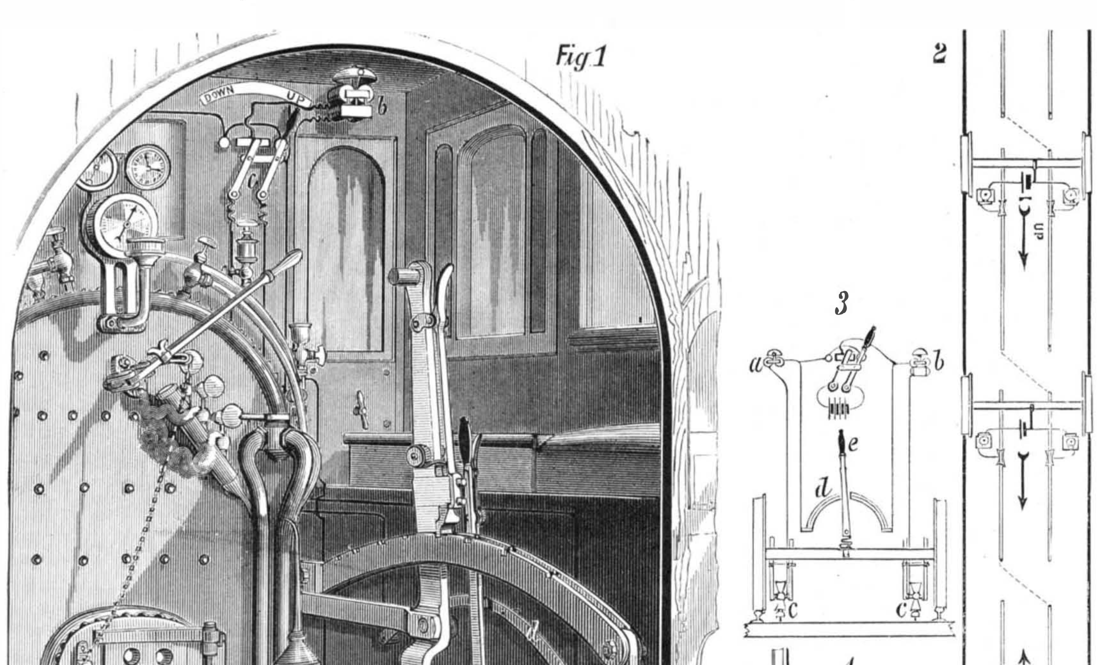
The batteries produce a current of considerable quantity at low potential, so as to work the signals with a good degree of force and lessen the tendency to leakage in wet weather. All the batteries have like poles in the same direction relative to the conductors, *c c*. For this purpose, in connection with each battery there is a reversing switch of any suitable construction. The arrangement of such a switch is plainly shown in the upper part of Fig. 3, and at *c*, in the front of the cab. This reversing switch is only moved when the engine is turned upon a turntable, that is to say, it is reversed only when the heading direction of the engine is changed, not the running direction, in order that the zinc pole may always remain in connection with the same conductor. With any change in the running direction of the engine the position of the batteries is changed automatically by the movement of the reversing lever of the engine. At the side of the reversing lever are two segmental bars which are connected with the sides of the reversing device by wires. A lever electrically connected with the axle and moved by the reversing lever of the engine is in contact with these bars. If desirable, the engine lever may be arranged so as to connect with the segmental bars.

In Fig. 3 the circuit is from the left hand conductor to bell, *a*, to its segment and to the axle; from the other conductor to the bell, *b*, to center plate of reversing device, to battery and wire to second segment. Both instruments give a signal when the current from one battery passes through their magnets; the instrument, *b*, gives an additional signal when acted upon by two batteries. The instrument, *b*, always warns of danger from the direction of the cow catcher, while instrument, *a*, warns of danger from the direction of the tender, no matter whether the engine be running forward or backward.

It is impossible, in the space at our disposal, to minutely explain how the signals resulting from various conditions are obtained; we can only give the work which the device will do. By its use no two engines can come within a prescribed distance of each other without both receiving warning at the same moment. This distance may be anything desired. At the same time each driver will know whether the other engine is before or behind and in what direction it is running. This is all done automatically, and has the advantage over a visual signal that it requires no special care or attention on the part of the driver.

Each engine carries its own danger warning apparatus, and the driver's attention is attracted by the ringing of an alarm bell. It is economical, since there is no expenditure of electric power except in time of danger. In case of drawbridges, the engineer is warned of an open draw on coming within a certain distance; at the same time the bridge keeper is warned of the engine's approach. The act of closing the draw opens the circuit, so that the engineer will know when it is safe to proceed by the alarm bell ceasing to ring. In case the engine goes upon a siding, leaving train on main line, the latter can be protected by laying a piece of wire or metal across the track, close to the train, so as to touch rails and conductors.

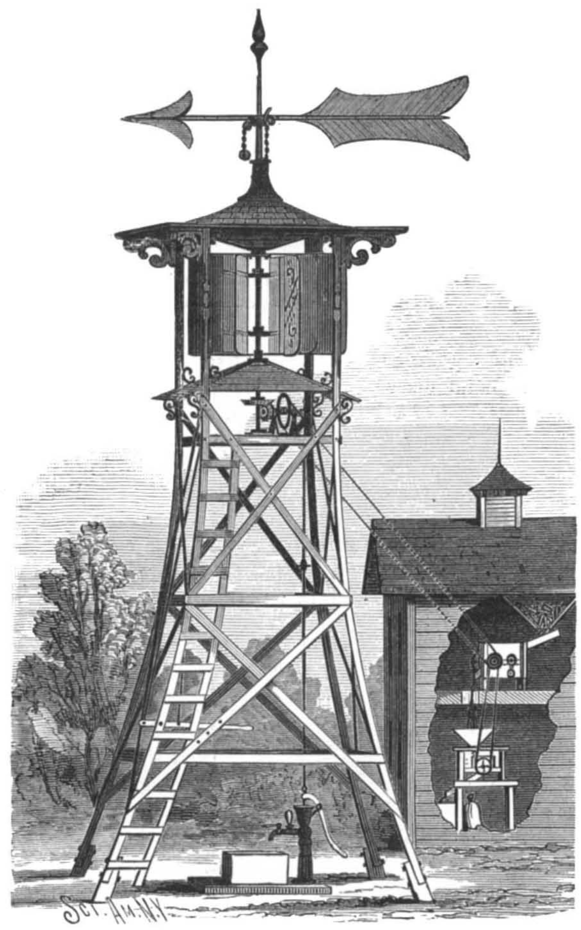
This invention has been patented by Messrs. J. C. Upham and J. P. Rogers, and further particulars may be obtained by addressing the latter at Truro, Nova Scotia.



IMPROVED ELECTRIC RAILWAY SIGNAL.

A NEW WIND ENGINE.

The accompanying engraving represents a new wind motor, which consists of a horizontal wind wheel partly surrounded by a semi-cylindrical shield. The shield is connected with the vane above by a vertical shaft that is independent of the wheel shaft. A novel governing device is attached to, and is directly opposite, the shield. When the



A NEW WIND ENGINE.

engine is in working order the full force of the wind is utilized, as one half of the wheel is shielded. When unshifted, the wheel is completely shielded from the wind. It is not necessary for the wheel to unshift in a storm, since when a sudden gust of wind strikes the governor it causes the shield to move around and cut off a part of the wind. As soon as the gust is past, the vane causes the shield to resume its normal position. This to and fro movement of the shield tends to make the wheel revolve at a uniform rate of speed. The governor is very simple, a plane board constituting the whole device.

The weight of the wheel is all on one bearing, consisting of a hardened steel step box, cup shaped, and one filling of oil lasts a long time. Oil cups are placed at the other bearings. A small horizontal shaft is connected to the wind engine. A crank, for operating a pump, is placed at one end of this shaft, which also carries a sheave to be used for running machinery, as illustrated in the cut. The vane and all other exposed parts are made of iron, and as the wheel is under cover, durability may justly be claimed as one of the principal advantages. When working, three (there are six in all) of the large plane sails are exposed to the wind. The large area of these sails gives them a powerful leverage, even in a light wind. As the wheel is inside of a part of the tower, it cannot blow down unless the tower goes with it. The funnel shaped opening in which it is placed greatly increases the effect of the wind. The wheel requires very little attention, and is adapted for the use of florists, dairymen, etc., for farm and household purposes generally, and for compressing air in the storage of power, to which attention has been recently directed.

Further particulars may be obtained from the manufacturer, Mr. D. H. Bausman, P. O. Box 163, Lancaster, Pa.

How the "Best" Butter is Made.

A Berkshire County, Mass., farmer writes: "My object has always been to make *the best butter*—not the most profitable, necessarily, but the best. Having this object in view, I have been compelled to discard oil meal, and thus reduce the quantity of my butter and the value of the manure. I have been obliged to take the cows out of all basement cellars, and have consequently received less butter for a given amount of food. I have been forced, instead of dropping the manure into a convenient cellar below the cows, to give up this cellar and wheel the manure into a shed. I have been obliged to discard deep setting, and to content myself with the open, shallow method, which is more expensive, and requires more attention, and returns less butter. I have been obliged to reject all feeds except corn, wheat, hay, beets, and carrots. I have been obliged to give up using the milk of cows that have calved too recently or too remotely. I have, for a dozen years, carefully and faithfully tried to make butter as good as it could be made; this has been the first consideration, profitableness has always been secondary. The result has been that for many years this butter has brought a higher price than any butter in the county of Berkshire, where much good butter is made, and it has taken the first prize over the county. It has been in such constant demand at 65 cents a pound, the year through, that when making 100 pounds a week there have been unfilled orders for 25 to 50 pounds more.

Independent Cut-off Valves for Locomotives.

Mr. W. Barnet Le Van, in his paper entitled, "Sixty Miles in Sixty Minutes on our Present Roadbeds," argues for the use of independent cut-off valves for locomotives. Reasoning from analogy, he says that the benefits to the stationary engine, derived from the independent cut-off, can also be applied to the locomotive.

It is well known, he says, that an engine may be run with an admission of steam to a shorter length of the stroke—in other words, with an earlier cut-off—when an independent variable expansion valve is used than with the link alone. This being admitted, the question again comes up, "What is the advantage of the link used in addition to the cut-off?"

Its advantage is simply as follows:

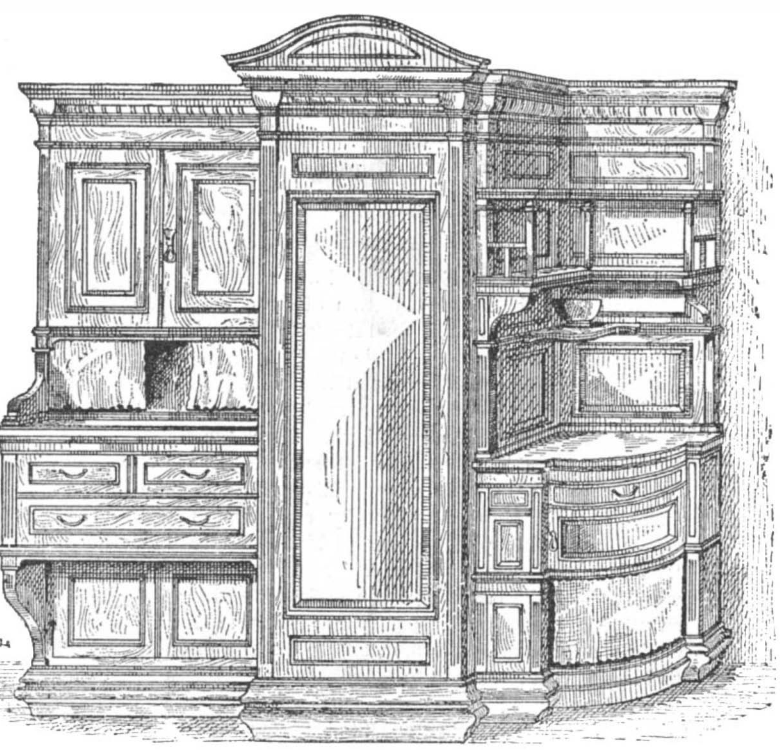
First.—The link is the simplest and readiest means of reversing.

Second.—While the cut-off is being run at, say, one-fourth or three-eighths stroke, the link may be worked to *vary the exhaust*. It is found to be less advantageous to hold on to the steam as long, when cutting off close, as when following for a greater length of the stroke. Let an engine, having both a link and a separate cut-off valve, have the latter set at one-quarter stroke, the engine meanwhile running along at a corresponding speed. The link, which is supposed to be working the main valve at full throw, may not be pulled up notch by notch. With each rise of the link and consequent shortening of the throw of the main valve, whereby the exhaust is released earlier and earlier, the engine will be found to quicken its speed. This result Mr. J. Snowden Bell informs me was the case with locomotive No. 27, of the Baltimore and Ohio Railroad, built from designs of Mr. Ethan Rogers, of the Cuyahoga Works, Cleveland, Ohio; in the exact words of Mr. Bell, she was "lightning."

A COMBINATION WARDROBE.

In chambers and in houses where the bedroom accommodation is limited, which very frequently is the case, combination furniture (such as the wardrobe here illustrated) is exceedingly convenient as well as useful. The *multum in parvo* piece of furniture is, however, by no means always deserving of the taking title thus applied to it, and instead of serving all the purposes aimed at fairly well, results in failure all round. Experience of this kind has led many to avoid so-called "combination furniture" as a delusion and a snare; but conclusions like this, says the *Building News*, are not to be universally depended upon, and the wardrobe here illustrated by Messrs. W. A. and S. Smee goes far to show how much really useful space can be got out of one comparatively small and compact piece of furniture when thought and ingenuity are brought to bear upon it.

A wash-hand stand occupies the right hand corner with useful drawer under, the marble top, a chamber cupboard, and a curtained recess below. Three shelves are arranged over the table top, and the lower one in the angle is intended for the sponge. The central space is utilized as a hanging cupboard, with a large silvered glass mirror in the panel of the door. To the left a clothes press extends the rest of the width, over a useful recess for books and bottles. Then comes a table top, with three drawers below, and under these is another cupboard for hats, bonnets, boots, or slippers. The whole stands on a heavy plinth.



NEW COMBINATION WARDROBE.

THE BOAT BILL HERON.

This remarkable bird (*Cancroma cochlearea*) is a native of South America. It has a singular shapeless flat bill, bent like a hook at the end.

Both mandibles are shortened and hollowed so as to resemble a pair of boats placed upon each other—from this it derives its name. Its legs are nearly covered with feathers; the wings are strong and moderately long. The feathers upon the back of the head and neck are elongated, forming a plume which hangs down over the back and shoulders. The feathers on the throat, back, and side of the neck are white. The plumage of the back is bright gray, with occasionally a touch of rusty red. The wing and tail feathers are grayish white; the sides black.

The eye is brown, the bill brown, and the foot yellowish. The length of the bird is about fifty-eight centimeters. The female is somewhat smaller; the young bird is reddish brown—darker upon the back—and paler on the breast.

The boat bill heron lives in the thickets and marshes on the shores of the forest streams of Brazil. It may often be seen sitting on the branches overhanging the water. It is more abundant in the inland forests than near the sea. On the approach of a boat it hops from branch to branch, and quickly hides itself.

Its food consists of various crustacea found at low water, but not of fish.

The Prince of Wied found only worms in the craw of one of these birds which he killed, and thinks that the bird with its broad, boat-shaped bill cannot catch fish.

Schomburgk says that they make a clatter with their bill, like a stork, or they do this at least when they are captured. Little is known of their brooding. The egg is oval, white, destitute of luster, and without spots.—*From Brehm's Animal Life.*

THE BOAT BILL HERON.

Making Sure Fits.

A subscriber to the *London Boot and Shoe Trades' Journal* gives the following description of a plan he adopts for making "sure fits," and thereby avoiding the annoyance of having goods left on his hands by customers: "I make it an invariable rule to measure customers myself. Having drawn the outline of a foot on a sheet of paper, and taken the girth measurements carefully, I fit up a pair of lasts to correspond with the measure. I always keep by me a few pairs of uppers—stale or damaged goods—and I last a pair of these on the lasts so fitted, using a stout pair of insoles. A pair of soles cut out of lifting, and which see service times over, are then put on and attached by a few pegs. The lasts are then drawn, the pegs cut out, and the "dummy" boots are sent to the customer with the request that he will wear them for an hour or two indoors, and a note is made of any suggestions he may offer as to additional ease being required in any part. Alterations, if required, are then made in the fittings on the lasts, before the customer's order is made up. Since I adopted this plan I have never had a customer's order returned for misfitting. I estimate the cost of making up the "dummy" boots at a shilling, and this, of course, I add to the price of the goods. A neighbor, a tailor, tries on his coats and insures himself against loss. It was from his practice," adds the writer, "and it seems to us a practical idea, which if adopted by our boot-makers would likely enhance the comfort of many of their customers, as well as save the maker much annoyance and cost for misfits, "that I took the idea."

A Horizontal Well.

In "Kidder's History of New Ipswich, N. H.," published in 1852, the following is related about David Hills, who became a resident of that town in 1772:

"In supplying himself with water he resorted to a most successful expedient. He reasoned thus: 'If my neighbor at the top of the hill obtains water by digging sixty feet, why may not I obtain the same by running a shaft into the *side* till I reach the same point?' He acted upon the obvious conclusion, and made a horizontal well, which not only supplied a perpetual stream to his house without the trouble of drawing, but afforded a most ample and capital cellar for the storage of butter, cheese, and other articles from both heat and cold."

KEROSENE oil will soften boots and shoes that have been hardened by water, and will render them pliable and new.

Making Cement Water Pipes.

A correspondent communicates to the *Country Gentleman* the following practical directions for forming cement water pipes. The implements used are few and simple. One is a wooden rod one inch in diameter and four and a half or five feet long. Attached to one end of the rod is a leather bag about one foot long, which when filled will be just the size of the rod. This bag is filled with sand and quite solid to within one and a half inches of the rod, after it is fastened to the rod. Another tool is a wooden box four feet long, made in the form of a trough three inches wide in the bottom, four and a half inches deep, and five inches across the top. A mason's brick trowel completes the tools required.

As all cement does not work alike the rule for mixing may be varied, but the mixture should be about one bushel of cement to three of sand. Sometimes more sand should be used. If the trench is made, mix enough cement to fill the box (and no more; if you do, it is wasted), lay the box of cement in the bottom of the trench, turn it bottom up, and lift it from the cement. The cement will be in the shape of the inside of box. Then take the pointed trowel and divide the cement along the top, and keep on dividing it until you can lay the rod in so that it will be within one inch of the bottom. When the wooden rod is laid in, close the cement over the rod and allow it to remain until you can turn the rod without injuring the cement (or until the cement is thoroughly set); then draw the rod, but leave the bag in. The part of the bag not filled will allow the rod to be turned to one side to receive the next box of cement at the end of the first one; repeat until you make such length of pipe as you choose. Care should be taken that the rod be not drawn too soon, as the cement after the rod is drawn is liable to settle and partially close the hole. Loosen the rod, however, as soon as it will not injure.

I would advise those making such a pipe, if they have had no experience in using cement, to employ a person who has. Much material and time may thus be saved without experimenting to get it right. The work must be done in dry or fair weather. Use the best materials; the fresher the cement the better. Old cement should not be tried. The sand must be perfectly clean. A pipe can thus be made which if laid below the frost will last as long as a stone.

I know of one such pipe which has been in use forty-five years, and is as good to-day as when first made.

The Zodiacal Light.

The cause of the luminous phenomenon known as the zodiacal light has long been the subject of speculation, and numerous hypotheses have been suggested to account for it. A correspondent of *Cosmos les Mondes* regards the entire phenomenon as one of the reflection of light. What we observe is nothing but the reflection of that part of the earth which is illuminated shortly before the sun rises and after it sets. In order to understand this we must assume that the earth is surrounded for a certain distance by a comparatively dense envelope of gas, beyond which the latter exists in a state of great attenuation. We therefore have two media of different density which influence the rays of light in the well known way, refracting them up to a certain limiting angle of incidence, beyond which total reflection takes place.

If we imagine the sun a little below the horizon, a part of the earth directly in front of us will reflect the rays of the sun at a very obtuse angle; these rays, meeting the boundary of the media at a very obtuse angle, will be totally reflected, and it is these totally reflected rays which we see.

This explains the appearance of the light in the shape of a cone whose line is always inclined in the direction of the ecliptic, and whose base is toward the sun; it also accounts for the fact that the changes observed in its appearance follow a reverse order in the evening from that in the morning. The reason why the cone is longer in the evening than in the morning is that the layer of dense atmosphere is expanded by reason of its exposure to the sun's radiation through the entire day, whereas in the morning the reverse is the case.

BLINDNESS has steadily decreased in England for the last thirty years, owing, it is thought, to the improvement of the opticians and the almost complete extinction of the smallpox among children.

Destructive Legislation.

The destructive tendency of much of the legislation of this country is forcibly illustrated by a recent bill which has been introduced into the House of Representatives, to reduce the lifetime of patents from seventeen years to five years. This bill strikes a blow at the very life of our civilization. Americans have signalized themselves in the world of thought in many ways, but in nothing, perhaps, more than in invention. So much encouragement has been given to inventors, by allowing them to reap, to a certain extent, the fruits of their labors, that the inventive powers of men have never before been so active or productive in the history of the world. Inventors made the very discovery of this continent possible; enabled men to subdue and settle it rapidly in its remotest parts; advanced our modern civilization to a degree of perfection never before attained; increased the powers of men and multiplied the application of skilled labor in every department of industry, and made every man in this country richer and wiser, more comfortable and happy. It is not possible for a man to live in this country without enjoying in multiplied forms the benefits conferred upon him by inventors. The benefits of invention are as diffusive as the sunlight, as free as the air we breathe, and as pervasive as the heat that steals into our homes and makes them comfortable. Invention has improved our houses, our clothing, our furniture, our vehicles, our machines, our tools, our instruments, our implements, our apparatus, in fact, everything we possess.

No man can sit, or walk, or ride, or eat, or drink, or sleep, or work, or write, or fish, or hunt, or fight, or legislate without doing it at an immeasurable advantage, compared to one doing the same thing fifty years ago. Aside from Christianity itself, nothing has done so much for this country in all its highest and best interests as invention. To strike down invention is to suspend progress in American science and arts, to arrest advancement in our manufacturing interests, to deal a death-blow to the development of the mechanical powers, and to prevent any further improvement in agriculture. Invention has taken the drudgery out of farming, and made it a pleasant employment. Invention tends powerfully to make every farmer in the West independent, comfortable, and happy. Invention brings to the most distant farmer, on our otherwise lonely and almost uninhabitable prairies, the rich blessings of our modern civilization. The most distant farmer is put within easy reach of centers of population, reads his morning paper, struck off by modern presses, hears the most important news flashed from all parts of the world, and enjoys life almost as well as if he lived in the very suburbs of some metropolis.

The mechanic finds every tool and machine which he uses improved by inventors, which saves him an immense outlay of muscle. The very capitol building, in which Congressmen sit and strike down invention, is indebted to inventors in multiplied ways for its comfort and elegance. The pens, paper, ink, inkstands, paper folders, stamps, desks, chairs, books, the maps and charts, everything, in fact, which Congressmen use, has been invented or improved by inventors. Invention saves them long and toilsome journeys across the country on foot or on horseback, to and from their homes, during which they would surely earn their mileage.

Seventeen years without renewal for the life of a patent is not a moment too long. The best thoughts of a lifetime are often given to an invention, and a fortune put into it. The invention is studied on all sides, special courses of study bearing on it are sometimes pursued, long and costly experiments made, the inventive moods are carefully watched, until at some rare and happy moment the inventive thought flashes like a ray of light across the mind. Nothing is more divine in this world, or more precious to mankind in all that makes life desirable, than the rare flashes of thought of inventive genius.

Then, when the invention is once made, it has to run the gauntlet of the Patent Office, where it has often been anticipated by some other invention, or for some other cause fails. When the patent is issued, the work is only half done. Inventors often involve their whole means in manufacturing and putting their inventions on the market. And some of the very best inventions, like the first anthracite coal carried to Philadelphia, which no one would buy, take some years before they begin to sell to any extent.

The great majority of the quarter of a million of patents taken out in this country have never produced anything for inventors, but have only been a source of loss of time, effort, and money. Some patents have become lucrative, and rarely an inventor, or more probably a purchaser, has made a notable fortune. But every invention which has enriched an inventor has made the world a thousand times richer, more comfortable, and happy. To cut down the life of a patent to five years would be to invention like trying to make a horse plow with his backbone taken out. And yet inventors cannot expect much encouragement from any legislators who never invent anything, unless it is mischief.

But this world cannot do too much for a man who, by his inventive genius, enables it to flash thought around the earth, or drive steam carriages across the continent, or make a ship walk the water "like a thing of life," or to render the most excruciating surgical operations painless.

Our world, in a word, is indebted to invention for almost all its comforts and luxuries. The air is clearer, the water purer, the soil more fertile, the cattle fatter, the horses stronger, the sheep and goats have finer fleeces, the grains are more productive, the fruits better, our homes more comfortable and cheery, our clothing warmer, our vehicles safer, our books and papers more numerous and valuable, and our wives and children are more healthy and happy on account of the inventive faculty of men.

Under the light of Christianity, invention has furnished us the very means of translating, publishing, and circulating the Bible over the globe. Everything is brighter and better and wiser in the whole world on account of invention, except our legislators, who seem to have lost their wits. If they do not stop trying to quench the lights of the age, and voting us back toward the dark ages, we fear it will not be long before we all, like our grandfathers, will go to mill on horseback, with the wheat in one end of the sack and a stone in the other. We would advise every legislator who votes for this bill to put on a fool's cap, and wear sackcloth and ashes for thirty days, and then try to keep step in the march of our modern civilization.—*Kansas City Centropolis.*

Artillery and Armor Plates.

At the Royal United Service Institution recently a paper was read "On the Present Position of the Armor Question, with a Summary of the Principal Recent Plate Experiments." The lecturer was Captain C. Orde Browne, late of the Royal Artillery, and at present lecturer at Woolwich in the Department of Artillery Studies on the subject of Armor Plates. The paper was illustrated by diagrams, and the object of it was stated to be the presentation of such features of the armor question as appeared to be peculiar and of great importance. Captain Browne began by explaining that "soft armor" applied to plates which yielded to perforation, and "hard armor" meant that which would not so yield, and was destroyed by breaking up. The first experiments noticed were the Krupp Meppem plates trials in 1882. The trials were against soft armor, either directly or obliquely, and he showed, in respect to the direct firing, that a projectile with a striking energy of 2,328 foot tons, for which it would have been sufficient work to have penetrated 12 inches of iron in two thicknesses, went through two 7 inch plates, and passed 328 yards up the range uninjured. He thought this was to be accounted for by the fact that 10 inches of wood between the plates was sufficiently thick to allow the point of the projectile to get clear of the bent and broken edges of the front plate before meeting the second, and thus the *maximum* resistance was not got out of the plates. The best thickness of wood was about five inches, and with this, while the plates were prevented from jarring one upon the other, the projectile could not get clear of one plate before it was resisted by the second. In the second experiment, that of the oblique fire, the projectile, with a striking velocity of 1,750 ft., was more than a match for the plate, 7·9 in. with a backing of 9·84 of wood and 0·98 of skin. The Spezia trials of November, 1882, were afterward examined by the lecturer, who described the hard armor plates made by Cammell, by Sir John Brown and Company, and by M. Schneider, and the damage which was done to them by the guns, the results being shown in diagrams, and dealt with in exhaustive figures. Captain Browne urged the need of a better system of estimating the effects of artillery on hard armor than was now possessed, the need for developing the manufacture of steel projectiles for artillery, and the necessity for making experiments in this country on very hard armor. He said that our steel faced armor was unrivaled, and in all the most important experiments abroad the English *materiel* took a prominent place; but nevertheless, we could by no means afford to shut our eyes to the elements in which we might be weak, and in which foreign powers might be gaining an advantage over us.

Pine Extract for Bathing.

It has long been recognized that the atmosphere of pine forests has an invigorating and beneficial effect upon people with weak constitutions and suffering from pulmonary disorders. At some of the watering places of Germany the very simple prescription of the physician is that the patient should spend several hours a day walking or riding through the pine wood. This simple treatment is sometimes supplemented by the taking of pine baths, and in the case of kidney diseases and for delicate children this is claimed to be highly beneficial. The bath is prepared by simply pouring into the water about half a tumblerful of an extract made from the fresh needles of the pine. This extract is dark in color and closely resembles molasses in consistency, and when poured into the bath gives the water a muddy appearance with a slight foam on the surface. The repugnance one feels to enter into such a muddy looking fluid is dispelled as soon as the delightful aroma which arises from the bath is inhaled. Although there may be some doubt whether pine baths act upon the system in any other wise than as a tonic, still as an adjunct to the daily bath, infusion of the pine extract induces a most agreeable sensation. It gives the skin a deliciously soft and silky feeling, and the effect upon the nerves is quieting. It is a matter of some surprise to us that the business of manufacturing and bottling the extract for private use and public bathing establishments has not been tried in this country, where pine forests abound so extensively. The extract when properly bottled and securely corked will not deteriorate for a long time, and the cost for gathering the pine needles and extracting their tarry substance would not be very great, while the demand for it would likely increase to large proportions when the public became accustomed to its use.

Progress on the Panama Canal.

There are many who yet doubt whether De Lesseps and his associates will eventually succeed in piercing the Isthmus of Panama with a practical canal. The work has now been fairly commenced, and some $40,000,000 has thus far been expended, not including the money paid for the Panama Railroad, but it is plainly apparent that the magnitude of the undertaking has been greatly underestimated, as it is also that the canal cannot be completed by the year 1888, the time announced by M. de Lesseps for its opening.

Lieut. Raymond P. Rogers, of the U. S. Navy, has lately passed over the line of the canal, where every facility was afforded him of making a thorough inspection, and his report brings our information concerning the work up to date. The number of men now employed in all sections is probably at least 15,000, brought chiefly from Jamaica and Carthagena, and the amount of excavation has gradually increased until 700,000 cubic meters per month have been reached. It was hoped that the month of February would produce 1,000,000 cubic meters, and that later the amount of 2,500,000 meters would be removed each month. The rainy season begins in May and continues till December, and it is estimated that the rains will reduce the excavation of the dry season by about one-fifth, so that it is not unlikely that from the 1st of May next an annual excavation of 25,000,000 cubic meters may be counted upon.

It is not impossible, with the requisite money, that the sections of the canal, exclusive of those of Obispo, Empire, Culebra, and Paraise, may be ready for service by the year 1888, but it does not seem possible that these most formidable sections, with their cuts of great depth and width, can be made ready, nor that the ports at the extremities can be completed for some years later. Consider the section of Culebra, with its great excavation of more than 25,000,000 of cubic meters, and suppose that the large amount of 300,000 cubic meters be removed each month from it; at this rate it would take seven years to complete this section.

There is an immense amount of machinery and material now on hand or contracted for, and it is probable that there remains sufficient funds from the amount already subscribed to meet promptly the current expenses for two years to come. After that, with the enterprise well begun and with a fair proportion of the whole excavation already removed, it would seem plausible that the prestige of M. de Lesseps' name, and the confidence which the investors of France have in his ability to carry through successfully this great work, would procure the further necessary subscriptions. Whether the estimated sum—600,000,000f.—will prove sufficient time alone can decide; but as one-third of this amount has already been expended, it would seem insufficient to complete this most formidable undertaking.

The climate has thus far not proved so fatal in most of the sections as might have been anticipated. Of course, exposure to the sun, heat, and fatigue have produced fevers and have occasioned mortality; but, as a rule, the employes of the company seem in fair health, and the Europeans have suffered more than the laborers, natives of the tropics. But, while most of the sections have not been very sickly, the neighborhood of Panama has proved an exception to the general rule. Here, during the past six months have appeared, in larger numbers than usual, pernicious fevers, and there have been several cases of yellow fever which have proved fatal.

How to Use Arsenic.

I am frequently asked if I am ever troubled with insects in my natural history specimens, and I only have one answer—never; and if my directions are followed, no one ever need be. After skinning, immediately cover the moist skin with pure arsenic—be particular to cover every part. I keep my arsenic in a large box and put my skins right into the arsenic; pull out the leg and wing bones as far as possible so as to introduce the arsenic to the extreme parts; the eye sockets, skull, and mouth should be well covered with the preservative. I usually, before mounting, place the specimen in my office cellar, and let it remain twenty-four or more hours, so as to get well impregnated with arsenic.

After mounting, brush the bill, legs below the feathers, feet, and ends of the wings that cannot be skinned, with a solution of corrosive sublimate in alcohol--about a teaspoonful of the former to one-half pint of the latter. I have bird skins that I have designedly left exposed to insects for thirty-five years which to-day are uninjured and will remain so forever—that is a good long time, I know, but they are good for it. I know of several collectors who have laughed at my "useless waste of arsenic," thinking a little just as good, or who prefer arsenical soap, or some other preservatives, whose collections are entirely ruined.

I have been in the habit of using from fifteen to thirty-five pounds a year for thirty-seven years in my private collection. It created some merriment in court, where I was summoned as a witness in a case of arsenical poisoning, when asked if I was familiar with arsenic, and I replied that I had probably used one-half ton of it. "What!" said the counsel, "given one-half ton to your patients!" When I receive dry skins, I pack them very loosely in a tight large box, leaving space for an iron kettle, in which are placed live coals. On these pour sulphur and close the box tight, leaving it for twenty-four hours or so; and if there are insects in the skins you will find them dead. Then subject the skin to the same arsenical treatment as a fresh skin.—*Wm. Wood, Ornithologist.*

ENGINEERING INVENTIONS.

A turbine water wheel has been patented by Mr. Elbridge W. Stubbs, of Lincolnton, N. C. The invention covers a novel construction of the guides or chutes, and the mechanism for opening them; also a flange ring gate hung upon a yoke pivoted to a support on the top plate, the object being to obtain a discharge of water on the paddles in solid streams through peripheral chutes.

A sand and gravel excavator, separator, and assorter has been patented by Mr. Nicholas W. Godfrey, of Northport, N. Y. This is an automatic excavator, which delivers its scrapings to screens or separators, where they are graded and discharged in different places according to the grades, the mechanism being movable to easily adapt it to the exigencies of ordinary work.

A friction drum for inclined plane cable railways has been patented by Mr. Earle C. Bacon, of Brooklyn, N. Y. There are two friction drums, around which the cable passes, with a brake-band for each drum, both being adapted to be applied simultaneously, also a cog wheel united therewith, and a pinion on a shaft that can be rotated, the pinion being adapted to be engaged with the cog wheel, the object being to facilitate the starting of cars.

An upright tubular boiler has been patented by Messrs. Remi Henry and Hiram B. Taylor, of New Rochelle, N. Y. An annular base tube is connected with the lower ends of a circle of upright tubes, these being connected with a circle of shorter intermediate tubes and a central annular tube, by connecting tubes with right and left screw threads upon their ends, the circular base tube having a blow-off cock and an inlet water pipe, and the central annular tube having a steam pipe.

MECHANICAL INVENTIONS.

A card sharpening apparatus has been patented by Mr. John Brierley, of Easthampton, Mass. The sharpeners are mounted to reciprocate across the faces of the rotating cards and doffers, but the arrangement is such that a uniform pressure is had over the whole width of the cards, to sharpen them without making them untrue.

A gauge attachment for boring bits has been patented by Mr. John Fuller, Sr., of Seneca, Kan. The device consists of a clamp adapted to be placed upon the shank of a bit, auger, or other boring tool, the clamp being constructed to hold a gauge bar in such manner that it will stop the progress of the boring tool when the right depth shall have been reached.

A mechanism for delivering pile warps in looms for weaving double pile fabrics has been patented by Mr. Frank Charcot, of Paterson, N. J. The mechanism covers clamping bars and rollers, between which the pile warps are passed, the bars and rollers being mounted on a frame with means, operated from the hooks of a Jacquard mechanism, whereby the bars and rollers are made to clamp and carry forward the pile threads.

AGRICULTURAL INVENTIONS.

An improved hay stacker has been patented by Mr. Albert Cooley, of Osceola, Iowa. This invention combines, with a base and suitably adapted inclined frame, a movable rake, adapted for the collection of hay in the meadow, and which can, by an attachment of ropes and pulley in the frame, be drawn up, and dumped by its own weight in position on the stack.

MISCELLANEOUS INVENTIONS.

A tag holder, for attaching and detaching tags to bundles, has been patented by Mr. Edward H. Tannehill, of Malvern Junction, Ark. The holder has a hook made integral therewith, adapted to receive a snap spring, with an internal groove closed at one end to receive a tag or label.

A trace buckle has been patented by Messrs. Ferdinand Wetstein and Frank H. Dyckman, of Sleepy Eye, Minn. The buckle is cheap and durable, and is intended to effect a saving in both material and labor in making harness, since it takes the place of leather portions now used, and no stitching is required.

An ointment for the cure of tetter and other cutaneous diseases has been patented by Mr. Manlius Huggins, of Waynesborough, Miss. It is composed of chrysophanic acid, glycerine, oil of sassafras, and other ingredients, in definite proportions, and to be mixed and applied after specific but exceedingly simple directions.

A whiffletree hook has been patented by Mr. William H. Best, of Eastport, Mich. This is an improvement on whiffletree hooks which have spring guards to prevent accidental detachment of the trace eye from the hook, and the novelty consists in the form and arrangement of the spring guard with reference to the hook.

An improved pack saddle has been patented by Messrs. William C. Smith and William L. Hunter, of Lone Pine, Cal. The pack boxes designed in this invention are contrived to be filled and emptied without removing from the animals, and the means are provided for substantial and durable connection to the pack saddle.

An ice creeper has been patented by Mr. Frank M. West, of Mohawk, N. Y. The invention covers a permanent heel plate and a detachable spur plate, the latter having spurs on one side and a screw-threaded shank on the other, so the spur plate may be easily detached from the boot or shoe, and attached when desired.

A timber and lumber stamp has been patented by Messrs. Levi Thrush and Leonard Wilson, of Brookville, Penn. This device covers a special arrangement of ratchets and pawls, whereby, with a simple pressure of the thumb, a changeable stamp whose characters are on wheels loose upon an axis may be operated very easily and rapidly.

An improved buckboard wagon has been patented by Mr. William Lockwood, of Madrid, N. Y. This invention covers details of construction and arrangement of parts, with simple springs and spring braces, durable and inexpensive, to give to the wagon easy riding qualities, while retaining the lightness and ease of draught of the common buckboard.

An improved lace fastening has been patented by Mr. Henry H. Porter, of Littleton, N. H. It is an improvement on a lace fastening patented by the same inventor last year, and provides for an additional cross bar at the bottom surface of the eyelet, to prevent the slack part of the lace from passing back, and holding it in position when the strain is taken off.

A trace carrier has been patented by Mr. Louis T. Anderson, of Carroll, Iowa. The invention covers a buckle frame with a cross piece having a pin or tongue, and a hook with a projecting guard, the pin serving to hold the buckle to the hip strap, the hook holding the cock-eye of the trace, and the guard serving to prevent the horses' tails or the lines from catching in the hook.

A portable counter has been patented by Mr. John T. Perry, of La Grange, Ga. The counter is mounted on wheels, to be readily movable, and standards are erected upon it, between which are hoppers to contain articles to be sold, while on the counter a scale provided with wheels may be made to run under either hopper, besides other novelties in the construction and arrangement of parts.

A picture exhibitor has been patented by Messrs. Abraham J. Dworsky, Marcus B. Kramer, and Simon Phillips, of New York city. It is a casing with a series of swinging doors, with recesses in the inner sides, in each of which picture holding frames are hinged, and with a central standard on which frames are hung, with mechanism for opening or closing all the doors.

A baling press has been patented by Mr. John P. McDonald, of Litchfield, Ill. The bale box is made with close top and bottom, and sides slotted to receive the bands, and there is a double-jointed lever, through which power can be applied by attaching a draught animal to its free end, the press being intended to promote convenience and economy in baling hay, cotton, etc.

A combined tire tightener and jack has been patented by Messrs. Riley McCloskey and Albert E. Tozier, of Walla Walla, Washington Ter. In combination with a lifting screw are fast wheels with reversed ratchet teeth, and other devices, so the jack may be used generally for raising the axle of a wagon for removing the wheel, or for spreading the fellies of wagon wheels for tightening the tire.

An improved bob sled has been patented by Mr. Joseph H. Kirk, of Brady, Clearfield County, Penn. The sled has a platform, or double bolster, and a jointed king bolt, so the bob will be free to move in any direction without affecting the position of the platform, the sled being free to adapt itself to an uneven surface, and being easy of being turned in a very small space without unduly straining any of its parts.

An improved ruler, for drawing lines readily and rapidly without soiling the paper, has been patented by Mr. Monroe Green, of Brooklyn, N. Y. A longitudinal frame is held on a ruler, between the wires of which is a stylographic or like pen, which, drawn lengthwise through the frame, draws a line, the frame being pressed upward by springs, so the pen will not be on the paper when not in actual use.

A cold-air blast centrifugal sirup cooler has been patented by Mr. Albert B. Smith, of Fairfield, Neb. The sirup is thrown by a revolving distributer against the inner surface of a cooling tube, the distributer being operated by compressed air forced into the tube, so the sirup is cooled rapidly, remains several shades lighter, and of a higher specific gravity than that cooled by the slow process.

A jewel support for the balance staffs of watches has been patented by Mr. Walter Ware, of Waverly, N. Y. This invention consists in setting the jewels, or the settings which hold them, at either or both ends of the balance staff, in the spring or springs, so the jewels will yield whenever unusual pressure is brought on them, as by a fall, etc., and the watch will be more permanently accurate.

An improved alarm clock has been patented by Mr. Isaac St. C. Goldman, of Pasadena, Cal. It has a latch plate so combined with other mechanism that when the alarm spring is wound immediately after the alarm has been sounded, the latch plate covers the disk, prevents the lever from passing into the notch, and stops the alarm from being again sounded until it comes to the time for which it is set.

A breeching attachment for carriage shafts has been patented by Mr. Samuel W. Booksh, of Baton Rouge, La. In combination with the thills is a bow with its ends clipped thereto, and its curved rear portion somewhat elevated above a horizontal plane touching the upper surfaces of the shafts; the bow is made strongly, and so connected that the harness breeching may be dispensed with, thus simplifying the harness and lessening the labor of harnessing.

An improved lock has been patented by Mr. David Morris, of Log Cabin, Ohio. The slide bolt is moved in either direction by a wiper, and the bolt is preferably a plain cylindrical rod, fitted to the case, of proper form and size to receive the same, so the bolt may be supported by the case only, making a more permanent and better working arrangement than is afforded by clips, guides, and other attachments to the interior of the case.

An improved process of treating volatile and inflammable fluids and oils has been patented by Mr. Solomon M. Eiseman, of New York city. It covers so treating crude petroleum, turpentine, etc., that they will be converted into a hardened compact mass, to facilitate transportation and storage, and for convenience in use, an acid, or a substance with acid properties, being incorporated by a suitable medium with the inflammable or volatile fluid or oil. It is an improvement on an invention patented by the same inventor last year.

Special.

T. S. ARTHUR AT SEVENTY-FIVE.

For many years the genial countenance of Mr. T. S. Arthur has been a familiar sight to the citizens of Philadelphia, as he has walked the streets of the city on the route between his home and his office. His name has been a household word among the readers of pure literature throughout the whole country. And "Arthur's Home Magazine," which he has so long and so successfully edited, has secured so hearty and so permanent a welcome in many thousands of the best households in the land, that Mr. Arthur cannot be regarded as a stranger by intelligent people anywhere. The many stories and tales of which he is the author are written in the interest of purity, good morals, and reform, and, especially those which are in aid of the temperance work, have been productive of immense good. They have had an exceptionally favorable reception, and have nobly served their purpose of stimulating people to high aims and noble intentions.

It might be supposed by those who have not personally seen Mr. Arthur, that a man who could for years work as diligently as he has, and who could produce the extraordinary amount of superior literary material which has come from his pen, must be one of giant physique and robust constitution. Those who are familiar with his slender form know that it is far otherwise; his constitution was never strong. About 1870 he had suffered to such an extent from physical and nervous exhaustion that most of his friends gave him up as not likely to live long. It seemed as if his work was almost done.

The narration of Mr. Arthur's decline in health, and of his restoration to vigor and the enjoyment of life, is of singular interest, as given by himself to one of our editors who recently enjoyed a protracted conversation with him. Mr. Arthur said, substantially:

"Previous to the year 1870 my health had been very poor. For a number of years I had been steadily losing ground in consequence of the constant physical and nervous strain resulting from overwork. I became so exhausted that my family and friends were very anxious about me. Only a few of the most hopeful of them thought I could live for any considerable time. I was forced to abandon all my most earnest literary work, and I regarded my career in authorship at an end. I was so weak that I could not walk over a few squares without great fatigue. The very weight of my body was to me a wearisome burden. My appetite was poor, and my digestion was much impaired.

"About this time my attention was attracted to Compound Oxygen as then administered by Dr. Starkey. I had heard of wonderful cures wrought by its agency; so wonderful, indeed, that had I not personally known the doctor and possessed the fullest confidence in him, I should have been very skeptical on the subject. I tried the Compound Oxygen Treatment, first simply as an experiment. I knew it could not make me worse than I was, and I hoped it might make me better. That it would do for me what it has I had not dared to hope."

How soon did you begin to realize the advantages of the treatment?

"Almost immediately. Its effect was not that of a stimulant, but of a gentle and almost imperceptible vitalizer of the whole system. Soon I began to have a sense of such physical comfort as I had not known for many years. My strength was gradually returning. This slowly but steadily increased. In a few months I was able to resume my pen, and within six months after doing so I completed one of my largest and most earnestly written books, and this without suffering any drawback, and without any return of the old feeling of exhaustion. For more than seven years after this I applied myself closely to literary work, doing, as I believe, the best work of my life."

Did your uniform good health continue during those years, or did you suffer relapses into your former state of exhaustion?

"The improvement was substantial and permanent. Not only had I no return of the old weakness and exhausted feeling, but I was able to work in my study from three to four hours a day. The constant remark I heard from my friends was, 'How well you are looking.' Nor was it only in strength and vitality that I gained by the use of Compound Oxygen. For twenty years I had suffered with paroxysms of nervous headache, sometimes once or twice a week. They were very severe, lasting usually six or seven hours. In a year after I commenced the Compound Oxygen Treatment, these were almost entirely gone. It is now over ten years since I had such an attack. I was, moreover, liable to take cold, and I had frequent attacks of influenza, which always left me with a troublesome cough. It is very rarely that I now take cold. When I do so I at once resort to Compound Oxygen, which invariably breaks up the cold in from one to three days."

And now, Mr. Arthur, what is your present condition of health?

"It is all I have any right to desire or expect at my somewhat advanced age of 75. I sleep well, and am able to take my proper amount of food, enjoying my meals with regularity and heartiness. My digestion, although slow, is good. I do not confine myself to any particular articles of diet, but eat what other people eat, rejecting of course that which seems to be indigestible, or too rich. I am able to attend to my customary literary work, devoting about four hours a day to it, and that without any sense of weariness except as to my eyes. Were it not for the fact that with advancing years I find my eyesight not as good as it formerly was, I should be able to work longer without fatigue. I enjoy moderate exercise, and take it regularly without that feeling of exhaustion which was formerly so depressing."

The testimonials and reports of cases published by Drs. Starkey and Palen in their pamphlets and advertisements, if literally true, show Compound Oxygen to be the most remarkable curative agent yet discovered. Do you believe them all to be genuine?

"I have the most complete confidence in them. For years I have had personal acquaintance with Drs. Starkey and Palen, and exceptionally good opportunities for observing them, as well in private life as in their professional relation to the public. I am sure that neither of them would or could become a party to any fraud or deception. But facts are of more value than opinions. Let me give you a fact. I publish a magazine, and have had an advertising contract with Drs. Starkey and Palen for over six years. During this time I have published monthly from one to six or seven different reports of cases and cures under their new treatment, or over three hundred in all. Now, *in every case I have examined the patient's letters, from which these reports were taken*, and know the extracts made therefrom, and published in my magazine, to be literally correct. Stronger evidence of genuineness than this cannot of course be given."

Mr. Arthur, some years ago you gave a testimonial in regard to what Compound Oxygen had done for you; and you also have spoken freely in your magazine concerning Messrs. Starkey and Palen. Do you, in view of your present acquaintance with these gentlemen, and your large experience with Compound Oxygen, indorse all you have said?

"I do, most fully, and without any reservation whatever."

And now, as to testimonials. Have you at any time given a testimonial in favor of other special remedial agents or modes of treatment?

"Never. The first and only time that I have permitted my name to be used in commending a curative agent to public notice and confidence is in the case of Compound Oxygen. This I have done, not from solicitation, but voluntarily, and from a sense of duty. I believe that in the use of this newly discovered substance, diseases long classed as 'incurable' may be greatly ameliorated and very often entirely broken, and the sufferer restored to comparative good health. I also believe, that by its use the liability to disease may be removed, and the general health of the community greatly improved. From what I know of its action, as well in my own case as in that of many others, I am satisfied that if promptly used it will arrest the progress of acute pneumonia, consumption, catarrh, and most of the diseases which originate in colds. Believing this, as I certainly do, and from evidence which is too direct and positive to be ignored, I would be derelict in my duty if I did not do all in my power to induce the sick and suffering to seek relief in the use of so beneficent an agent.

Have you seen and known other persons who have used Compound Oxygen, and have you had opportunities of observing to what extent they have received benefit?

"My observation and my opportunities in this respect have been large. I have been much at the office of Drs. Starkey and Palen, and have become personally acquainted with many who have taken the treatment. In almost every case, where a fair trial was given, decided benefit was obtained. Some very remarkable cases in consumption, rheumatism, catarrh, congestion of the lungs, asthma, etc., have come to my personal knowledge, the results of which seemed almost miraculous."

Do you still resort to the Compound Oxygen Treatment, now that your health is restored?

"I do not, as a regular thing. Only, when I have a cold, as I before remarked, I take it for a day or two, and always with good effect. I find that it helps nature to throw off the cold, by imparting the needed vitality to enable the system to do its proper and natural work. It puts nature into condition to defend itself against the attacks of disease. If there are any cases in which persons are disappointed in regard to Compound Oxygen, I believe them to be those in which patients have been so impatient for speedy cure that they have dropped the treatment before it had opportunity to make its impression on the system. Such people will fly from one remedy, consume large quantities of almost every medicine brought to their notice, and yet continue to be invalids. Compound Oxygen does not cure by magic in a moment. If it claimed to, it would be quackery. But I regard it as one of the most wonderful and beneficent curative agencies ever brought to public notice."

For further and fuller answers to the countless inquiries suggested by the above to thoughtful minds, and to those who are solicitous about their own well-being and that of their friends, mail your address to Drs. Starkey and Palen, 1109 and 1111 Girard Street, Philadelphia. The pamphlet you will receive in reply will set forth full particulars.

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.

All Books on Electricity, cheap. School Electricity, N.Y.

"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 86 John St., New York.

Stationary, Marine, Portable, and Locomotive Boilers a specialty. Lake Erie Boiler Works, Buffalo, N. Y.

Wanted, a situation in some Southern State, by a mechanical engineer, who is thoroughly and practically acquainted with all branches of manufacturing metal goods and an expert on special machinery. Will take interest or salary. Address J. G. Lettelier, 1005 Wilcox Avenue, Chicago, Ill.

Railway and Machine Shop Equipment.
Send for Monthly Machinery List
to the George Place Machinery Company,
121 Chambers and 103 Reade Streets, New York.

The Hyatt filters and methods guaranteed to render all kinds of turbid water pure and sparkling, at economical cost. The Newark Filtering Co., Newark, N. J.

Stephens Bench Vises are the best in use. See ad., p. 173.

If you want the best cushioned Helve Hammer in the world, send to Bradley & Company, Syracuse, N. Y.

Sleeve nuts, best, cheapest. Pittsburgh Sleeve Nut W'ks.

Iron and Steel Drop Forgings of every description.
R. A. Belden & Co., Danbury, Ct.

"The Sweetland Chuck." See ad. p. 188.

Hoisting Engines for Mines, Quarries, Bridge Builders, Railroad Construction, etc. Send for catalogue.
Copeland & Bacon, New York.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Pumps—Hand & Power, Boiler Pumps. The Goulds Mfg. Co., Seneca Falls, N. Y., & 15 Park Place, New York.

Fox's Corrugated Boiler Furnace, illus. p. 354. Hartmann, Le Doux & Maecker, sole agents, 134 Pearl St., N. Y.

For Freight and Passenger Elevators send to L. S. Graves & Son, Rochester, N. Y.

Best Squaring Shears, Tinners', and Canners' Tools at Niagara Stamping and Tool Company, Buffalo, N. Y.

Lathes 14 in. swing, with and without back gears and screw. J. Birkenhead, Mansfield, Mass.

The Best.—The Dueber Watch Case.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN Patent Agency, 261 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Wanted.—Patented articles or machinery to make and introduce. Gaynor & Fitzgerald, New Haven, Conn.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

NEW BOOKS AND PUBLICATIONS.

BOILERS AND THEIR USE.

The practical treatise of the late Prof. C. A. Smith on the above subject is to be published in book form by the *American Engineer* of Chicago, under a contract of the publishers with the author.

A BIBLIOGRAPHY OF ELECTRICITY AND MAGNETISM, 1860 TO 1883. Compiled by G. May, with Index. Trubner & Co., London.

This little volume gives a full list of works on electricity and magnetism issued within the period during which these subjects have become of such general interest. The titles are given in the languages in which the different works are written. By far the greater number of the works noted are in German, after which come French, English, Italian, etc.

THE CINCHONA BARKS PHARMACOGNOSTICALLY CONSIDERED. By Friedrich A. Fluckiger, Ph.D. Translated by Frederick B. Power, Ph.D. F. Blakiston, Son & Co., Philadelphia. Price, $1.50.

This monograph is based upon the treatment of the same subject in the " Pharmakognosie " of the author, who is a professor in the University of Strassburg, although the details have been amplified, and the latest information is given touching the natural and chemical history of this most important remedy.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

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.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

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.

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

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their indentification.

(1) G. W. B. asks: What is the ratio between powder and ball in a rifle, or in other words what weight of powder will give the best results with a given weight of ball? A. The relative weight of powder to ball varies very much in practice; from one-seventh to one-half the weight of the ball in powder has given good results. The quality of powder, form of ball or bullet, kind of arm, proportional length of barrel, rifled or smooth bore—all are elements in the proportion. With the Harper's Ferry rifles (U. S.), 70 grains U. S. rifle powder to a 500 grain bullet at 200 yards gave the greatest penetration, while in some of the later rifles at target practice the charge reaches to nearly one-half the weight of the bullet. There is a U. S. regulation charge of 75 grains powder for a 218 grain bullet. The cartridges for sporting rifles as practiced here are charged from one-third to one-half the weight of the ball; for pistols, one-sixth to one-quarter weight of ball.

(2) A. McD. G. asks: 1. I want to light a room 18 x 20 three hours a day by electric light; can I obtain sufficient electricity to do it by means of a battery? A. Yes. 2. How many and what size cells would be necessary, and please describe the form of them? I want the details so that I can make them, as also directions for making and using the points. A. Use 25 cells of Bunsen battery. You will find full particulars, which will enable you to make this and other batteries, in SUPPLEMENTS 157, 158, and 159. Better purchase your carbon pencils. They are inexpensive, but would give you a great deal of trouble were you to try to make them. The same advice would apply in regard to an electric lamp. 3. Could I use this battery during the day to operate a telegraph line of one-quarter of a mile? A. You could use it in that way, but a gravity battery would answer better. It would require not more than two cells to work your telegraph.

(3) H. C. T. writes: I have some small iron articles that I wish to japan. Should be glad to have you give directions in the SCIENTIFIC AMERICAN. A. For japanning small iron goods, the japan may be put on with a brush, generally two coats. If the goods are of a kind that will bear dipping, you may thin the japan with a little turpentine. You will have to make a few experiments to find just how much to thin the particular kind of japan that you are using. The goods should be heated upon a plate of iron over the oven stove to a little above the temperature of boiling water, then dipped into the japan quickly and out, either with a hook or on small wires, then drained for a moment and hung in the oven. The oven should be raised to a temperature of 250° Fahr. Great caution should be used with an oven heated by a stove. Nothing but the pipe or such part of the stove as will not communicate fire to the vapor of the japan should be exposed in the chamber. The air that feeds the fire should not under any circumstances be taken from the drying chamber. A steam coil is the best if you can use steam at 60 pounds pressure, as that pressure is necessary to produce the desired temperature.

(4) C. L. asks at how early a date cast iron stoves came into use. A. Have no information in regard to iron stoves earlier than the middle of the eighteenth century. The Hollanders made stoves at a very early date of tile. A search among early illustrations of household goods might be of advantage to you.

(5) F. R. R. S. asks: 1. How can I remove coal oil from a carpet without destroying the colors, the spot not a very large one? A. Coal oil is soluble in ether, naphtha, chloroform, etc., so that by proper manipulation with these reagents the spots can be removed. No light, however, must be brought near them, as they easily catch fire.

(6) F. H. P. asks: 1. Is or was clover seed of any kind ever used for coloring purposes? A. No. At least not in our day. 2. Are or were dried apples ever used for coloring? A. No. Not that we know of.

(7) R. S. B. says: I am a constant reader of your valuable paper. Would consider it a favor if you would give me a receipt in detail for making Babbitt metal. Also what is necessary to harden it when too soft? A. Melt in a crucible 8 parts copper by weight; add 90 parts tin and 2 parts antimony. Proportions are varied for different purposes. Harden with antimony.

(8) M. D. asks: 1. Will not Swedish iron boiler tubes one-sixteenth of an inch thick, two inches in diameter, stand 120 pounds to the square inch pressure applied inside of tube? A. Yes, if the tube is one inch long; no, if it is six feet long. 2. Will not copper tubes be better made same size and thickness? A. No. 3. What is the mineral sent? A. The mineral is massive quartz not commercially valuble.

(9) W. H. says: I would be glad if you would inform me in your Notes and Queries what the composition is that is used to whiten the belts of the militia? A. Pipe clay.

(10) J. H. L. asks: Can you inform me how to obtain a hard, smooth, glossy black surface on wooden panels for art decorating purposes? A. Dissolve gum shellac in alcohol and add enough powdered ivory black or drop ivory to give it the consistency to apply with a brush. Put on three or more coats, rub down with rottenstone and a woolen cloth when dry, and varnish with thin coach varnish.

(11) A. V. asks: 1. If a dynamo would give 100 candle power, what candle power would double the size give? A. It should give at least 400. 2. What is the candle power of a Bunsen cell? A. The amount of light a Bunsen cell can produce depends upon its size and upon the kind of lamp used. In any case a single cell would produce very little light—not equal to one candle.

(12) W. M. B. asks: 1. What can I mix with varnish to cause it to dry immediately after being applied to smooth wood surface, that will retain a bright, lively appearance and will not crack or peel off? A. There is nothing you can use that will accomplish your purpose. Driers are added during the process of making the varnish, so that it is best for you to purchase a quick drying varnish. 2. I have some cheap silver looking ornaments that turn dark when exposed to the air. What can I cover or coat them with to exclude the air, and retain their bright silver appearance? A. Cover them with a "silver lacquer," which can be purchased of the ordinary paint supply houses.

(13) H. S. asks how to dye and fix the aniline colors so that they will not rub off? A. Albumen will be found a satisfactory fixing agent.

(14) R. H. H. writes: In one of your SUPPLEMENTS you mention using mercury flasks in making small steam boilers. 1. What are the dimensions of the flasks? A. Five in. diameter by twelve in. length. 2. Where can they be obtained, and what is the cost of them? A. From druggists and instrument makers. 3. How many would be required for an engine 4¼ inch cylinder, 4 inch stroke, running 250 to 300 revolutions per minute? A. From 65 to 70. 4. How many pounds steam pressure will they stand, or what pressure will it be safe to carry? A. Safe to carry 130 to 150 pounds. We suppose they will stand 600 to 800 pounds; we cannot, however, say that they are tested to that pressure.

(15) F. C. S. asks: What the so-called diamond ink used for writing or etching upon glass is composed of? A. The preparation is said to be made from ammonium fluoride dissolved in water and mixed with three times its weight of barium sulphate.

(16) W. H. McA. asks: 1. How is citric acid extracted from lemons? A. The juice of lemons is allowed to ferment, and chalk added to form calcium citrate. This salt when treated with sulphuric acid decomposes, giving rise to calcium sulphate, a white insoluble powder, and citric acid, which is in solution. The latter is then evaporated and the citric acid purified by crystallization. 2. Is there much of a demand for it? A. It is in good demand, and regularly sold by wholesale drug houses. 3. How much is it quoted at per pound? A. Forty-eight to forty-nine cents.

(17) P. P. H. asks: 1. How to polish, smooth, and brighten wooden (pitch pine) floors? A. This information is given on page 312 of the SCIENTIFIC AMERICAN for November 17, 1883. 2. How to stain rattan chairs to imitate mahogany and ebony? A. Wash the rattan with a concentrated aqueous solution of iron acetate, having a strength of 14° B. Repeat this until a desirable shade is produced. Then give a coat of quick drying varnish, such as can be made by dissolving black wax in spirits of wine. 3. How to regild much used gilt frames (without using the varnish and gold powder)? A. We fail to understand how it is possible to regild frames unless the size or varnish be employed with gold leaf or powder. 4. How to fix looking glasses where the quicksilver is partly gone, and with black spots? A. See SCIENTIFIC AMERICAN for Nov. 10, 1883, answer to query No. 23, for this information.

(18) L. D. B. asks for some simple chemical or other means for analyzing common drinking water to ascertain the different ingredients, and also for iron and lead? A. A simple test for water is to place it in a clear bottle, and first examine if it be colorless, and thus free from organic matter. Then taste it, and if no peculiar flavor is discernible let it stand a day or two; then heat or boil, and if no odor is present, the water is in all probability pure.—*Heisch's Test for Sewage Contamination*: Fill a clean pint bottle three-fourths full of water, dissolve a teaspoonful of loaf or granulated sugar, cork the bottle, and place it in a warm place for two days. If the water becomes cloudy or muddy, it is unfit for domestic use. If it remains perfectly clear, it is probably safe to use. If the water is sufficiently concentrated, it will give a blue precipitate with potassium ferrocyanide when iron is present, and a black precipitate with hydrogen sulphide if lead is present. It would be unwise to attempt these tests without some previous knowledge of chemistry.

(19) O. B. W. writes: 1. I wish to build a marine engine suitable for a small launch. Will you please tell me what is the most economical rate to drive propeller? Would 250 revolutions per minute be too high speed? A. Two hundred and fifty revolutions not too fast. 2. I do not understand how to get the size of ports. The steam pressure in boiler will be about sixty pounds per square inch. What should be the size of steam ports, and what pressure should there be in cylinder? The diameter of cylinder and stroke of piston is four inches, and the number of revolutions of engine per minute, say two hundred and fifty. A. Steam ports 3 x ⅜ in.; exhaust, 3 x ⅝ in. 3. What size boat would the above engine drive at about seven or eight miles an hour, the boiler pressure being sixty pounds? A. Boat about 26 ft. long and 4¾ ft. beam by 2 ft. 9 in. deep. Your boiler should have not less than 110 ft. heating surface.

(20) J. C. D. asks in what respect is a coal burning locomotive constructed differently from an ordinary wood burner, and also what change would be necessary to make in changing from wood to coal, as a fire under a common horizontal flue or tubular boiler? A. There is a difference in fitting the furnace for bituminous or for anthracite coal. For coal the furnace has much less depth and larger grate area than for wood. Anthracite coal furnaces have generally more grate area than for bituminous. Generally all that is required is to reduce the depth of the furnace and fit suitable grate bars. Furnace for anthracite coal, about 24 in. or 26 in. deep.

(21) R. R. asks: What is the minimum power required to operate an air pump cylinder 5½ in. diameter and 8 in. stroke, forcing air into a reservoir until it contains 100 lb. to the sq. in? The engine or power used to have same number of revolutions as air pump, with 75 lb. steam to the sq. in. A. We cannot estimate the power, as you do not give the number of strokes per minute. The pressure upon the steam piston must be at least equal to the *maximum* pressure of the air pump piston, if both have the same stroke; the total pressure on the air pump piston at 100 lb. per sq. in. will be 2,376 lb.; and as the pressure per sq. in. is but 75 lb., the diameter of its piston must be say, 6¼ in.: add to this 33 per cent for friction of engine and pump, will give a cylinder 7¼ in. diameter.

(22) J. M. B. asks: Why the notches on a scale beam or steelyard weigh say uniformly 1 pound on the platform, no matter whether the piece be near the fulcrum or at the end of the beam; the notches on beam are of equal distances. Why should not the balancing power increase, the greater the distance it is placed from the fulcrum? A. Because the power of a lever is as the ratio of its two arms.

(23) S. B. G. asks: 1. What is meant by each of the following chronological cycles. They are used in the almanacs, but are not generally understood: 1. Golden number, 4? A. The Golden number is the year of the lunar cycle of 19 solar years; after which the new and full moon fall upon the same day that they did 19 years before. The number of the year in the cycle is called the *Golden number*, because it is supposed that it was inscribed in letters of gold in the Greek temples. The cycle is supposed to commence with the year in which the new moon falls on the 1st of January. This happened in the year preceding the commencement of our era; hence to find the number of any year in the lunar cycle, or *Golden number* of that year, add one to the date and divide by nineteen; the quotient is the number of cycles elapsed, and the *remainder* is the *Golden number*. If there is *no* remainder, the *Golden number* is the last, or nineteen. 2. Epact, 3? A. The Epact is the moon's age at the end of the year, or the number of days by which the last new moon has preceded the beginning of the year, and is used in ecclesiastical computations. It is computed from the difference between the number of days in the solar and lunar year, which is 11, and its yearly multiples divided by 30; whence if a new moon fall on the 1st of January, the moon will be 11 days old on the 1st day of the following year. The Epact for that year will be 11, the next year 22, and the third year 33 — 30 = 3, and so on —subtracting 30 whenever the added 11 becomes 30 or more. 3. Solar cycle, 17? A. The Solar cycle is a period of time after which the same days of the week recur on the same days of the year. Its duration is obtained by multiplying the days of the week by the leap year period—7 × 4 = 28 years. Its number for a given year is found by adding 9 to the date and dividing by 28; the quotient is the number of cycles elapsed, and the remainder is the year of the cycle. Should there be no remainder the cyclical number is 28, or the last of the cycle. 4. Dominical letters, F, E? A. The Dominical or Sunday letter in the ecclesiastical calendar is denoted by the first 7 letters of the alphabet. A commencing with the first day of the year, the letter falling upon the first Sunday is the Dominical letter for the year. They recur every 28 years upon the same day of the year. 5. Roman indiction, 12? A. The Roman indiction is a period of 15 years, not astronomical like the other cycles, but entirely arbitrary. It is supposed to have been introduced by Constantine the Great about the year 312 A.D., and had reference to certain judicial acts that took place under the Greek emperors. Its number is found by adding three to the date and dividing the sum by 15; the remainder is the year of indiction.

(24) W. O. D. asks: 1. What is meant by caliber 12 or caliber 14 in speaking of shot guns? From what standard is the caliber of a gun calculated? A. The caliber of shot guns is designated by the number of round balls to a pound. Thus 12 is 0·73 of an inch in diameter, No. 14 is 0·69 inch, etc. Rifles and pistols are designated by their diameter in hundredths of an inch. Thus 40 caliber is 0·40 of an inch diameter. 2. From what standard is a wire or saw gauge calculated? What is meant by saying a saw is gauge 10 or 12 or 14? A. The saw gauge standard is the Stubs gauge, which is also a wire gauge; it is sometimes called the Birmingham gauge. No. 10 is 0·134 of an inch; No. 12 is 0·109 of an inch; No. 14 is 0·083 of an inch.

(25) J. C. asks us if the following, which appeared in a Chicago paper, is correct: How many cubic feet are in a stick of square timber 1 foot square at one end and tapering to a point at the other, and 100 feet long? The answer was 25 feet. Orton & Saddler's calculator gives the rule for finding the solid contents of squared or four-sided timber as follows: "Multiply the breadth in the middle by the depth in the middle, and that product by the length for solidity." A note says: "If the tree taper regularly from one end to the other, half the sum of the breadth of the two ends will be the breadth in the middle, and half the sum of the depth of the two ends will be the depth of the middle." In this case the breadth and depth of one end would be 0. Following the rule, the breadth and depth at the middle would be 6 inches, and the example would be 6 times 6, equals 36 inches, multiplied by 100 feet equals 3,600, divided by 144, equals 25 cubic feet. A. We believe this answer to be incorrect. Haswell's rule for computing the volume of a pyramid is, multiply area of base by perpendicular height and take one-third of product. This will give us a cubic contents of 33⅓ feet.

(26) F. S. asks for a good recipe for making up citrate of magnesia, such as is sold by druggists? A. The following receipt will make a quantity sufficient to fill 12 bottles. Take of:

Magnesium carbonate	4 oz.
Citric acid	8 oz.
Sugar	12 oz.
Water	9 pints.

Flavor with essence of lemon, then dissolve and filter. Fill the bottles at once and add to each 30 grains of potassium hydrogen carbonate, and cork securely. The bottles must not be filled up higher than the shoulder.

(27) B. A. asks: 1. Is there any varnish or wash for water color drawings to give them a glaze or shiny appearance? If so, please inform me where it may be had or how to make it? A. A varnish that is sometimes used consists of:

Dextrine	2 parts.
Alcohol	½ "
Water	2 "

Previously, however, prepare the drawing by coating with 2 or 3 coats of thin starch or rice boiled and strained through a cloth. 2. Do you know of any cement or adhesive substance that will glue broken pieces of meerschaum together? A. Try a little white of egg, thickened with finely powdered quicklime or by a mixture of newly baked and finely powdered plaster of Paris mixed with the least quantity of water.

(28) J. D. McC. asks if liquid albumen will remain pure or sweet by being securely sealed and protected from the air? A. Yes; if protected from air, it will remain sweet, but it is almost impossible to securely protect in anything so that air will not have access to it.

(29) E. S. B. asks how carbolate of iodine is made. I have looked in all the books on chemistry that I know of, and cannot find anything about it. A. Carbolate of iodine is not a chemical compound, but a preparation much used for catarrhal affections. It is prepared by moistening chopped lint in a bottle with equal parts of spirits of ammonia, tincture of iodine, and carbolic acid.

(30) D. H. asks: What is cyanogen of ammonia? I came across it in reading the other day where it was used in connection with the hardening of steel, but on my applying to a druggist he did not know what it was. A. Cyanogen of ammonia is the term applied to the grouping of the atoms of cyanogen, hydrogen,

and nitrogen in steel. It is entirely theoretical, and does not exist in a free state. Ammonium cyanide is a crystalline salt, and can be obtained of any druggist. It may be that you have confounded the latter with your cyanogen of ammonia.

(31) C. G. asks how to make new whisky barrels look old? A. By washing the barrels with a solution of iron sulphate (green copperas), the wood will become darker.

(32) J. M. K. asks: How the oiling process on black walnut furniture is done? A. For fine oil coat on black walnut, first make what the varnishers call a filler, of whiting and burnt umber in proportion to make the color correspond with the color of the wood. Rub these up with boiled linseed oil and with it about one-tenth the quantity of whiting and umber, of litharge as a drier. Make mass of consistence of paint. Rub this into the surface of the wall—not with a rag—and allow it to dry. One coat will probably be enough. Then rub the surface with boiled oil. After this is dry, if a higher finish is required a French polish rub will answer most wants.

(33) J. L. asks: How to make a paste to stick pasteboard together that will not be affected by dampness, and at the same time be pliable, so it will not break when the board is bent? A. Use the following: gum shellac 3 parts, caoutchouc (India rubber) 1 part, by weight. Dissolve the rubber and shellac in separate vessels in ether free from alcohol, applying a gentle heat. When thoroughly dissolved, mix the two solutions, and keep in a bottle tightly stoppered.

(34) G. and V. L. ask: What is the present value of bar aluminum? Is there much demand for it? Where is the principal market to dispose of it? A. Bar and sheet aluminum is now on sale in New York at $1.50 per ounce. The price in Paris and London is from 75 cents to $1.00 per ounce. There is very little used except for experimental purposes. Jewelry, mathematical and optical instruments are made of it and its alloys, as aluminum bronze. There would be a large demand if it could be made cheaper.

(35) H. H. requests: Let me know how to soften an oilstone, and what oil is best to use on it. And are the tops and bottoms of violins curved by pressing, or are they gouged out? A. Oilstones cannot be softened; there are different grades of oilstones hard and soft. The best oil to use on an oilstone is kerosene; water is better on a hard stone. The best violins have their tops and bottoms cut out to swell, by hand, from boards from five-eighths of an inch thick to three-quarters of an inch thick. Cheap violin tops and bottoms are pressed from thin wood.

(36) C. M. writes: 1. Do you know of any place where files are made by the "sand blast" process? A. No. Files are generally cut, tooth by tooth, by means of hammer and cold chisel. Files are cleaned and sharpened by means of the sand blast. See SCIENTIFIC AMERICAN, March 3, 1883, "Resharpening Files." 2. Also do you know of any concern that cleans stove castings by same process? A. No. Cleaning stove castings by the sand blast would be an expensive process compared with the present means of the pickle tub and wire brush.

(37) H. W. S. asks: Which are the best, machine or hand riveted boilers. A. Hand riveted boilers.

(38) J. H. writes: Please inform me what kind of solder is used for soldering band saws. I have tried it with tinsmith's soft solder, but it seems it is too hard; as soon as I bend the saw, the weld separates, otherwise the weld is better than the usual way with silver. A. The usual solder is spelter, but good tinman's solder is effectual—composition, two of lead and one of tin by weight. But the metals should be pure. The saw should be cleaned with the file and washed with the usual saturated solution of zinc and muriatic acid. Then apply the solder, and grasp the joint with a hot tongs to keep the solder fused until the saw is heated.

(39) J. K. says: You will please give me a receipt for making a mixture of acids, to make bright again tarnished brass and copper. I have seen it used by men who wished to make bright the small brass bells, such as are used on masquerade suits. I wish to use it for the same purpose. The bells were first dipped into the acid, then into clear water, and then put into fine sawdust to dry; when taken out, they had a bright shine. A. Clean the brass by warming it and dipping in water charged with washing soda, then into clear water to remove the grease. Then dip in a bath of one part by measure of sulphuric acid, one part sal ammoniac, two parts nitric acid, and four parts water. Dip for a moment, then dip in clear water, and dry in hot sawdust.

(40) A. S. P. asks how the name, etc., is stamped on books in gold? A. Gilding on book covers is done by means of engraved brass or electrotyped patterns, heated and pressed on the substance over the gold leaf, which is fixed by an albuminous size—white of eggs. 2. How lead pencils are stamped in gold? A. The gilding on lead pencil wood is done in a similar manner by a stamp. In both cases white of eggs for size, gold leaf for material, heat and pressure for means are used.

(41) L. D. writes: Having tried several methods, but without success, of removing a letter in stipple, printed with aniline blue mixed with what is known as Boston drier upon a costly piece of muslin, I would be pleased to be informed by you what could be used to remove the same without injury to the fabric. A. Hydrogen peroxide is probably as good a reagent as you can use for this purpose. See description of its properties in SCIENTIFIC AMERICAN SUPPLEMENT 339.

(42) J. M. D. writes: Please inform me how to make solder that will stand from 800° to 1,000° F. without fusing? A. Silver solder will stand more than 1,000° F. Or a solder of silver 2 oz., antimony 1 oz., will stand more than 800° F.

(43) C. B. W. writes: There are two boilers in every respect identically the same, excepting crown sheets, one being circular, the other flat. I think that the former (crowned) boiler generates more rapidly than the other. If right or wrong, please give reasons? A. We think the difference will be scarcely appreciable, as there will be more heating surface exposed with the flat crown, but the circular crown is stronger and gives better circulation.

(44) S. H. asks: 1. Is there any particular proportion between the amount of rags and sulphuric acid used in making glucose, and what is it? A. First extract the starch from the rags, and boil the solution containing the same down to a density of 5° to 10° Baume, then use the acid in the proportion of 5 lb. to 100 gal. solution. 2. What is the best thing to use to neutralize effectually muriatic acid, so that the neutral compound shall be insoluble in water? Chalk does not seem to kill the acid completely, as soda carbonate still produces effervescence no matter how much chalk is added. A. Try silver oxide; silver chloride is the only insoluble chloride in water. 3. How does nature supply the constant drain on her store of oxygen? Is it being steadily reduced, so that it is only a question of time when the air we breathe will no longer support life? A. The supply of oxygen is obtained from plants, which exhale oxygen. The composition of the air is practically constant, and any diminution of oxygen is not appreciable. 4. Does a bullet partake of the motion of the rifle if discharged as the hunter is following the game with his gun, when the animal crosses his line of sight at a right angle? A. The bullet will have the motion of the rifle added to its own movement.

(45) C. B. H. asks: What number of cubic feet of compressed air under a pressure of from 80 to 100 pounds per square inch will be required to drive a 10 horse power engine 10 hours? A. At 100 pounds pressure it will require 200 cubic feet per hour for 10 horse power. This will require 2,400 feet of air to be compressed to 200 cubic feet of about 8 volumes into 1, each hour.

(46) A. P. asks in regard to drying wood with superheated steam. Can it be successfully done? Would it be as likely to check as when dried with hot air? What is the better plan of superheating steam? A. Superheated steam may enable you to make a hotter drying room. We do not know that it has many advantages and is liable to cause trouble. Eighty pounds boiler pressure with sufficient pipe will enable you to boil the sap out of the wood. The best way to prevent checking is to heat the wood in steam for a short time or until the wood gets thoroughly heated through, and then ventilate slowly, keeping up the heat in the dry room.

(47) J. R. M.—The following is a description of the apparatus and process of manufacturing birch oil: "The apparatus consists of a furnace, a boiler, a tin pipe, a trough into which water is continuously brought from a mountain brook, a barrel, and a glass jar. The furnace is made of loose stones, so arranged that the fuel is put in at one end and the smoke goes out at the other, through an old piece of stove pipe. Over the furnace is the boiler, which is merely a wooden box, about three feet wide, four long, and three deep, with the bottom covered with sheet iron to prevent burning. The boiler has a wooden lid, so that it can be tightly closed, and from the top leads the tin pipe. This pipe runs into the water trough and through it, so that the water always surrounds and cools it. The end of the pipe, after coming out of the trough, opens over a barrel, and in this barrel, exactly under the end of the pipe, is placed the glass jar. This constitutes all the plant." The boiler is filled about a third deep with water; the birch bark and twigs are shoveled in until it is full; the lid is placed, and the fire started in the furnace. For hours the fire must be carefully watched, and fresh fuel continually furnished. The material in the boiler becomes heated, the oil in the twigs extracted and mixed with the water. At boiling heat, the steam arising from the water and oil passes through the tin pipe and becomes chilled by the water in the trough; a condensed liquid is the result; and this mixture of oil and water escapes from the pipe, when it naturally separates. It drips into a glass jar placed over a barrel; the heavy oil sinks to the bottom of the jar, while the water flows over and is saved in the barrel, to be again reboiled the next day. The oily substance saved in the jar is the oil "pure and undefiled."

(48) E. H. asks how to color finished wrought iron articles without heating them, so as to make the articles have a blue black color? A. Finished wrought iron cannot be colored blue black without heating. It may be varnished or painted. It may be oxidized by acids to retain a brown, but a permanent blue black must be induced by oxidation by heat.

(49) C. M. H. & Co., ask: 1. Is there any advantage in distance between the point of application of the power and any resistance that it is proposed to overcome, provided that the medium through which the power is transmitted be devoid of elasticity and exactly parallel to the direction of motion, the power acting in the same line? A. None whatever. 2. Does this or does it not apply to a case where a horse is hitched to a vehicle, the trace being fastened to the hame at exactly the same level as it is attached to the vehicle, the road being always perfectly level? A. We think the draught is easier under the conditions named. We do not see the parallel between the two questions, however.

(50) E. B. K. asks: From which will I get the best results—a 7 in. silvered glass reflector, or a 3 in. achromatic objective? Wishing to construct a telescope with the 3 in. objective, using two lenses, eye and field, what focal distance should they have, and what power would such a telescope have? A. The 7 in. silvered glass reflector will give the best results and the most light, always provided that both are of equal class in the perfection of finish and definition. The 7 in. reflector should be 7 ft. focus with a small plane reflector for the Newtonian form, which gives the best results as to image, but sacrifices a part of the light; such a telescope, if first class, should bear a power of 300. The 3 in. refractor should be from 40 in. to 45 in. focus, and if first class should bear a power of 250.

(51) K. B. asks: 1. Can tar bone be rendered fluid merely by action of steam or heat? A. By boiling in water—and the effect of steam is similar—bone is converted into gelatine and dissolves, forming a solution clouded by suspended fat and vascular tissue, and solidifying in a jelly on cooling. 2. Bone, being an organic matter, ought to be soluble like hair, hide, or wood fiber. Do you know of any process or chemicals effecting it? A. The bone cartilage is likewise soluble in hydrochloric acid. 3. Of what is celluloid composed? A. For description of celluloid see page 3617 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 227.

(52) P. A. S. asks for a receipt for making the percussion powder for metallic cartridges? A. The priming used in percussion caps is made by triturating 100 grains fulminating mercury with a wooden muller on marble with 30 grains water and 60 grains gunpowder. A solution of gum mastic in turpentine is used as a medium for attaching the fulminate to the cap.

(53) C. S. B. and F. H. T.—For cleaning buckskin you might try the following: Make a solution of weak soda and warm water, rub plenty of soft soap into the leather, and let it remain in soak for two hours, then rub well until quite clean. Rinse thoroughly in a weak solution of soda and yellow soap in warm water, but not in water only, else it dries hard. After rinsing, wring it well in a rough towel and dry quickly, then pull it about and crush it well until soft. Your best plan, however, is to have them cleaned at a professional dyer's.

(54) N. E. L. asks the proper size of the ports of a cylinder 3 x 5 in., speed 200 revolutions per minute? A. Steam opening, $\frac{5}{8}$ x 2$\frac{3}{4}$ in.; exhaust, $\frac{3}{4}$in. x 2$\frac{3}{4}$ in.

(55) T. N. H. asks how to apply French polish to inlaid woodwork? A. Lay on a coat of fine shellac varnish. When dry rub it down with fine emery paper and lay on another coat. Repeat until you have a fine, smooth surface, then with a flat camel's hair brush lay on a final coat of fine furniture varnish. The following gives good results: Take of rather thick shellac varnish and boiled linseed oil equal parts. Shake it thoroughly whenever used. Apply sparingly with a cloth and rub briskly until the desired polish is secured.

(56) J. T. T. says: In making a one-sixteenth in. cut lengthwise through a seamless brass tube 1$\frac{1}{2}$ in. diameter by 12 in. long, it springs open about three-sixteenths in. Can you tell me how to prevent it? If tube was cast brass, would it spring as much when cut open? A. Before splitting the tube anneal it by heating red hot and slowly cooling. Drawn brass tubes are hard. Cast brass tube will not spring open.

(57) G. S. asks: 1. Do you think a good, strong cask would be strong enough to generate steam for an engine 1$\frac{1}{2}$ in. bore, 3 in. stroke, if connected with a coil of pipe placed in a stove near by the cask, having double heads and braced? A. No; do not risk it. 2. I saw something about using mercury flasks for boilers for small engines (as above); is it possible to use them as such? A. Yes. You will find in the SCIENTIFIC AMERICAN SUPPLEMENT for June 28, 1879, a cut of a boiler so made. 3. How are Pharaoh's serpent eggs made? A. See SCIENTIFIC AMERICAN, vol. xliv., No. 4, and vol. xlviii., No. 6.

(58) J. P. P. asks concerning Connelsville coke—how made, from what, etc.? A. The Connelsville coke derives its value from a very rich seam of bituminous coal in Western Pennsylvania, said to be the purest vein of bituminous coal in the United States, and very similar in quality to the Durham vein in England, which is also famous for its coke producing qualities. The coking is done by burning off the volatile matter or hydrocarbon gas in large ovens.

(59) J. F.—Wheel No. 2 will give from 10 to 15 per cent the most power, and is an improvement over No. 1. Both plans are old. You will get better results from No. 1 by reducing the number of chutes.

(60) S. N. G. writes: Say two rubber bags, sixty gallons capacity, as used for oxyhydrogen light, be placed one on top of the other under 250 pounds pressure, will the gases be forced from each tube with same power as if the bags were separate under same pressure? A. The pressure would be same in both cases. The plan you suggest is in common use, and is preferred on account of the facility with which both gases can be put under exactly the same pressure. Of course there will be the difference of the weight of the upper bag, but this is so slight as to be of no account.

(61) R. W. G. asks: 1. Could a steel sphere or spheroid be permanently magnetized? A. Yes, but if perfectly symmetrical and homogeneous it would not exhibit polarity until fractured. 2. If so, what would determine the position of the magnetic axis? A. It would not be determined so long as the sphere remained perfect. 3. Do the variations of the needle in an electric storm indicate an increase or a decrease in the earth's magnetism? A. Probably neither. The needle is affected by electric currents. 4. Does the number of sun spots sensibly diminish its heating power on the earth? A. It is generally believed to make no material difference. 5. What kind of an eye piece would be best, and of how high a power, for a telescope having a meniscus lens of about 36 in. focus, with a diameter of 2$\frac{1}{2}$ in., as an object glass? A. Low power. 6. Would it be best to use this with full aperture, or to diaphragm it down with diaphragms in the tube or over the glass? A. Full aperture on nebulæ and faint objects. Use a diaphragm outside of the objective for the planets and a very small aperture for the sun.

(62) F. B. J. says: I have a brick house with stone foundation for cellar; the stone portion is constantly damp; and in time of great thaws from snow and ice, as also from rains, a portion of the north side leaks or oozes water under the foundation into the floor. How can I prevent it? The cellar is otherwise dry, except at this place; 5$\frac{1}{2}$ feet of walls are under ground. A. Where water comes under walls five feet below the surface, it will be difficult to keep a cellar dry. In some wet locations in New York city, cellars are made with bottoms somewhat on the flat-boat bottom shape, and heavily cemented on the under side, and with a drain for carrying off the water.

(63) H. L. asks: 1. For a solution for making the yellow oiled clothing that teamsters wear instead of rubber coats and pants? A. Dissolve 1 oz. of beeswax in 1 pint of the best boiled linseed oil over a gentle fire, applying when cold with a piece of rag, rubbing it well in, and afterward hanging up to dry, which will take about 4 days. 2. Also a solution for making aprons that are used in slaughter houses; they are soft and pliable, black on one side, and show the canvas color on other side, but will not let water soak through. By giving me above information through your paper you will greatly oblige a reader. A. Let 4 oz. of India rubber in small pieces be softened in 8 oz. of oil of turpentine, then add 2 lb. of boiled oil, and boil for two hours over a slow fire. When dissolved add 6 lb. boiled linseed oil and 1 lb. of litharge, and boil until an even liquid is obtained. Apply warm.

(64) G. S. S. writes: We build our row boats by commencing at the keel with strips one-half by seven-eighths inch in size, nailing one to another until we reach the top. What is the best material to put in the joints as we build? A. Cotton cloth saturated with thick white lead paint.

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

R. McW.—The mineral is pyrite (iron sulphide), and may carry gold. An assay will be necessary to determine its value, the expense of which will be $5.00.

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March 11, 1884,

AND EACH BEARING THAT DATE.

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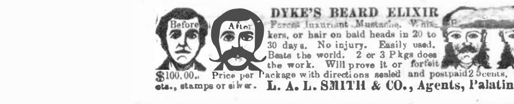

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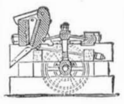

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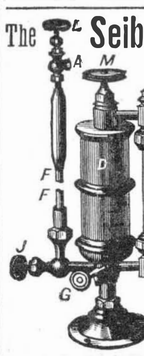

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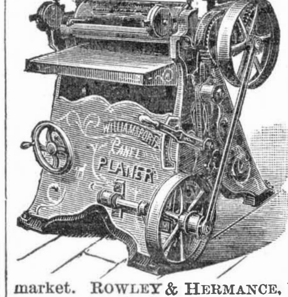

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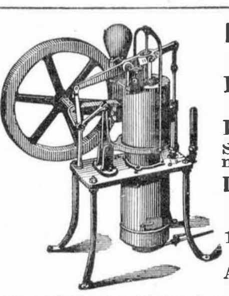

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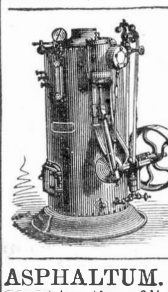

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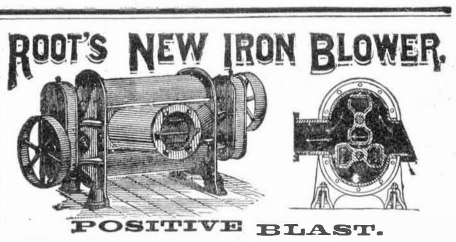

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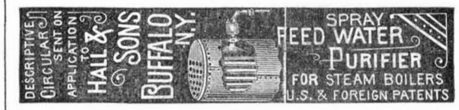

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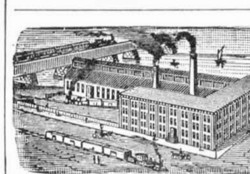

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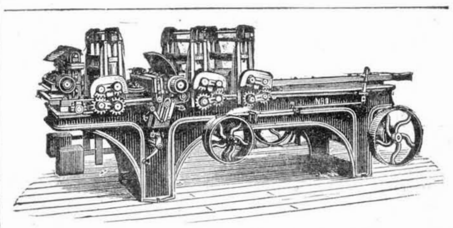

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