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Collecting and Removing Scums from Boilers.

Our engraving illustrates a simple and undoubtedly effective device for removing scums from boilers, which has, we are told, proved its efficacy and value in a five months' practical test on the steamship *John Gibson*. Upon inspection of the boiler in which it has been used, it was found that no scale had collected on the tubes, and only a slight and easily removed scale had collected on other parts.

In a trip between New York and Washington, with the cock kept a quarter turn open, it is stated that the salt saturation was kept within limits by its use.

The principle of drawing off scums from the surface of water in boilers, by means of a surface blower, is not new. The inventor of the present improvement rests his claims upon something beyond this, namely, the form of the collector and its position in the boiler at the point to which all the surface circulation tends. It is obvious that if, at this point, a device be placed that allows the free descent of the water while it obstructs the motion of the scums, the latter will gather in the collector, from which they can be forced out under pressure through a tube provided for that purpose.

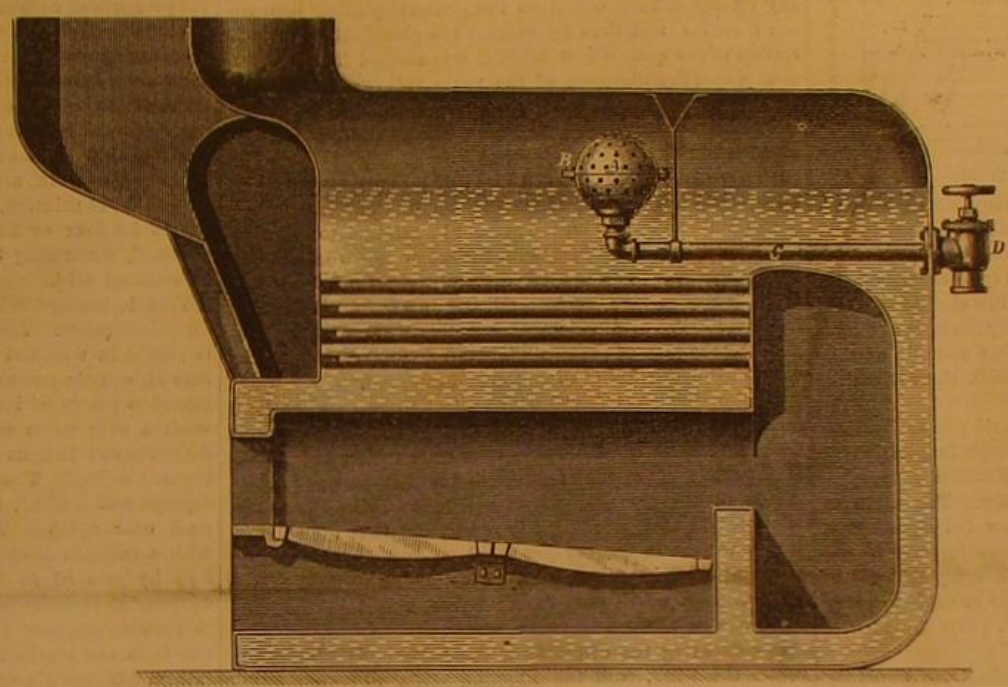
This is claimed to be the action of this surface blower, the parts of which are as follows:

A is a perforated globe put together in halves, which are connected by lugs and bolts, B. C is the eduction pipe, and D the cock.

The engraving shows the device as applied to a marine boiler, and placed in the focus of surface circulation. It is scarcely necessary to add that the same appliance may be used in any boiler, when impure water renders it needful.

Patented through the Scientific American Patent Agency, March 5, 1872, by B. C. Davis and J. T. Hardester, Baltimore, Md.

For further information address Phillips & Calvert, No 444 Water street, New York, or Holmes & Co., 72 West Pratt street, Baltimore, Md. The former are the agents for New York State, and the latter for the State of Maryland.



DAVIS AND HARDESTER'S SURFACE BLOWER.

BRIDGE OVER THE MISSISSIPPI, AT BRAINERD, MINN.—NORTHERN PACIFIC RAILWAY.

Our engraving is a fine view of one of the bridges of the Northern Pacific Railway, a work which is now being pushed with energy, and is destined to become a most important artery of commerce. The bridge is, we think, the northernmost of all the bridges that cross the great Mississippi, which, at this point, however, is a narrow and easily spanned stream.

The bridge, in itself, has no peculiar points calculated specially to interest engineers. It is of plain trestlework, yet over it will pass an enormous traffic; and as a view of one of the features of a magnificent enterprise, our engraving possesses interest.

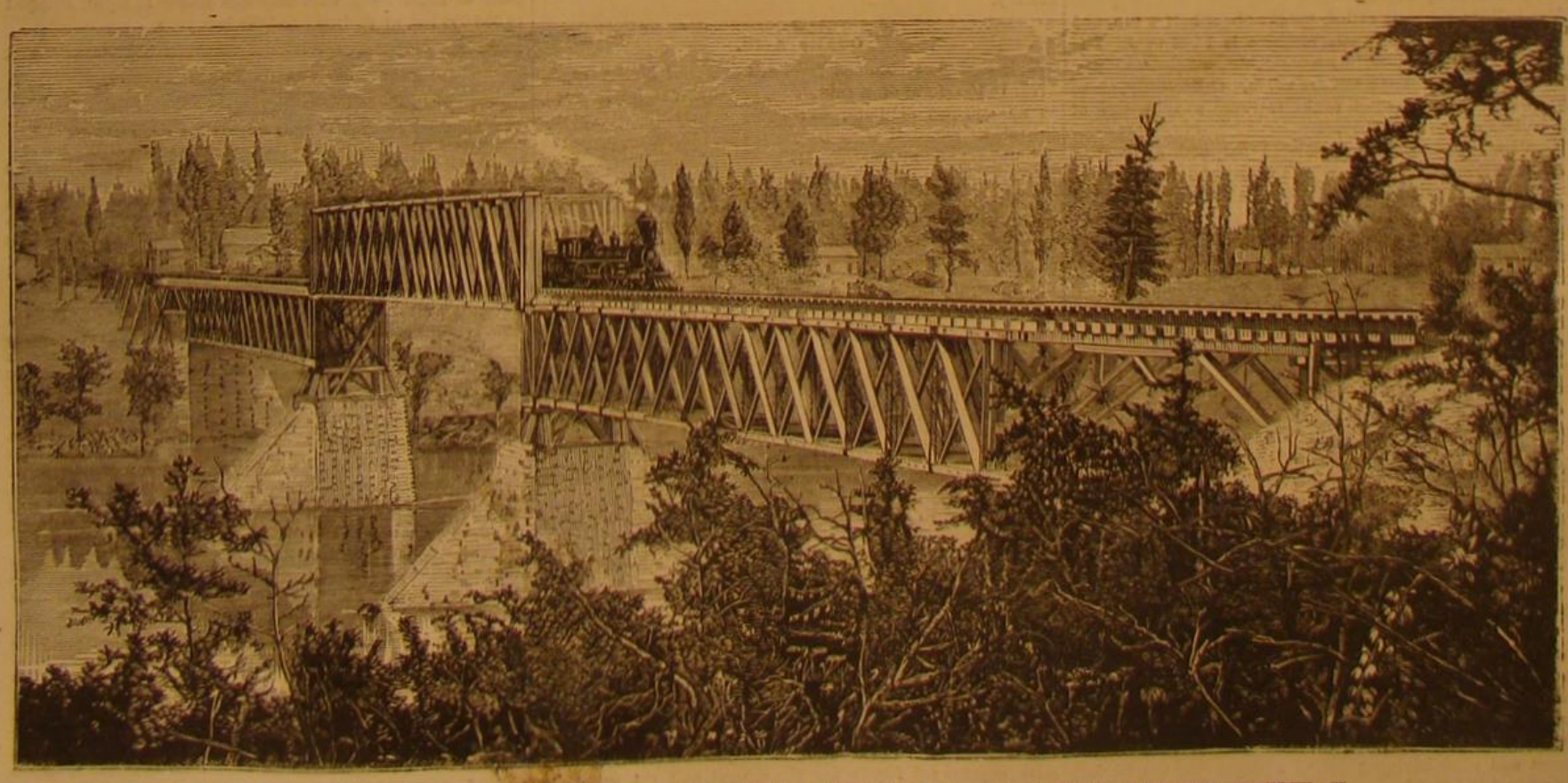
The road follows a natural line of commerce, which must, in time, develop into something enormous. It penetrates a region remarkably productive, into which civilization is crowding even in advance of the construction of the railway. This country has been appropriately called the "Garden Region" of the North. As a wheat producing region, it is probably unsurpassed anywhere, and fruits, of nearly all the kinds natural to the temperate zone, thrive in the mild climate of its luxuriant valleys.

All the elements of prosperity exist in the territory which will supply the road with traffic, namely, Minnesota, Dakota, Montana, Idaho, Oregon, Washington, and a part of Wisconsin, and a brilliant future for this work cannot be regarded as doubtful.

According to statement of Messrs. Jay Cooke & Co., (December 25, 1871,) this road is now completed across the State of Minnesota, 255 miles, from Duluth to Fargo, on the Red River of the North, and trains are running regularly The Dakota division, extending 200 miles westward, from the crossing of the Red River to the crossing of the Missouri in central Dakota, is now under construction, and contracted to be finished July 1, 1872. In the meantime, a section of 65 miles is building between the Columbia river and Puget Sound, in Washington Territory, where track laying is progressing.

The Northern Pacific company, in order to remove hurtful rivalry and secure early and direct connection with St. Paul, Chicago, and the East, recently purchased the main line and branch of the St. Paul and Pacific road. During the past year the main line has been completed, through an excellent country, to Breckenridge on the Red River. At the same time the branch has been extended from its late terminus at St. Cloud, 65 miles northward, to Brainerd, where it joins, and becomes tributary to, the trunk line of the Northern Pacific. Finally, contracts have been let for the construction of a branch road (to be technically known as the St. Vincent Extension of the St. Paul & Pacific Railroad), from St. Cloud, 375 miles, to Pembina, near the northwestern corner of Minnesota, and on the border of the British Province of Manitoba. This is to be completed before the close of 1872. It will drain the richest portion of the Red River valley and open direct communication with the British settlements of Winnipeg and the productive valley of the Saskatchewan. It will also serve as the southeastern arm of the Northern Pacific road, reaching to St. Paul and Minneapolis.

At this date, the Northern Pacific company own, by construction and purchase, 640 miles of finished road. The completion of the above named contracts will give the company, at the close of 1872, more than 900 miles of completed track in the prosperous State of Minnesota alone, and 1165 miles altogether; it will carry the trunk line nearly one third of its distance across the continent, and bring to it the large and profitable traffic of Montana and the Government transportation of the Upper Missouri. The Hudson's Bay Company have already leased wharves and warehouses at Duluth, preparatory to doing the whole of their large business over the Northern Pacific line. Nearly two million acres of the company's lands in Minnesota are ready for sale, and many thousand have been sold to colonies and settlers, who are moving to the line of the road in gratifying numbers.



BRIDGE OVER THE MISSISSIPPI, AT BRAINERD, MINNESOTA, NORTHERN PACIFIC RAILWAY.

A NAVIGABLE BALLOON.

The recent trial of M. Dupuy de Lôme's balloon, at Paris, has certainly taken the importance of a scientific event in France. The construction of this aërial machine starts with the principle that to obtain a navigable balloon, the two following conditions must be complied with:

1st. The permanence of the form of the balloon, without any sensible undulation of its surface.

2d. Obtaining a horizontal axis of least resistance in a direction parallel to the propelling force.

The permanence of form is assured by a fan carried in the car, and put in communication by a tube with a small balloon placed within the largest one at its lowest part. The volume of this small balloon is one tenth of that of the large one. It is furnished with a valve opening, both within and without, and regulated by springs. The large balloon is provided with two hanging tubes, open to the air and falling for a distance of 25 feet from the lower part of the balloon. The inflation of the little balloon causes the hydrogen to fall more or less in the hanging tubes, but never sufficiently to force it out of their open ends.

To obtain a horizontal plane of least resistance, the form given to the balloon was that developed by the arc of a circle turning around its chord, and in which the versed sine was nearly one fifth of the length of the chord.

The following are the principal dimensions of the balloon:

	Feet.	Ins.
Total length from out to out	118	6
Greatest diameter	48	9
Cubic contents	122,000	0
Total hight from the top of balloon to the bottom of the car.	95	6
Length of the car	41	3
Greatest width of the car	10	8
Diameter of screw	29	6
Pitch of screw	26	2
Ascensional force:	Tons.	
With small balloon not Inflated	3.799	
" " Inflated	3.419	
Number of revolutions of screw per minute to obtain a speed of 5 miles pe. hour	21	
Time required to fill the small balloon by aid of the fan	15 minutes.	

The upper portion of the balloon is covered with an envelope of fabric which supports the car by a zone placed around the centre of the body. This envelope is then continued below the upper half until it covers about three fourths of the body. Below the envelope and attached in a similar manner, is a second zone within the first one, having the form of a cone tangential to the sides of the balloon. The summit of this cone serves to attach the cordage by which the car is sustained.

The rudder consists of a triangular sail placed beneath the balloon and near the rear, and it is kept in position at the bottom by a horizontal yard 19 feet 8 inches long, turning around a pivot on its forward extremity. The hight of this sail is 16 feet 4 inches, and its surface 161 square feet. Two ropes for working the rudder extend forward to the seat of the steerer, who has before him a compass fixed to the car, the central part of which is large enough to carry a crew of 14 men. The forward and aft parts are formed with a framing of bamboo.

The screw is carried by the car. The shaft can be easily lifted from the rear and thrown upon a forward support, so that no damage can arise to it, either on departure or arrival. The screw is driven by four men, or by eight men working at a capstan. The gas escape valves, of which there are two, are placed at the top of the balloon immediately over the pendent tubes, before spoken of, and through which the cords for working the valves pass into the car. The balloon is made of white silk, weighing about 7 oz. per square yard, with seven thicknesses of caoutchouc superimposed; the envelope also is of white silk. The joints are so arranged that they are stronger than the material itself. On the inner face three coats of varnish were applied, formed of gelatin, glycerin, pyroligneous acid and of tannin. Such a varnish is impermeable to hydrogen.

The balloon, properly called, weighs about half a tun, and the total weight of the whole machine is 1 753 tuns. The crew, luggage, provisions, instruments, etc., weigh 1·446 tuns Of ballast, two thirds of a tun are taken. Collectively, these figures give 3·85 tuns, equal to the full ascensional power of the balloon at the ground level.

M. Dupuy de Lôme had calculated that, with a speed of 5 miles an hour, the resistance of the balloon in the direction of its main axis would be 24·26 lb., and that the speed of the screw should be 21 revolutions per minute to overcome this resistance. This speed could be easily obtained by four men, working half an hour and being relieved at the end of that time by four others; with the eight men, working together at a capstan, 27 or 28 revolutions could be obtained, which would give a speed of about 8 miles an hour.

The stability assured by the system of suspension adopted is such that, even under the maximum effort of eight men working the screw, the equilibrium was only disturbed half a degree, and a man in walking from one end of the car to the other only affected it by half a degree.

The apparatus for producing the hydrogen, by the action of diluted sulphuric acid and iron turnings, consists of two batteries of 40 casks, each producing at one operation lasting three hours 5,375 cubic feet of hydrogen, and working alternately.

At the trial trip, three days were required to fill the balloon. It was ready on the 1st of February in the evening, and it was kept inflated all night; but at two in the morning it was allowed to ascend sufficiently to attach the car, rudder, fan, connections, etc. The loss of gas during the night had been inappreciable, and previous experiments showed that the varnished silk was perfectly reliable. The wind had risen, and the meteorological bulletins were far from being encouraging. However, the inventor decided to make the ascent, and after having repaired a slight damage, he left the ground at 1 P. M.

There were about two thirds of a tun of ballast on board, and the balloon was in perfect equilibrium. Three hundred and fifty pounds of ballast were thrown out, and the ascending force thus produced carried the balloon up rapidly.

A strong wind was blowing from the south. A few minutes after the departure, the shaft of the screw was lowered upon its bearing and was started by the eight men together, slowly at first and then with an increased speed. The rudder was first moved to the right, then to the left, and then was adjusted in order to ascertain how far its influence would be felt by the balloon. When the screw was set in motion, the effect of the rudder was immediately felt, as desired, proving that the balloon had acquired a sufficient speed with relation to the surrounding air.

The experimental trips had a threefold purpose: to ascertain the stability of the balloon, the relative speed that could be obtained, and the manner in which it obeyed the rudder, either on a fixed course or in tacking. An anemometer, previously regulated, gave the relative speed of the balloon; a compass attached to the car indicated the direction of movement. To measure the course followed in relation to the ground, a planchette was fixed to the side of the compass, parallel to the vertical plane and in the direction of the true north. The field of the planchette was painted black, the part forming a vertical surface being white. By this arrangement, it was very easy to obtain a visual ray in a vertical plane, the verticality of the planchette being assured by the mode in which the compass was hung. By observing any clearly defined object on the ground passing beneath the observer, and then by turning the planchette in the direction of the same object when it was shifted from the vertical plane, the direction of the route followed by the balloon could be read direct off the compass.

The same observation gives the speed of the balloon, the hight being observed by a barometer.

Between 1.15 P. M., and 2.35 P. M., eight observations were taken of the hight of the balloon, of the temperature, of the route measured on the ground in relation to the magnetic meridian, four times with the screw not working, and four times whilst it was being driven by eight men. At 2.35 P. M., it was resolved to descend, and at 3 P. M., the balloon touched ground at Mondécourt, exactly at the village indicated on the map of the route laid out beforehand from the calculated deduction of direction and of speed.

The landing was effected with perfect success and without accident, in spite of the force of the wind. M. Dupuy de Lôme arrives at the following conclusions from the results of the trial: That the stability of the balloon was perfect, that it manifested no signs of oscillation under the action of the eight men working the screw, and that the shifting of the weight in the car produced no sensible movement. The vertical axis was only *shifted*—under the most trying conditions—a small part of a degree, and longitudinally there was no change.

In comparing the direction of the balloon, drifting freely before the wind, with the direction given to it when the screw was in operation, it was found that the resultant made with normal direction an angle of 12°. It is stated also that the speed given to the balloon, with 27½ revolutions of the screw, was 6¼ miles an hour, whilst the rate due to the wind alone was from 26 to 37 miles an hour.

With the same weight, for a mechanical motor as, that required by the eight men for driving the screw, a force ten times as great might have been obtained, and the speed due to the balloon under such improved conditions would be 13·60 miles per hour. With such a power, it would be apparently practicable not only to make a considerable angle with the wind's direction, but also under favorable circumstances to shape the course of the balloon according to will.—*Engineering.*

Oxalic Acid.

This acid, first obtained from salt of sorrel by Savary, in 1773, in the form of a sublimate, and by Wiegler in 1779, as an aqueous distilate, was subsequently recognized by Scheele as identical with Bergman's acid of sugar, prepared from sugar and nitric acid. Its composition was established by Dulong, Döbereiner, and Berzelius.

The principal commercial product of oxalic acid is the binoxalate of potash, known as salt of sorrel. This substance is produced by decomposing carbonate of potash with excess of oxalic acid. The carbonate of potash is first dissolved in hot water, and the oxalic acid added until effervescence ceases; after which a similar quantity oxalic acid is added, the solution boiled for a few minutes, and then set aside to crystallize. After being drained and dried, the crystals are fit for the market.

This salt is the form in which oxalic acid is found in nature, in living plants, such as the various species of *rumex* and *oxalis*. The *oxalis acetosella*, the wood sorrel, and the *rumex acetosella*, the field sorrel, are well known as containing this compound.

Oxalic acid is, with exception of carbonic acid, the most highly oxidised of all carbon compounds. In plants it seems to be more the product of decay than growth, being found deposited in the cells of the root, bark, and leaves of old plants in the form of small crystals of oxalate of lime, the so called *raphides*. It is in this shape (in which it is innocuous) that it exists largely, and in some of the lichens is said to constitute as much as thirty five per cent of the total weight of the plant.

On the small scale, oxalic acid is prepared by heating one part of sugar with eight parts of nitric acid, sp. gr. 1·38, to the boiling point; the solution is evaporated down to one-sixth, copious red fumes are disengaged, and the sugar is rapidly oxidized; on cooling, white crystals of oxalic acid are deposited, which may be purified by solution, in a small quantity of water, and recrystallization. It is important that enough nitric acid is used, as the mother liquor will then crystallize down to the last drop. But if the sugar is in excess, saccharic acid and other intermediate products will be formed, which will turn black or brown on evaporation.

In the chemical factory, oxalic acid is prepared by the action of nitric acid upon vegetable substances containing no nitrogen, such as sawdust, starch, gum, treacle. A little pardonable exaggeration, respecting the amount of oxalic acid obtainable from a given amount of sugar, is apt to prevail among the manufacturers, but it may be taken that one cwt. of good treacle will yield 116 lbs. of good marketable oxalic acid, and the same weight of good brown sugar, about 140 pounds of oxalic acid. As a general rule, 5 cwt. of saltpeter, or its equivalent in nitre, and 2½ cwt. of sulphuric acid will evolve sufficient nitric acid to decompose one cwt. of sugar. Attention of manufacturers is far more directed to economizing the nitric acid than to increasing the production of oxalic acid from a given bulk of sugar.

The process is conducted in large lead lined tanks, or in earthenware jars, each of the capacity of a gallon or less, placed in a water bath. In the former case, the nitric acid need not have quite so high a specific gravity as in the latter. The temperature should be about 125° Fah. If the process is going on well, gas is regularly evolved with but slight appearance of red fumes, notwithstanding that the gases are a mixture of nitric and carbonic acid; but the fact is that the presence of carbonic acid prevents for a time the oxidation of the nitric oxide. So long as carbonic acid is present, the mixture may be mingled with its own bulk of oxygen gas for several minutes without diminution of volume; but if the carbonic acid be condensed (by addition of ammonia vapor, for instance), the whole becomes of a deep orange hue.

When 100 parts of starch, sawdust, straw, hay, bran, tobacco cuttings, etc., are mixed with about 300 parts hydrate of potassa in solution, the liquor evaporated, and the residue heated for four or five hours, a quantity of oxalic acid is obtained, amounting to between 100 and 150 parts of the crystallized acid.

This is the method adopted by Messrs. Roberts, Dale & Co., Manchester. The material they use is sawdust; this is placed in vats and moistened with a lye made of a mixture of caustic potash and soda. The sawdust is then removed to plates of iron, where it is dried and afterwards washed with warm water in small quantities; the potash dissolves and is thus removed, the oxalate of soda remaining undissolved. The mother liquors are then evaporated to dryness and ignited, to secure the potash, which can be used over again. The oxalate of soda is then treated with a solution of caustic lime, oxalate of lime is produced and hydrate of soda remains in the solution, which is evaporated and the soda recovered. The oxalate of lime is in turn decomposed by sulphuric acid. The liquor decanted from the insoluble sulphate of lime upon concentration yields crystals of oxalic acid.

Oxalic acid crystallizes in large transparent colorless crystals containing two atoms of water, $C_2 H_2 O_4 + 2 H^2 O$. These melt at 208° Fah. in their water of crystallization; on continued heating, they are partly decomposed and partly volatilise as dry oxalic acid, $C_2 H_2 O_4$.—*Mechanics' Magazine.*

We have received from the Graphotyping Company, of London, some specimens of their prints made from engravings of various kinds, copied in the form of electrotype blocks by photographic agency. These specimens are fully equal to any that have been produced here by the same means.

The town of Lawlew, Iowa, which three years ago was a patch of hazel bush with only one house in sight, shipped 12,000,000 lbs. of railroad freight last year.

NEW BOOKS AND PUBLICATIONS.

PHONOGRAPHY.

The AMERICAN JOURNAL OF PHONOGRAPHY is a very neat little publication, devoted to the illustration of the art of short hand writing. It is conducted, at No. 33 Park Row, by Mrs. Eliza B. Burns, an experienced and talented worker in this field. This system of writing is adapted to useful and valuable purposes—more especially reporting—but we disagree with those advocates who seek its introduction into the public schools on the ground of its facilitating study. It sometimes helps the boy to carry on his thumb nail what he ought, by real study, to have fixed in his mind. Phonography is an abbreviated code of private signals, and deserves no place in the schools.

AMERICAN BUILDER.

The publisher of this magazine has returned to Chicago, and will continue the publication of the "Builder" in that city. The great fire consumed the publication office; but we are happy to see the publication again, looking brighter, if anything, from the ordeal through which it passed. See advertisement on another page.

THE METRIC SYSTEM OF WEIGHTS AND MEASURES. An Address delivered before the Convocation of the University of the State of New York, at Albany, August 1, 1871. By Frederick A. P. Barnard, LL.D., President of Columbia College, New York City. Revised Edition. Published by Order of the Board of Trustees of Columbia College. New York. 1872.

We regard this as by far the ablest exposition, of the merits of the metric system of weights and measures, yet published in this country. In it will be found a complete answer to objectors, who base their opposition upon the difficulty of transition from the present system to that of the decimal.

AN INQUIRY INTO THE INFLUENCE OF ANTHRACITE FIRES UPON HEALTH, with Remarks upon Artificial Moisture, and the Best Modes of Warming Houses. By George Derby, M.D., Surgeon to the Boston City Hospital, etc. Second Edition. Revised and Enlarged. Boston: A. Williams & Co., 100 Washington Street.

This is a paper, read by the author before the Boston Society for Medical Improvement, now published in pamphlet form. As we propose to refer to it more at length on a future occasion, we will simply say here that it is an important contribution to the general diffusion of knowledge upon sanitary subjects.

THE PARKES SILVER EXTRACTING PROCESS IN GERMANY.

In the year 1850, Alexander Parkes, of Pembrey Copper Works, South Wales, and Birmingham, took out a patent for extracting silver from lead by means of zinc, the metals being mixed in the liquid state, and it being stated that the silver would combine with the zinc and be carried to the top of the metal bath through the smaller specific gravity of the zinc silver alloy, and that then the latter could be easily separated from the desilverized lead. The announcement of this process caused a great sensation amongst the metallurgists of the time, and was generally believed to be fallacious until, in 1851, Mr. Parkes proved beyond all doubt the correctness of his statement by trials which were carried out on a large scale.

In 1866, this method was resorted to at the lead works of Pirath and Jung, at Commern, and Herbst and Co., at Call, in Rhenish Prussia, at Tarnowitz, at the lead works near Clausthal and Lauthenthal, in the Hartz, near Sterlberg in Rhenish Prussia, and at the works of Messrs. Rothschild, at Havre, in France. In all these localities, it is in permanent use.

The lead under operation at the various works differs materially through variations in the percentages which it contains of silver and other accidental metals, such as antimony, copper, iron, arsenic, bismuth, and others. While the lead of the Hartz contains at Clausthal 40 oz. of silver per tun, and at Lautenthal 45 oz., it has only 32 oz. at Tarnowitz, 13·20 oz. at Havre, and not more than 8 oz. at Commern and Call, in Rhineland. This latter is too little to pay the cost of extraction by the old cupelling process, and just bears the expenses of the Pattinson system, while it is stated to be profitable with the Parkes process. The amount of zinc to be used in the process depends upon the quantity of silver contained in the lead.

The process is carried out in large cast iron Pattinson pots, about 7 feet in diameter, and from 22 to 24 inches in depth; these pots holding from 10 to 12 tuns of lead. This is melted rather rapidly, and heated sufficiently so that a piece of zinc, thrown on its surface, at once melts when the first portion of spelter in bars is introduced. The whole quantity of zinc to be used is divided into three portions, of which the first is two thirds, the second one fourth, and the last one twelfth of the whole quantity to be employed. When the first portion is melted, it is well mixed from 20 to 30 minutes with iron rabbles and perforated iron ladles, or, as at the Havre works, by a movable mechanical stirring machine. After that the fire is removed from under the pots, and they are covered with wet coal slack, and allowed to cool slowly, when the spelter gradually rises again to the surface, and carries the silver with it. The spongy crust, or the silver sponge, which is now formed on the top of the metal consists of a mixture of dross or oxides and grains of metal, and it is taken off with the ladle, together with the skulls of zinc silver alloy which form on the sides of the pot, and are detached with a chisel. This crust is removed about 2 inches thick, when the lead below begins to show signs of crystallization. The metal is now again heated up and the second portion of zinc incorporated and treated exactly as before. After the second sponge is removed, some liquefied lead, which is subsequently removed from the sponge and still contains a little silver, is added, together with the last portion of spelter, and the operation is finished after about 20 or 24 hours.

The lead loses its silver with each portion of spelter, while the poor lead contains from 0·6 to 0·7 per cent of zinc. The silver sponge is found, besides the silver, to have taken up the copper and gold of the lead, but it leaves antimony and bismuth behind.

REFINING THE LEAD.

The lead must, of course, be refined before it becomes marketable, which is generally done by remelting with salt and sulphate of lead for from 10 to 24 hours.

The refining operation is in each instance continued until such time as the lead flows readily from the ladle without forming skulls; and, when cast in molds, it solidifies, showing a colored surface—a dull gray color and crystals on the surface always indicating the presence of antimony.

A method of refining lead, which we shall notice here, is that of M. Condurié, of Havre, by means of steam, which is now in much favor on the Rhine, the Hartz, and in Silesia. For this purpose, iron Pattinson pots are used, which hold 5 tuns of lead. This is heated to a light cherry heat, when a hood of sheet iron is put over it, and dry steam of four atmospheres pressure blown into the metal. This begins to boil violently, the steam is decomposed, its oxygen combining with part of the lead and its impurities; while hydrogen, together with some metallic fumes, escapes to a condensing chamber. After three hours' operation all zinc, and at Havre all the antimony, are found to be gone. This, however, is not the case with antimony in the Hartz, where steam of an effective pressure of one atmosphere only is employed, and where this metal occurs in larger quantity. The result of the refining process is generally from 82 to 88 per cent of refined pig lead, containing only traces of impurities. Experience shows that, with this steam process, less dross or oxides are obtained than by the ordinary furnace refining. This dross is remelted in a low blast furnace, and reduced into hard lead. In some places, it is washed to get the small globules or grains of lead separated from the oxides, when the former go back to the refining process, and the latter, containing from 60 to 67 per cent of oxide of zinc and 33 to 40 per cent of oxide of lead, are sold for paint. When using the steam process, great caution is necessary to avoid explosions from hydrogen gas, it being requisite to blow some steam under the hood, and thus drive the gas off.

REFINING THE SILVER.

We have now to speak of refining the silver. It has been stated above that all the silver is contained in the silver sponge, a mixture of oxides and metallic alloys. By heating this in an iron melting pot, a great part of the lead will run or liquefy out of the rest, and collect at the bottom. This silver lead goes back to the first operation, while the alloys of zinc lead and silver will fuse only at a higher temperature. Mr. Parkes had proposed to treat these alloys and oxides with hydrochloric acid, but it seemed to be preferable to distil off the zinc. At the works at Call this acid process is, however, in use, with the following modification: One and a half tuns of the oxides are put in a cast iron melting pot and mixed with hydrochloric acid, at first cold, later with increased temperature, until all water is evaporated, and the mixture has become dry. The metallic alloys of the sponge are then added, and heated up, together with the chlorides formed during the first stage of the operation, when chloride of lead and zinc will exchange the chlorine, and be converted into chloride of zinc and metallic lead, which takes up all the silver, and contains 1·5 to 2 per cent of the latter. The operation is finished in about 24 hours, when the rich silver lead goes to the silver fining furnace.

Another mode of utilizing the sponge is by melting it in a low blast furnace with coke and an addition of puddling slag and sand, when part of the zinc is volatilized and the rest carried away with the slag, while the silver remains with the lead. This is done at the works of Pirath and Jung, at Commern, at Clausthal, Tarnowitz, and other places. In adopting this mode of treatment, great care is to be taken that the top of the blast furnace is kept cool, otherwise lead and silver may be lost by volatilization.

A third method of reducing the sponge was first adopted by M. Condurié, at the Havre works, and later imitated at the lead works of Lauthenthal and Tarnowitz, in Germany. According to this plan, five tuns of sponge are melted in a pot at a cherry heat, when the pot is covered with a hood, as explained in speaking of the lead refining process, and dry steam is driven through the mixture of oxides and metals, the effective pressure employed being about four atmospheres at Havre and one atmosphere at the German works. The steam being decomposed, the oxygen combines with the zinc, the hydrogen reduces the oxide of lead, and large masses of hydrogen gas are developed, which must be carefully mixed with steam, or a great surplus of air, to avoid an explosion. After four hours, 100 cwt. of sponge are converted into from 70 cwt. to 75 cwt. of metallic silver lead and 32 cwt. to 36 cwt. of oxides, which still contain some lead globules. The latter are separated by sieves, the rest of the oxides digested with hydrochloric acid, when chloride of zinc, free from silver, will form a solution, while the insoluble residue, together with the lead globules and the rich silver lead, goes to the refining furnace.

Lastly, the distilling process, which was long ago suggested by Dr. A. Gurlt, and which is in use at the Llanelly Lead Works, has been of late resorted to again at Tarnowitz. After trying to reduce the oxides with salt and charcoal in cast iron or wrought iron crucibles, this idea was abandoned, but common Silesian retorts, lined with carbonaceous substances, employed, when the sponge was intimately mixed with small coke, and the retorts heated to a white heat Thus 100 kilogrammes would give out from 30 to 36 kilogrammes of silver lead, containing 3·52 to 4·01 per cent of silver, and 26 to 28 kilogrammes of spelter, almost free from silver, collected in the condensing pot. Although it cannot be said that the arrangement at Tarnowitz is a perfect one, yet we still adhere to our original opinion that the distilling process, if judiciously carried out, will be the most advantageous of all methods for reducing the silver sponge.

The rich lead obtained in one or the other way goes in each instance to the cupelling furnace where the lead is oxidized, while fine silver remains upon the test in shape of a cake.

It has been stated above that zinc will combine with copper and gold before the silver, and this property may be utilized for separating very small quantities of gold which would not pay the expenses of extraction if alloyed with the whole mass of the silver. It is only necessary to dose the lead with a small quantity of spelter and to remove the sponge before the real desilvering operation commences.

If the Parkes process is carefully carried out, it causes hardly any loss of silver; it generally produces even more than, according to the dry assay, should be contained in the lead, while the Pattinson process involves a loss of 1·5 or 2 per cent. The total cost of this silver extracting method varies from 8s. to 10s. per tun, according to prices of coal, labor, etc. It is rather curious to see that a very ingenious and highly successful English invention has required 20 years to be brought to perfection in foreign countries before it returns to the land of its origin, where we hope to see it soon widely adopted.—*Engineering.*

Meerschaum.

At the Berlin Geographical Society's December meeting, M. Ziegler described the sources whence the considerable annual supply of meerschaum for meerschaum pipes is derived. Large quantities of this mineral, so highly esteemed by smokers, come from Hrubschitz and Oslawan in Austrian Moravia, where it is found embedded between thick strata of serpentine rock. It is also found in Spain at Esconche, Vallecos, and Toledo; the best, however, comes from Asia Minor. The chief places are the celebrated meerschaum mines from 6 to 8 miles southeast of Eskischehr, on the river Pursak, chief tributary to the river Sagarius. They were known to Xenophon, and they are now worked principally by Armenian Christians, who sink narrow pits, to the beds of this mineral, and work the sides out until water or imminent danger drives them away to try another place. Some meerschaum comes from Brussa, and in 1869 over 3,000 boxes of raw material were imported from Asia Minor at Trieste, worth 345,000 florins. The pipe manufacture and carving is principally carried on in Vienna and in Ruh'a, Duchy of Saxe-Coburg-Gotha. The commercial value of meerschaum carvings at these places may be estimated at $2,000,000 annually. However, very large quantities of them are not made from genuine but from artificial material. The waste from these carvings is ground to a very fine powder, and then boiled with linseed oil and alum. When this mixture has sufficient cohesion, it is cast in molds and carefully dried and carved, as if these blocks of mineral had been natural. It is said that about one half of all pipes now sold are made from artificial meerschaum.

The Ostrich.

The domestication of the ostrich has assumed every year greater importance, and this industry promises to become considerable. Mr. Kinnear, of West Beaufort, Cape of Good Hope, is the one who has given most attention to the subject. His farm is a model of simplicity, and surprises many who are disposed to consider that large tracts of territory are necessary to breed the ostrich with success. On eight acres of land, attached to his dwelling and enclosed with fences, he has at this moment thirty ostriches, nearly all reared by himself. This enclosure is sown with lucerne, and would suffice for nearly 100 ostriches, if his system of irrigation were more extended. A lodge and sheds are constructed for the protection of the young birds during the winter months, and it is here the business of obtaining the feathers is carried on. For this operation, two processes are resorted to; some advise the plucking out of the feathers, others consider it best to cut them a little above the roots, and to remove the roots two months afterwards. Mr. Kinnear prefers the latter mode, as he thinks the former is often injurious to the bird. The first plucking of feathers takes place when the bird is about eight months old, but the feathers are then small, and not of much value. The operation is renewed every eight months. Three pluckings of ostriches, when in full plumage, realized to Mr. Kinnear $50 per annum per bird. One portion of the enclosure is divided into compartments, in each of which the ostriches are paired. At liberty, in the wild state, five females are often attached to one male; and they all lay their eggs in one nest, and set on them in turn. Mr. Kinnear, however, only assigns one female to each male. They are coupled in July, commence laying in August, and continue laying for about six weeks, after which they set till October. A month or six weeks later, about December, they recommence to lay for about five weeks, provided the young brood is removed. In the first season, the hen will lay fifteen or twenty eggs, but the second is much less. The male sits on the eggs more assiduously than the females, often sixteen hours successively, from four in the afternoon to eight in the morning; the female, on the contrary, takes the greater care of the young ones. Mr. Kinnear removes the young when they are sufficiently strong to be taken from the nest—that is, one or two days after they are hatched. They require a warm temperature, and hence are placed in a deep box lined with sheepskins, taking care to let the air penetrate by the cover. During the severe colds of winter, the lodge is heated and kept closed. Their usual food is chopped lucerne, but they do not like the stem. Grain is also given to them, and when they are strong, maize. Trefoil and vetches agree with them as well as lucerne. They neither have iron nails, metal buttons, nor other delicacies of that class to which many travellers assert they are partial; but they have sand, earth, pulverized quartz, small bones, and plenty of water.

The transport of ostriches demands great care; many die during journeys of long duration. Experience demonstrates that the best mode of transport is to place them in spacious wagons, and to proceed slowly, traveling only in the night. Mr. Kinnear states that, for their usual food, nothing equals lucerne or trefoil, but they also like cabbage leaves, fruit, and grain. Each ostrich will eat about twenty pounds of lucerne a day.

In the district of Coleberg, some farmers have enclosed with walls large spaces of ground, leaving the ostriches as it were in a state of liberty. Competent persons think they obtain by this means feathers of a superior quality to those from animals kept in a domestic state; but the rearing of the young ostriches does not succeed so well. On the farm of Mr. Murray, in that district, many ostriches died last year without any apparent cause, their death being attributed to a worm found in the intestines.

In the districts of Worcester and Graff Reinet, the rearing of the birds has succeeded well. The advance which has taken place in ten years, both in the price of the birds and of their feathers, will give an idea of the importance which this industry has already attained in the Cape Colony. In 1860 a pair of ostriches six months old could be bought for $2.50; now, for one bird alone, a few days after hatching, $25 will be given, and for those of three or four months old, $40 or $50. In 1870, the quantity of ostrich plumes exported was 29,000 lbs., valued at $435,000; and it may be stated that an ostrich which has attained its full development will only yield every eight months a quarter of a pound of feathers.

DURING 1870, Philadelphia produced $10,000,000 worth of carpets, $5,500,000 of prints, $3,000,000 of silks, and other fabrics to the value of $40,000,000.

Improved Wagon Wheel.

The chief peculiarity in this wheel is the method of mortising the hub, cutting the tenons on the spokes, and inserting the latter in the hub.

Fig. 1 shows the hub with a portion cut away to show the method of inserting the spokes. Fig. 2 shows the form of tenon on the spoke, and Fig. 3 shows the method of mortising the hub.

By referring to Fig. 2, it will be seen that a partition of the tenon, marked A, is cut as on ordinary spokes. Below this the wood is further cut away, as shown at B, making a smaller tenon, and leaving a shoulder on three sides of the tenon, which, when the spoke is driven home, rests upon the ledge or shoulder, C, Fig. 3, formed in the mortise to correspond with the shoulder on the tenon.

It will be observed that the shoulders in every alternate mortise are reversed in position, and the spokes are to be driven accordingly, so that they stand as shown in Fig. 1.

By this means, the hub is not cut away so much in its center, and a very small and light hub may be made to be very strong, so that it is claimed a prettier wheel, with ample strength, is secured. It is also claimed that the wheel is more elastic than the old style of wheel, and therefore less likely to break axles, so that, even for large and heavy wheels, the method is a decided improvement. Where machinery is employed to do the tenoning and mortising, the improvement will not add materially to the cost of the wheel, and even with hand work the increase of cost would be trifling.

The spoke is strong just where it needs strength, namely, at the shoulder, and the hub is strong just where it requires most strength, at the middle. The principle of construction is sound, and we have no doubt an excellent wheel may be made in this way.

Patented through the Scientific American Patent Agency, January 2, 1872, by Christian Anderegg, of Lawrenceburgh, Ind., whom address for further information.

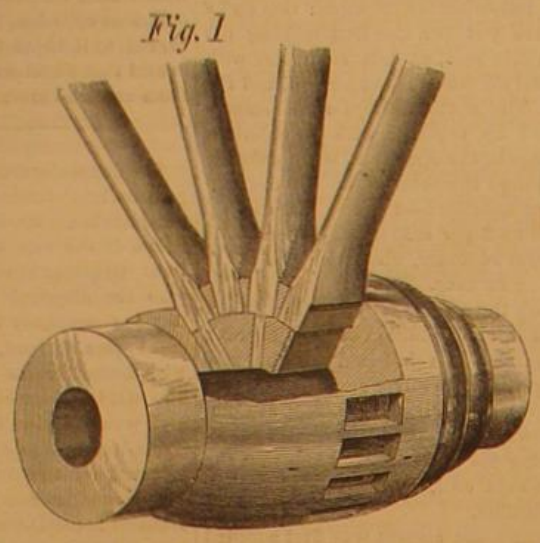


Fig. 1

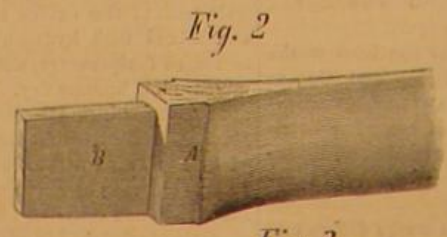


Fig. 2

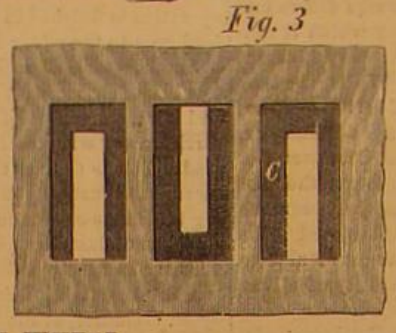
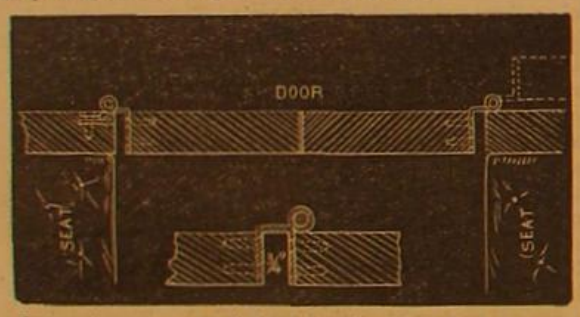


Fig. 3

ANDEREGG'S WAGON WHEEL.

Car Doors.

A correspondent of *Engineering* proposes the following construction, to prevent injury to passengers by the accidental placing of their fingers on the door jambs:



It is to leave a space of three fourths of an inch between the door and the frame, so that it would be impossible for the door to tighten upon the fingers, should they be in the space. This might be done in existing carriages by cutting away the frame, or reducing the door, or both; but best of all by a new door made narrower than the doorway.

Narrow Gage.

It is now a little more than a year since the *Railroad Gazette* first took issue with the advocates of the narrow gage, and denied their main proposition, which was that "the dead weight of trains is in direct proportion to the gage on which they run." For this denial, we were assailed from all sides. We were denounced as "enemies of progress and civilization." It was said we "did not understand what we were writing about." We were requested "to revise our theories" if we "wished to promote the public service and add to our scientific reputation," and we fear we were regarded by the advocates of the narrow gage as being afflicted with what Artemus Ward was in the habit of calling "pure cussedness." Being human, it therefore gave us much pleasure to find, on reading the report of the Pennsylvania Railroad Company, that the President had taken the same ground, in relation to this question, that we have advocated. He said: "The saving, in dead weight of machinery carried, by one system over the other is not important, as the heavy engines and cars used upon the usual gage (four feet nine inches) are not due to the width of the track, but to the necessity of maintaining higher speeds and the movement of heavier loads, than is obtainable with economy and safety on the narrow gage. The equipment now used on the narrow gage is heavier than that formerly used upon the four feet nine inch lines."—*Railroad Gazette.*

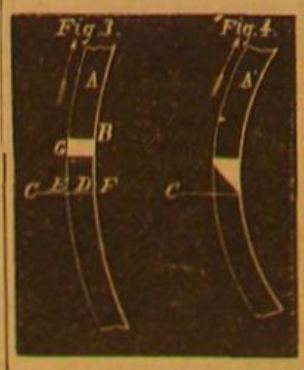
An Asiatic Railroad.

England seems to be successful in once more imparting vigor to the "sick man" of Europe—Turkey—with the same old object of counteracting the evergrowing influence of Russia; this time, however, by more peaceful measures than of yore. The project now on foot is the construction of a system of railroads through Asia Minor and the intervening countries—Persia and Afghanistan—to India. This time England seems to be in earnest, for a section of railroad from Scutari to Ismid is almost completed, being made in superb style, with steel rails and other modern improvements. From Ismid, the road is to be conducted in a southerly direction towards and across the Taurus mountains. Great difficulty appears to be anticipated in finding a convenient pass through this rugged chain, but it is also set down as the only drawback. When once the Taurus has been crossed, a branch is to be extended towards Smyrna, and to the British settlement at Aleppo, to establish the vital connection with the Mediterranean, and liberate the undertakings of the western power from the direct influence at the Bosphorus. The eastern progress of the road will naturally be slow, because its construction will be very expensive; but its importance to the commerce of the world cannot be overestimated. The road will not only bring the East Indies into much more rapid communication with the civilized world, but will open immense tracts of agricultural and mineral lands that were hitherto hardly known by aught but their names. The political significance of the enterprise cannot be without interest, even at this distance. It will be a strife who will be ahead in Afghanistan, England with her road or Russia with her soldiers. The final possession of the East Indies may depend to a great extent on the results of this race.

ROTARY ENGINES.

In our last article, we explained that the working of the abutment constituted one of the most important problems we have to deal with; it may be well to explain here that the reason, for making the piston so narrow as four inches for an engine of 150 horse power, lies in the fact that by so doing we reduce the travel of the abutment. If the velocity of piston and abutment are identical, then four inches will intervene between the abutment and the piston at the moment the first is home. Steam is admitted at the same moment, and we have four inches of clearance. The waste of steam in this space will be considerable if the engine is worked very expansively, for if we suppose the diameter of the circle described by the center of effort, to be, say, 9 feet 8 inches, and the circumference to be 29·3 feet, then, if the steam is cut off at 0·1, it will be admitted for but in round numbers 3 feet; and 4 inches would be one ninth of this, and therefore an enormous clearance; not all dead loss, it is true, but still a loss to be avoided, above all in an engine intended to be theoretically perfect. One mode of reducing the loss, as we have already explained, consists in sloping off the back of the piston so that a portion of the waste space will be filled up; by this means, the clearance can be reduced one half. The arrangement will be understood from the accompanying diagram.

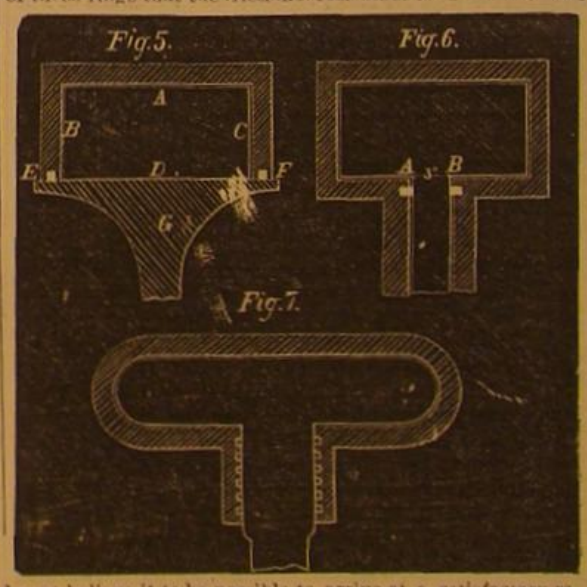
In figure 3, A is a portion of the annulus, B is the piston with sides nearly in the plane of the radius of the annulus; C is the abutment. The abutment begins to close at the moment the back edge of the piston passes the point E; but while the abutment is moving from E to F, the piston has advanced from D to G. This is the clearance space.



In Fig. 4, it will be seen that the back of the piston is sloped off at such a rate as just to keep out of the way of the slide, and thereby the clearance is reduced one half. If we also slope off the abutment and make it very thick, we may virtually get rid of the clearance difficulty altogether. It may, therefore, be laid down as a principle that it is possible so to shape an abutment working vertically and a piston working circumferentially that clearance will be done away; and further more, this principle can, within reasonable limits, be so applied that it will be unnecessary to impart a very high velocity to the abutment, because the piston may be supposed to travel a couple of feet while the abutment is moving through not more than *four inches*. There is a grave practical difficulty to be got over here, however, which is that as much of the outer ring of the annulus must be removed as the abutment is long—or rather thick—and as this space is not filled up when the abutment is withdrawn, the packing ring of the piston would be destroyed by flying out and catching the edge of what we may term the abutment port. Therefore, it is only safe to assume; that one half the clearance could be saved, and that by the prolongation of the piston in the rear. We have said nothing as to the mode in which the abutment is to be put in motion, nor shall we enter into any particulars on the subject. Some form of cam, worked from the main shaft, suggests itself at once; and it would probably be well to compress a strong spring in the act of taking the abutment out, which, being suddenly released at the *proper* moment, would drive the abutment in again in the shortest possible time. The Corliss valve gear supplies an illustration of the principle involved.

We may now proceed to consider the nature of the means to be adopted in connecting the piston with the main shaft, and the method of making the joints tight without undue friction. As regards the connection of the piston with the main shaft, no better device can be adopted than a disk.

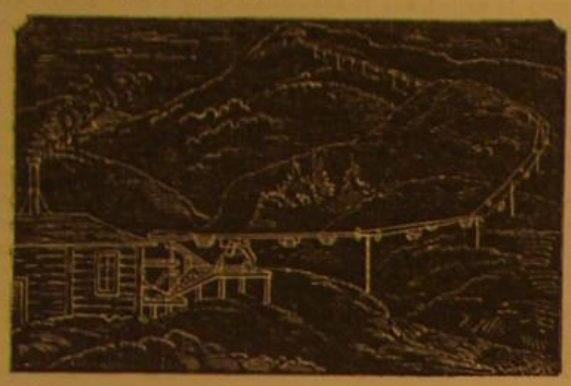
It will be seen that, make what disposition of the parts we will, there are four edges of the piston, or their equivalent, to be packed. If we adopt the arrangement shown in Fig. 5, it is true that only three edges of the piston, A, B, C, have to be packed, the fourth, D, being part and parcel of the disk, the wide flange of which is made tight at E, F, by packing rings. In the same way, the abutment will rest on a scraped face, the section of A, B, C, and will require no packing; but its inside edge must rest against the face of the flange G, and therefore, it must be fitted with the packing saved from the piston. Now on the whole, it will be found the best plan to concentrate the packing in the piston and the scraped face joints in the abutment as much as possible; therefore the annulus may be made of the form shown in cross section in Fig. 6. The abutment will then have a fixed bearing, except the small portion of its length from A to B, representing the thickness of the disk, say 3 inches. By adopting this plan we are able to dispense with a rectangular cross section and adopt that shown in Fig. 7, which gives a form of piston as easily packed as though it were made of the ordinary cylindrical form. Supposing this piston and abutment to be made tight, we have next to make the disk tight with the casing or annulus, and this is no small undertaking. The length of joint to be made tight in a 16 foot engine is about 60 feet, or as much as would be represented by the piston of an ordinary engine with a cylinder 120 inches in diameter. Nothing is more easy than to make a good job with packing rings, but it unfortunately happens as a result of the action of these rings that the frictional resistance is enormous. We do not believe it to be possible to arrive at a satisfactory result if any attempt is made to pack the joints between the disk and the annulus in the ordinary way. The solution of the problem probably lies in making the disk for a considerable portion of its breadth, say at least a foot from the edge, absolutely true. The cheeks of the annulus must be made equally true, and we must rely on a series of grooves turned in the cheeks to keep the joint tight as in the ordinary solid piston.



With first class workmanship the thing may be done; and the leakage may be still further reduced by enclosing the whole engine in a case filled with steam from the boiler. The leakage would then be from this jacket into the engine and would vary in amount, of course, as the pressure inside and outside varied. The packing of this joint constitutes, in one word, the great problem to be solved—the great difficulty to be overcome in constructing a thoroughly efficient rotary engine. The working of the abutment is a matter requiring much careful thought, but it presents no insuperable obstacle to the competent engineer. We wish we could say as much of the annulus joint. How to make this tight without excessive friction is the question, and we have no doubt that, in proper hands, its satisfactory solution would prove a very remunerative speculation. It is to say the least, highly probable that an engine, occupying no more space than a flywheel, and simply bolted up against the wall, would become extremely popular, especially as the engine would be eminently economical and efficient.—*Engineer*

HALLIDIE'S WIRE ROPE WAY FOR TRANSPORTING ORES.

This invention is one of great importance, especially to the miners of the Pacific slope. Our illustration gives a general view of the whole apparatus in practical operation, conveying quartz from the top of a mountain in a rough mining region to the mill below. The *Scientific Press* thus describes it: "The wire rope passes over pulleys elevated upon posts of a suitable length, and, as shown in the engraving, the sacks of ore are suspended by the proper device to the rope. The sacks or cars are loaded on the dump at the mine on the mountain, and, the patent grip pulley being revolved by means of the engine, the sacks or cars pass down on one side, deliver their load, and pass up empty on the other side. Boxes may be used that are self dumping, or operated by hand, as desired. By this means, the expense of road building, teams, drivers, etc., is done away with, and a safe and very convenient method adopted by which the ore is delivered to the mill. Either sacks or cars may be used for carrying, as desired. The patent grip pulley is a very ingenious device, and accomplishes its purpose admirably.



"The rope way may be run by the same engine that runs the stamps at the mill; and when the descent is sufficient and the load comes down, no extra power is needed, the gravity of the descending loads being sufficient to keep it in motion; it being desirable, however, in all cases to connect with the steam engine or water wheel, in order to regulate the speed of the rope, which is usually about 200 feet per minute. The posts, of course, are arranged high enough so that the cars may be clear of all obstructions from the ground, but the undulations of the ground can be followed. There being a pulley over the rope as well as under it, the rope is kept between the pulleys and enabled to pass over any mountain at any angle. A brake is sometimes used to regulate the rapidity. One very great advantage, possessed by this system of conveying ores, is that the weather will not affect it, for it can be worked during heavy storms and freshets, and the depth of snow is of no consequence; moreover it will run as well by night as by day, and with no more care.

"The advantages of this apparatus will be obvious at a single glance to any one familiar with the general rugged character of the Pacific slope.

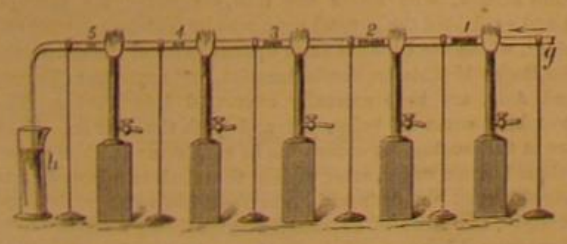
"This apparatus should not be confounded with the ropeway of Hodgson's patent, which is now in operation at the Eberhardt and Aurora Company's mines in White Pine, as it is totally different in its construction."

PRECIPITATION OF ARSENIC BY HEAT IN MARSH'S TEST.

BY JOHN C. DRAPER, M.D., PROFESSOR OF CHEMISTRY, UNIVERSITY MEDICAL COLLEGE, NEW YORK.

Among the methods for the detection of arsenic, there is not one which promises better quantitative results, for the purposes of medico-legal investigators, than that by the action of heat on the arsenide of hydrogen. I have, therefore, endeavored so to improve the ordinary method, of precipitation of arsenic from its gaseous compound with hydrogen, as to render this method both satisfactory and reliable.

In the text books on medico legal chemistry, it is recommended that the arsenide of hydrogen, developed by the action of zinc, dilute sulphuric acid, and the arsenical solution, should be conducted through a hard glass tube of narrow caliber which should be heated at some part by a spirit or Bunsen flame. The compound gas is, under these circumstances, separated into its constituents, and a metallic mirror of arsenic deposited a short distance beyond the flame. After the gas has been exposed to the action of heat, it is to be passed into a dilute solution of nitrate of silver, where any portions that have not been decomposed produce a dark brown precipitate.



From the above *resumé*, it will be seen that the arsenide of hydrogen is only partially decomposed by heat, since the silver solution is intended to arrest the portions that escape its action. I have, therefore, investigated the extent to which the precipitation by heat takes place, and for this purpose have passed the gas through a Marsh reduction tube, heated at five points by Bunsen flames, as shown in the adjoining figure, and which takes the place of the tube in the apparatus represented on page 179 of the last number of the SCIENTIFIC AMERICAN.

In the first experiment, the arsenious acid solution, introduced into the decomposition flask, was moderately strong, and a stain soon appeared at 1. This was followed by another at 2, then at 3, 4, 5. The passage of the mixed arsenide of hydrogen and hydrogen was continued about half an hour, at the close of which time there was a thick deposit of arsenic about two inches long at 1, another about the same length but not so thick at 2, one still weaker at 3, while 4 and 5 were of about the same appearance.

In a second experiment, a very dilute solution of arsenic was introduced, and the rate of evolution of the gas was very slow; in this nearly the whole of the arsenic was arrested at 1, very faint and unsatisfactory stains appearing at the other heated spots.

In a third trial, a strong solution of arsenious acid was introduced with a result similar to that obtained in the first experiment. We may therefore conclude that, in the separation of arsenic by heat from arsenide of hydrogen, though the greater part of the metal may be removed by a single application of heat when the current of gas is very slow and it is largely diluted with hydrogen, if the flow is at all rapid or if the gas is rich in arsenic a very large proportion of the metal may escape reduction, even though the passing gas is frequently heated; and the last portions of arsenic are only separated in this manner with the greatest difficulty.

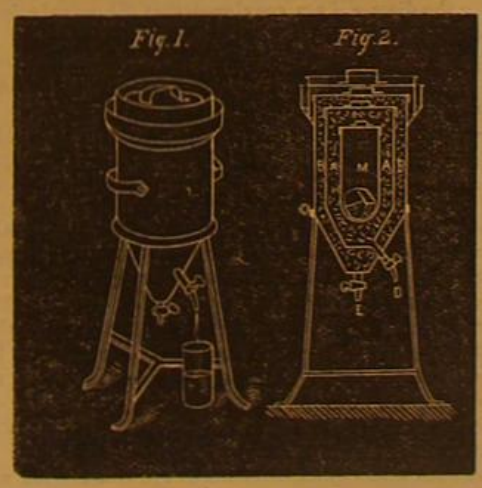
In an examination of the liver or other organ, in cases of arsenical poisoning, the solution generally obtained by the process of Fresenius and Babo is moderately strong when arsenic is present; it is therefore necessary to secure under these conditions the precipitation of the whole of the arsenic at the first heated spot, and obtain it in such a form that it may be weighed without loss, and then subjected to any other tests that may be desired. The possibility of accomplishing this problem in a satisfactory manner, we propose to discuss in a future paper.

DETERMINATION OF HIGH DEGREES OF HEAT BY THE MELTING OF ICE.

It was mentioned in our number for March 9 (page 168 of the present volume), that any substance, able to withstand the heat of a furnace, may be used to determine its temperature. We will now explain this method, which is one of the most interesting applications of our knowledge of the specific heat of bodies.

Suppose we take a lump of mica, asbestos, fire clay, or a large fire brick or a piece of graphite, and expose it so long to the heat of the furnace that we are satisfied that it has attained the same temperature; and then transfer the piece rapidly to the ice calorimeter of Lavoisier and Laplace, and notice how much ice it will melt.

As this most useful apparatus is not as universally known as it deserves to be, and as its description is totally omitted from most text books on natural philosophy, we will describe it here. Fig. 1 represents the exterior view, and Fig 2, a



section of the same. It is made of three vessels of sheet tin, of similar shape, and fitting concentrically one into the other. In the smallest central vessel, M, we place the body of which we wish to determine the number of heat units; the space, A, between this vessel and the one surrounding it is filled with pounded ice; the vessel has a lid and this is also covered with ice. This ice is intended to be melted alone by the heat of the body, M. In order to secure this, and to prevent the melting of this ice by the exterior heat of the room where the experiment is performed, the space, B B, between this second vessel and the third exterior one is also filled with ice. The latter will be melted only by this exterior heat, and the water proceeding from this melting runs off by the stop cock, E; while the water proceeding from the melting of the interior ice by the heat of the body, M, runs off by the stop cock, D, and is collected in a proper vessel (see Fig. 1), and carefully measured or, better, weighed.

As the substances used for this experiment may lose some of their weight by the intense heat to which they are exposed, it is unnecessary to weigh these before they are exposed to that heat; their weight is ascertained only after the practical portion of the experiment is finished, that is, after they have been exposed in the calorimeter, melted all the ice they could melt, and are cooled to the temperature of the melting ice, 32° Fah.

It is evident that precautions must be taken against loss of heat during the transfer, of the heated substance, from the furnace into the calorimeter; it is, of course, impossible to prevent this loss altogether, and all we can do is to bring this loss to a minimum by care in our manipulations. It is unnecessary to make any corrections for the specific heat of the vessel itself, as we commenced with having it at 32° Fah.; and the heat the interior lining absorbs from the body, M, is finally all given off again to the ice to be melted. The heated body is best laid in the space, M, on a non-conducting cushion of mica and asbestos, as otherwise the heat would be too rapidly communicated, and serious disturbances caused.

Suppose now we have taken a piece of fire brick, heated it, and introduced the same in the calorimeter. We find that the weight of the water proceeding from the ice melted is 7·62 lbs., while the weight of the piece of brick after cooling is found to be 3 lbs.; 7·62 lbs. of melted ice is equivalent to $142 \times 7{\cdot}62$ or 1,082·04 units of heat, and as this number was carried out of the furnace by 3 lbs. of fire brick, of a capacity of 0·19 specific heat per pound, we have $3 \times 0{\cdot}19$ or 0·57 as the divisor of 1082·04 units, which gives for the temperature of the furnace 1,898° Fah.

If there is any doubt as to the correctness of the result, by reason of the uncertainty in the specific heat at the high temperature to which we exposed the sample of fire brick used, one single determination with a substance like platinum, of which the specific heat is exactly known, gives us the correct temperature of the furnace; and this may then be applied to correct the specific heat of the fire brick. Suppose, for instance, the method with platinum and water, explained on page 168, gave us, in the same furnace at the same time, a temperature of 1,790° we should then reason as follows: 7·62 lb. melted ice is equivalent to $7{\cdot}62 \times 142$ or 1,082·04 units of heat; and as 3 lbs. brick carried this amount, each lb. of brick carried one third of 1,082·04, or 394 units, that is, one lb. of brick, when it had absorbed 394 units of heat, showed a temperature of 1,790° sensible heat; its capacity for heat or specific heat must then be $394 \div 1{,}790$ or 0·22. As long, then, as we use this quality of fire brick and take its specific heat as equal to 0·22, we shall have more correct results than if we take it at 0·19, as it is found at ordinary temperatures and given in most of the tables of specific heat.

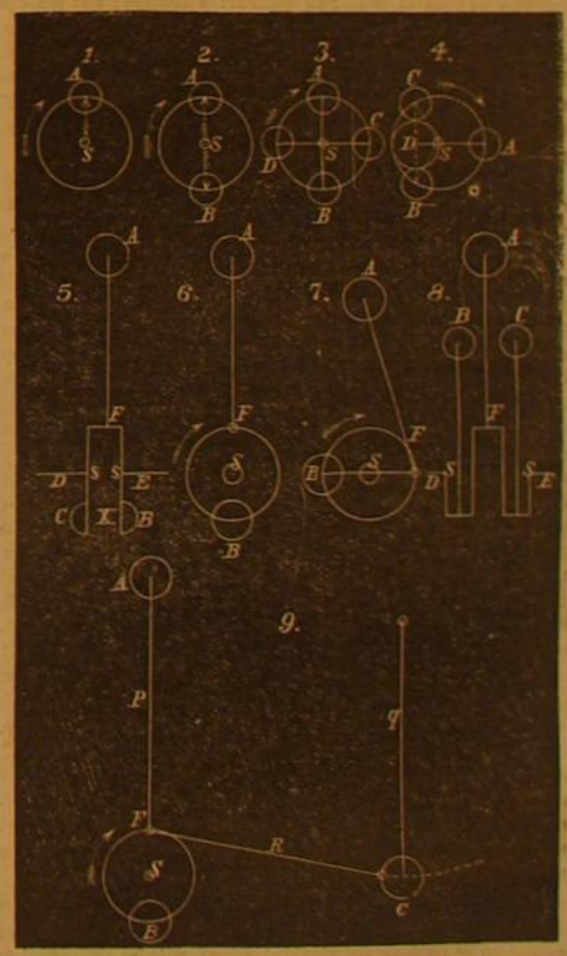
Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Counterbalancing Saws and other Machinery.

To the Editor of the Scientific American:

E. F. J., writing in your issue of March 2, wishes to know how to counterbalance his gang saws so as to prevent vibration, and states that the saw gate weighs some 5,500 lbs. As the theory of counterbalancing seems to be but little understood among millers, I propose to occupy some of your space in explaining it in a practical way.



Let the circle, Fig. 1, represent a disk or wheel revolving upon a horizontal axis, S; it is evident to any mechanic that, if the disk be perfectly true and of uniform density, there will be no vibration; but if we attach the weight, A, to one side, throwing the disk out of balance, a vibrating action will be produced, which increases with the weight, distance from the center, S, and number of revolutions in a given time. To make our disk run smoothly, we apply an equal weight, B, equidistant from S, Fig. 2.

Before leaving Fig. 1, we must inquire what are the natures and directions of the vibrations produced by the weight, A. If we whirl a plummet in the air, we find a force developed called the centrifugal force, which keeps the string taut and draws the hand constantly towards the bob. So also with our disk; the centrifugal force of the unbalanced weight

A, causes a tension in the direction, S A, which wears away the side of the axle next to A, and causes it to vibrate in the direction in which it is poorly supported. If it be supported upon a poor foundation, the vibration may be in the vertical direction; or if the axis or shaft be supported by the overhead sleepers of a weak framed building, then the vibration will be in the horizontal direction. These evils may be prevented, as shown in Fig. 2.

Fig. 3 shows four equal weights, A opposite B, and C opposite D, all at equal distances from the center, S; therefore Fig. 3 rotates without causing vibration. Fig. 4 shows three equal weights, A, B, and C, at equal distances from S and their centers, dividing the circumference into three equal parts; then this disk also revolves without vibration. The practical way of determining when pulleys, disks, etc., intended for rapid revolutions, are balanced is to lay the shaft or axis across two beveled straight edges, as the sills of a lathe, which allow it to revolve without friction, and the heavy side speedily turns down, and pieces may be applied to the top until the pulley remains in any position.

Referring again to Fig. 4, draw the dotted line, B C, and extend the line, A S, to D; we will have S D equal to half A S; at the point, D, we will apply a weight equal to G+B, or double of A; and removing B and C, our disk will still be balanced when tested on the straight edges, and will revolve without vibration. The principle of the lever applies here as to all mechanical constructions; and weight, A, multiplied by distance, A S, equals D multiplied by D S.

Although we do not practically calculate, the method of balancing on the straight edges accomplishes the calculation, and we come to an important point usually overlooked, which is that the attraction of the earth, or gravitation, has nothing to do with the vibration of unbalanced mechanism.

Gravitation supplies a convenient method, of measuring the mass of matter in any body by weighing, which is tolerably correct, and also their moment or leverage; for we have found, when disk No. 4 balances perfectly, that A×AS=D×DS.

In Figs. 5, 6, and 7, let F represent the position of a crank pin to which is connected the pitman represented by the line, FA. To the upper end is connected the saw gate which, for our purpose, may be represented by the weight, A. Now we may counterbalance by adding the weight, B, equal to A, on the opposite side of the axis, and equally distant from it with the crank pin, F; and this will be balanced, that is, the crank will stand in any position. Now run the mill at a rapid rate without B, there will be a strong vertical vibration only, because A, the unbalanced part, moves only in that direction, but attach B, and the vertical vibration is counterbalanced and removed; but there is introduced a vibration equally severe in the horizontal direction. Therefore it appears that we cannot counterbalance a reciprocating weight by a revolving one so that it will run without vibration; but we can use another weight moving in directly the opposite direction, as in Fig. 8, where B and C represent two weights, each one half of A, connected to the pins, G and H, directly opposite to the pin, F. Two cranks are used, one on each side of F, because a single weight at B or G, equal to A, would tend to produce a tilting motion in the crank shaft.

I hope that I have now shown clearly that a simple reciprocating motion cannot be balanced by a rotating motion, but can be by another reciprocating motion, equal and opposite

To apply the results of our investigations to the case submitted by E. F. J. He can first apply a counterbalance of half the weight of his saw gate, which would reduce the vibration in the vertical direction but one half, and would introduce a horizontal vibration of equal amount. To this may be added a heavy fly wheel, which will reduce the vibration in proportion as its weight exceeds the weight of the gate; these excessive weights, however, produce heating and wearing of the journals. They must, moreover, be placed very close to the plane in which the center of the length of the crank pin rotates, or else formed on a pair of disks each side of the pin, as in Fig. 5. Fig. 9 shows a method which will prevent vibration both in the vertical and horizontal directions. The weight, A, being counterbalanced by B, of equal amount, another weight, C, equal to A or B, is introduced, suspended by the rod, *q*, made as long as can be and connected to the same crank, F, by the pitman, R; the weight, C, counterbalances the horizontal action of B. The best way, however, is a modification of Fig. 8, in which a forged crank is used, having three pins or wrists, two down and one up. If the pitman, AF, has a good length, the weights, B and C, may slide vertically each side below the gate, or they may be suspended in a pit under the crank. It will not be found necessary to counterbalance within 500 or 1,000 lbs., as some allowance must be made for the power required to force the saws down through the timber. W. H. HARRISON.

Philadelphia, March 4, 1872.

[The remarks of our correspondent, relative to balancing cylinders or pulleys on straight edges, will be demurred to by some of our readers who have had experience in balancing cylinders destined to run with high velocities. It is a fact, not as universally known as it should be, that cylinders that are in standing balance when tried on the straight edges will often shake heavily when set to running at high speeds, owing to the distortion produced by unequal centrifugal force, the inequality in this force being due to nonhomogeneity of the cylinders, etc. This subject was discussed at length in Vol. XXIII. of the SCIENTIFIC AMERICAN. The diagrams above given, relative to balancing saws, will, however, prove valuable hints to many readers.

CALIFORNIA boasts the largest orchard in the world. It contains 426 acres, and over 75,000 fruit trees.

Small Pox Remedies.

To the Editor of the Scientific American:

I was interested in the perusal of an article in the number of your excellent periodical for February 24, on "A Remedy for Small Pox, by one who has tried it," and also in a notice of the same in your editorial columns. I have long since learned to "go slow" in recommending and using medicines that gain some reputation in the treatment of this disease; and your correspondent, I think, presumes too much upon his observations in a single case.

One or two points which this case brings to my mind may be of interest to your readers, and help your correspondent to account in another way for the results following the administration of the sulphite of soda in the care of his patient.

Whatever authorities may say in a general way, in relation to the correspondence between the severity of the premonitory symptoms and the subsequent stages of the disease, a large experience has taught me that even if this be the rule, it is not without numerous exceptions. There is a class of nervous, impressible, neuralgic persons, in whom the febrile stage of small pox produces severe back ache, headache, nausea, and even delirium from the general febrile excitement, etc., and in whom the later stages of the disease are of the mildest type. I think I have seen as severe symptoms at the onset of an attack of varioloid as frequently occur in unmodified small pox. I have now in my mind the case of a professional brother, who suffered so intensely throughout the first stage of the disease that the most serious apprehensions were aroused, among his friends, as to the result; but the later stages were of the mildest kind.

Again, there is a variety of the disease which is designated as "dry pox" or "horn pox," which, I think, is frequently the cause of too hasty conclusions in regard to the potency of medicines in this disease. In this variety, the premonitory symptoms may be very severe, and the eruption on its first appearance be so profuse as to denote a case of confluent small pox; but when the eruption has reached the vesicular stage, that is, when the contents are transparent, instead of passing on to suppuration (formation of yellow matter), it becomes dry and hard, and desquamation takes place rapidly. No pitting occurs usually in these cases, and these are the cases that give reputation to certain medicines and methods employed to prevent pitting. Now it will be seen how easy it is to mistake these cases, in which nature seems able to bring about this abortive action, and attribute it to the wonderful specific properties of a medicine which the patient was taking, but which had no agency in the matter whatever; for this is the result in scores of cases that are treated on a purely expectant plan.

Sulphite of soda is no new remedy for this class of diseases. It was heralded forth a few years ago as the antidote to blood poisoning, and tuns of it have been used in the treatment of zymotic diseases. But I am of the opinion that the observing, intelligent portion of the profession have lost confidence in it.

After a quite extensive observation in the treatment of small pox and employing all the reputed remedies and abortives for the disease, I am convinced that *the* remedy is not yet discovered.

But why search for the pound of cure while we hold in our hands the ounce of prevention, in the form of true Jennerian vaccination?

Chicago, Ill. R. M. LACKEY, M. D.

Elastic Backing for Armor Plating.

To the Editor of the Scientific American:

A correspondent in the number of your valuable journal for February 24 says: "The fostering of erroneous opinions or other causes have left us without an efficient navy," etc.; and he proceeds to demonstrate the practicability of elastic backing for armor, as though it were the only thing essentially necessary to produce an efficient navy. Permit one of long experience in naval affairs, and a close observer of all matters appertaining thereto, to suggest a few objections to elastic backed armor, and to offer a few general remarks about our navy.

It has been found by experiments at the Washington navy yard that the difficulty, in securing the plates having elastic backing, more than counteracts any advantage gained by diffusing the impact of percussive force. The more unyielding the backing, the better the condition in which the fastenings were found after impact of the projectile. A fifteen inch shot seldom failed to destroy some of the fastenings of armor having elastic backing. Properly securing the plates is quite as important as the plates themselves. The experience of the *Essex* and others is not sufficient evidence of its efficiency, having only to oppose comparative pellets, as scarcely any gun of the rebels, on the Mississippi away from Vicksburg, was above a 64 pounder. I am quite sure, at close quarters, before a fifteen or twenty inch gun, the *Essex* would not only have had her armor stripped from her, but the St. Louis ferry boat would have been knocked to pieces in a short time.

To produce a good and efficient navy, it is neither essentially necessary to expend "untold millions" on plate vessels with elastic backed armor, nor to plate a cruising vessel at all. The writer of the article alluded to is evidently not informed of the improvements made for conducting a naval war, and the important part the torpedo is destined to play in future naval engagements. We have at present in our navy three vessels of about three hundred tuns each, capable of steaming ten knots an hour, fitted with torpedo engines. Alongside of either in an engagement, the heaviest ironclad extant would not float twenty minutes. Much credit for the adoption of this plan is due to Chief Engineer Shock and Superintendent Wilson.

For an efficient navy, two types of vessels are necessary, one for cruising purposes and the other for coastwise purposes. For the latter, the *Monitor* class are especially adapted, their low freeboard, sheer deck, and rounded turret presenting very obtuse angles to the line of fire, and presenting a target very difficult to penetrate. But such a vessel, while well adapted for attacking or defending ports, is not fitted for a cruiser.

For a cruising vessel, a different type is needed. She should be a swift vessel, provided with a fifteen or twenty inch pivot gun forward and aft, arranged to train to all quarters, to carry fewer men and still fewer officers, and occupy their places with coal, etc.; and she should be fitted with a torpedo engine above referred to. In the event of an engagement between such a vessel and an ironclad, there would be no sailing in circles with the former, but she would go for her antagonist at once, striking her at the bottom. Unless the ironclad should cripple her before reaching her, a matter highly improbable when going bows on, her fate would be decided in a few minutes.

To impute old fogyism to the late administration of the navy is unjust, and is not sustained by facts. Never was there so much ability and energy displayed in that department. It was then the great advance was made of reducing the number and increasing the caliber of the guns (it would have been better, however, had the practice extended to the *personnel* also), thus requiring a less number of men, leaving more room for stores, and rendering the vessel more efficient.

The fault of the present condition of the navy is not to be attributed (as some persons, having hobbies to ride or axes to grind, suggest) to "old fogyism and fossil-like plans, expedients, and devices," but to Congress in not providing the means wherewith to make it more efficient. TORPEDO.

Baltimore, Md.

The Models in the Patent Office.

To the Editor of the Scientific American:

D., in your issue of March 2, defends the antiquated notion of illustrating by model at Washington every invention for which a patent is solicited, and asserts that the inventor's labor in comparing notes on inventions would be increased a hundred fold in the absence of models. While I differ from him on this point, and claim instead that it would be much reduced were good and generous illustration by well executed drawings the rule, to the exclusion of models, necessarily more or less inaccessible internally, I will not argue this point, but will suggest to him to inquire what proportion of the inventors of our widely extended country ever visit the Patent Office, or can possibly avail themselves of the facilities there afforded to examine models? Perhaps he would reply one in one hundred, though I think even this a large estimate. Is it wise to maintain an institution so necessarily expensive (both to the inventor directly in the first instance and indirectly through increased office expenses), and unwieldy a branch as the models require, simply to accommodate the few inventors who are favored with the pecuniary ability and time to make it possible to visit Washington? How much better for them to be at (as they would have to only about) one per cent of the cost in most cases, and receive the excellent drawings and specifications—provided for by the wise system lately inaugurated—at their homes where they can examine them during the fragments of leisure time they may be able to command! Let no hindrance be placed in the pathway of inventors, but let them understand and unite upon that which is for their true interest.

The writer believes the expense may be much better bestowed, upon developing and further improving the present excellent facilities for furnishing inventors with good copies of drawings and specifications relating to the classes of invention they are severally interested in, than by accumulating and caring for, at the inventors expense, the immense aggregation of models to which but few can ever make the necessary journeys to gain access.

INVENTOR No. 2.

Buckskin Leather and Glove Making.

To the Editor of the Scientific American:

To a stranger passing over the Fonda, Johnston and Gloversville railroad, large and frequent fields, filled with skins hung on poles to dry, form the most noticeable feature of the country. A desire to trace the deerskin as it comes from the hunter's hand through all the processes by which it is converted, first into leather and then into mittens and gloves, led me; and the courtesy of the proprietor, Mr. D. B. Judson of Kingsboro, gave me an opportunity to visit the, as I suppose, largest mill and factory in the country. Mr. John Filmer, who leases the mill, conducted me through it and explained the several processes by which about 200,000 hides, which are brought from distant parts of the continent, the Rocky Mountains, South America, and some from Europe and Asia, are here annually converted into leather. The deerskins come in bales, dry and with the hair on. They are at first soaked for some time in vats, some in clear water, others in lime water, after which the flesh is removed from one side and the hair and grain from the other with large, straight, two handled knives, the skins being stretched over zinc covered beams, and the workmen taking the position of a person rubbing clothes upon a wash board. The skins are then worked for hours in oil, in a kind of fulling mill; the oil is taken out with soda ash, which converts it into soap, which is in turn removed by washing. After drying, the skins are made fast and stretched and softened by means of the stake, an instrument resembling that with which the blacksmith trims a horse's hoof. The coloring is done with ocher. Last of all, the face is smoothed by grinding on

wheels covered with emery and pumicestone. From the mill, the leather is taken to the factory, where it is cut with steel dies, and made up into gloves and mittens on machines. The finished gloves are dampened, stretched upon a hand shaped board, dried and packed in paper boxes, ready for market. Besides deerskin, American sheepskin and lambskin German and French kid, and chinchilla, velvet, cassimere, and Petersham cloth are used. Cloth gloves with kid and deerskin palms are a novelty of the past season, and have had an extensive sale.

Mr. Judson's leather mill employs some fifty men, and his factory, about the same number in the factory and from there to four hundred at their homes. Some twenty thousand dozen pair of gloves and mittens, worth about $250,000, are made yearly. This business, commenced twenty-one years ago on a small scale, affords an instance of what a thorough knowledge of business, persevering industry and integrity, with the favor of Divine Providence, may accomplish. The town contains many other mills and factories, some nearly as extensive as this; but one may serve as a type of the whole. The annual sales in Gloversville amount, I am told, to about about $4,000,000.

Gloversville is a flourishing village, with a population of 5,000, on the Cayadutta creek, eight miles from its junction with the Mohawk. It is the northern terminus of the Fonda, John-town, and Gloversville railroad, but a company has been formed for the purpose of extending it to Northville, fifteen miles farther north, the gate to Hamilton county and the north woods the Paradise of sportsmen. Kingsboro', though older than Gloversville, is really a suburb of the latter place. C. H. D.

Kingsboro', Fulton Co., N. Y.

Borax.

To the Editor of the Scientific American:

Your Nevada correspondent requests a description of the borax lagoons and marshes of Tuscany in Italy. I was there many years ago; and if no better account is given, the following may perhaps be worth perusal:

The borax region covers about thirty miles square, the water therein being weakly impregnated with boracic acid. In some locations, this is stronger than in others. The general appearance of the region is desolate, and gaseous puffs of the acid are often seen rising from the water. The borax of commerce is made artificially, by saturating this solution with carbonate of soda, sal soda, or the barilla of soap makers. The solution is concentrated to the crystalizing point in wooden vessels lined with lead, in which leaden steam coils are placed. The crude article contains about twenty per cent of impurities, which are generally sulphates of ammonia, lime, magnesia and alumina, with chloride of iron, sulphur, etc. These are extracted by redissolving the crystals in lead lined tanks heated by steam, decanting from the impurities which have settled to the bottom, adding more carbonate of soda and recrystalizing. The result is refined borax, well known in the arts, being of a clear white color, resembling alum, of a sweetish, alkaline taste, slightly efflorescent on the surface. Sulphuric acid takes the soda from this salt when in saturated solution, leaving the boracic acid in white, shining, scaly crystals, which give to the flame of burning alcohol a greenish color—indubitable evidence of the presence of this article.

Large quantities of tincal or crude borax are brought to Europe, for refining, from the East Indies where it is collected by the natives as it exudes from the soil. It is generally in crystaline lumps, usually yellowish or greenish in color, feeling greasy and having a soapy smell, and is mixed with earthy matter.

A more lengthy account may be found in the "United States Dispensatory," which is in the library of nearly every physician and apothecary. If Mr. Lewis intends prosecuting his pursuit permanently, he would be abundantly repaid by taking a voyage to Europe. B. T.

Steam Traction on Canals.

To the Editor of the Scientific American

All other devices, except that of self-propelling of the vessel, seem to have been ruled out in offering inducements for an economical conveyance on canals. Notwithstanding this, why would not a wire rope, passing over drums located on the tow path and actuated by stationary engines at proper distances, answer the purpose? There would be two ropes, to which boats passing either way could be attached by means of a clip on the tow rope. The promoters of this style of power advertise to transmit from "one to 300 horse power, any distance." The last named power could certainly move 150 boats, seventy-five each way, of the usual capacity. It has long been considered unprofitable to exceed four or five miles an hour speed on canals. This could easily be attained in this way. Why would it not answer? The waste water of the locks might be used in many places. B. T.

TECHNICAL EDUCATION.—The Polytechnic Academy at Munich is frequented this winter by 900 students and non-inscribed visitors (*hospitanten*). The engineering class has the greatest number of pupils, namely, 346 students and 12 casuals. However, in the general class the casuals have a majority, being 115 strong. Of all visitors, 670 are natives of Bavaria, and 230 non-Bavarians, amongst whom are a great number of foreigners, particularly Russians and Americans. It appears that the South German and Swiss polytechnic schools at Munich, Stuttgart, Carlsruhe, and Zurich have greater attractions for these two latter nations than the North German technical institutions.

SCIENTIFIC AND PRACTICAL INFORMATION.

SICK HEADACHE.

Mr. James Lord, of Erie, Pa., writes, in reference to an article on sick headache published on page 128 of the present volume, to say that he has suffered much from this painful and distressing malady, and has, of course, tried many remedies; among these he mentions tansy tea, rhubarb, bathing in salt water, abstinence from fat and rich meats, etc. He found relief by the use of a bath of hot water, softened with carbonate of soda, taking the bath in a sitting posture and remaining in it for ten or fifteen minutes. This is the sitz bath, a favorite application of hydropathists, and is an effective means of allaying nervous irritation of any kind.

CONFLAGRATION AT JONES AND LAUGHLIN'S WORKS.

We regret to hear of a destructive fire which took place at the extensive iron manufactory of Messrs. Jones and Laughlin, Pittsburgh, Pa., on the 28th ult. This establishment is, we believe, the largest iron works in the United States, and the damage, which has only partially disabled the operations of the firm, amounts in value to $300,000. The enterprise and courage of the proprietors is characteristically exhibited by their determination to have the whole establishment again in working order in seventy days from the date of the fire, so that the employees (2,500 in number) of the firm will suffer as little as possible by the calamity.

PULVERIZED SOLID COD LIVER OIL.

The difficulty of overcoming the nauseating qualities of cod liver oil has attracted the attention of many pharmaceutists, among others of M. Tissier. He takes of white gelatin, 4 parts, distilled water 25 parts, simple sirup, 25 parts, refined sugar in powder, 50 parts. The gelatin should be heated, in a water bath, with the water and sirup till dissolved, the cod liver oil and sugar being mixed in a mortar; the two compounds should then be stirred together, and the stirring continued till the mixture is cold. It will then appear as a gelatinous mass, and powdered sugar should then be added till a firm paste is made, which, after being cut in small pieces, must be left to become so hard as to be easily granulated in a mortar. The second addition of powdered sugar will bring the quantity up to 250 parts, 20 per cent of which will be cod liver oil. It should be kept in a tightly stoppered bottle.

MINERAL CAOUTCHOUC.

A Parisian journal reports the finding, in Australia, of a mineral substance resembling caoutchouc in most of its characteristics. It contains 82 per cent of an oily hydrocarbon. We shall be interested in any further particulars of this discovery, as they may lead, on future investigation, to the production, by synthesis, of one more organic substance.

MERCURIC SULPHIDE.

A metallic substance, previously unknown to science, has recently been found in California, in Lake county. On analysis, it exhibits all the powers of mercuric sulphide, and is undoubtedly that compound, formed naturally. It has a metallic appearance, a dark gray color, and a specific gravity of 7 701. It is proposed to call it metacinnabarite.

UTILIZING SUBTERRANEAN FIRES.

The island of Ischia, off the coast of Naples, has for over two thousand years been a favorite resort of Italian invalids, on account of its hot sulphurous and other springs. This land was evidently thrown up by volcanic agency, and a large proportion of the soil is still kept at an abnormal temperature by subterranean fires. It is proposed to use this heat for the evaporation of sea water and the manufacture of salt, and the project seems feasible and likely to be a success.

ABSORPTION OF MATTER BY PHOSPHORUS.

The red amorphous phosphorus (not the red scales obtained by spontaneous sublimation, by the heat of the sun, in a Torricellian vacuum), possess a power, similar to that of porous carbon, of absorbing many substances without acting chemically upon them. Rosanilin, iodine, and sulphur are perceptibly taken up by the phosphorus. The powdered phosphorus, shaken up with the violet solution of iodine in bisulphide of carbon, or of rosanilin in ether, will take up the iodine or rosanilin and leave the fluid colorless; and the rosanilin may be recovered from the phosphorus by treatment with alcohol. Signor Testini recently published these facts as the results of personal investigation.

Hydrofluoric Acid on Glass Viewed Microscopically.

The hydrofluoric acid was prepared in the ordinary method, from calcium fluoride by the action of sulphuric acid. The solution was then diluted and kept in a lead bottle for use when required.

When the acid was first dropped upon the glass, no action was evident, the appearance presented being simply that of a drop of water on glass. In a very short time, however, the drop became a little duller, but this almost immediately cleared away, and several small particles, seemingly of glass, were seen floating in the drop. These seemed to be undergoing a process of fusion, the appearance being similar to that seen when a small portion of metal is thrown into some of the same substance in a state of fusion; it is tossed about for some time, and then finally disappears. This was what evidently appeared to me to be going on here, the hydrofluoric acid having apparently a solvent action on the glass. What strengthened this opinion was the presence of magnificent colors, changing every moment as these small portions of glass were liberated from the larger piece and were undergoing the process of solution, thus leading one to suppose they consisted of small glass prisms, the colors being more perfect than those obtained by water prisms, simply. Some of these particles were completely surrounded by a halo of color, as if they had been thrown into a variegated solution. The principal color evident in such cases was a deep green, but dark blue was also seen at rare intervals.

The above observations were repeated several times, and always with the same results, with the exception that the small particles of glass floating in the drop of acid exploded now and then, causing a great commotion in the liquid and throwing up little jets of finely divided acid, behaving as if the small glass particles were hollow spheres. I may also mention that when these explosions occurred, bright flashes of light were visible, resembling closely the appearance of rainbows seen in waterfalls.—*Microscopical Journal.*

Ignition of Explosives.

Interesting experiments were recently made by Messrs. Leygue and Champion, to ascertain the temperature at which certain explosives ignite. They used for this purpose a bar of copper, which was heated at one end only. It was provided with small grooves, placed 10 centimeters apart from each other, and provided with metallic alloys of different fusibility, so that the temperature of each part of the bar was easily ascertained. The substance under trial was then strewn upon the bar in small quantities, and the place where it ignited gave the temperature of ignition. Thus was it shown that, for their explosion, was required for:

	Deg. Cent.	Fahr.
Chassepôt percussion cap powder	191	374
Fulminate of mercury	200	392
Equal parts of sulphur and chlorate of potassium	200	392
Gun cotton	220	428
Nitro-glycerin	257	494·4
Chasse powder	288	550·2
Cannon powder	295	562·8
Picrates of mercury, lead and iron	296	564·6
Picrate powder for torpedoes	315	598·8
" " musket	358	676·2
" " cannon	380	715·8

These researches prove the great explosive power of fulminates and nitrite compounds, while our ordinary gunpowder and picrate powder may be employed with much greater safety.

Prussian Steel Field Guns.

It appears that the great artillery question, as to the best material for field cannon, has recently been decided in Prussia in favor of cast steel. The materials considered were ordinary gun metal, cast steel, cast iron, wrought iron, and phosphoric bronze, which latter alloy was repeatedly recommended for its great strength and tenacity. The large stores of old smooth-bore guns of gun metal in Prussia, and the enormous augmentation which they had received during the war, in the shape of captured French bronze ordnance, had to be taken under careful consideration, in order to utilize their value. The final decision, however, was in favor of steel, at at least for field pieces, and large orders have been received at Krupp's steel works, at Essen, while gun metal will be reserved for middle sized ordnance in fortresses only. The advocates of gun metal at the *Artillerie Pruefungs Commission* were not few, but steel remained the favorite, in spite of its very disagreeable property of getting brittle in great cold. Your correspondent had some experience as to this quality, when he commanded, during the late siege of Belfort, a battery of long cast steel 24 pounders. Though the guns were almost new, and handled with very great care, the cold was so intense, up to —16° R., or —4 Fahr., that after a fortnight's firing the sudden expansion had caused fine flaws, near the expanding ring which acts as a gas check. These flaws increased rapidly in size, and the cannon had to be readjusted. Under ordinary circumstances, the guns would have stood at least twice as long.—*Engineering.*

A NEW EXPLOSIVE.—A new explosive has been lately brought under public notice by Dr. Justus Fuchs, of Alt Berun, in Prussian Silesia. It is called fuiminatine, and is another kind of nitrite explosive. This new agent differs from dynamite in having a considerably larger contents of nitro-glycerin, and in the 25 per cent of silica contained by the latter being replaced by 15 per cent of a chemically prepared substance. This hitherto unknown substance is said to possess much greater absorbing power than *kieselguhr*, and, when ignited, to be almost entirely dissipated as gases, thus considerably augmenting the explosive effect. While all the silica of the dynamite is left as a white residue after explosion, fulminatine only leaves a little black carbonaceous remnant. The prices of both explosives are the same.

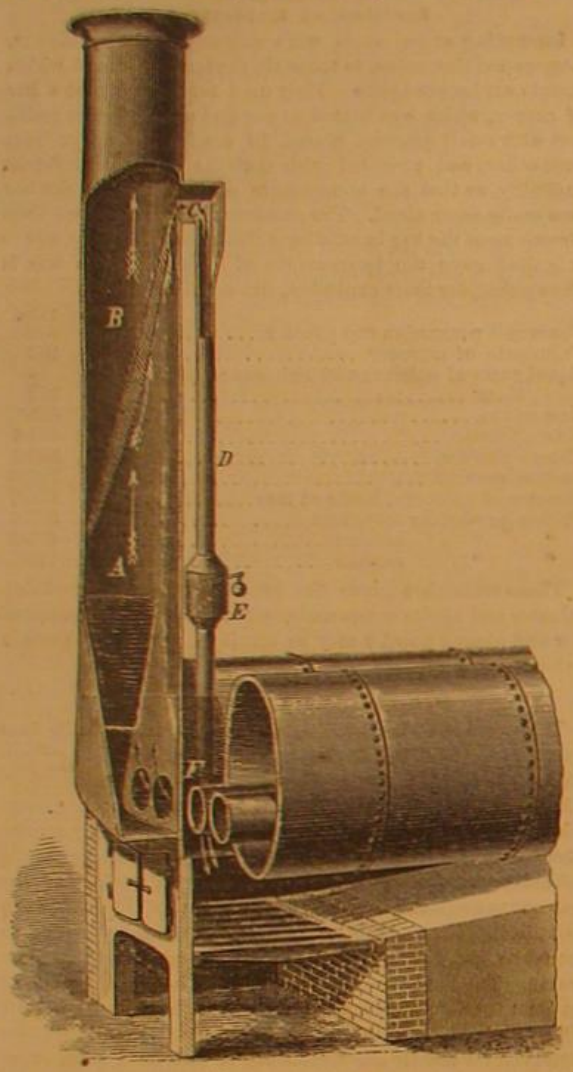
NITRO-GLYCERIN can be analyzed by means of an eudiometer, which is an instrument for ascertaining the quantities of certain gases in any given bulk of elastic fluid. Hydrogen and oxygen are introduced within the instrument after having first been carefully weighed, and a small quantity of nitro-glycerin is finally added. An explosion of the mixture is then effected by means of an electric spark. The gas produced within the eudiometer can then be readily analyzed, showing the following to be the constituents of nitro-glycerin: Carbonic acid, 45·72; binoxide of nitrogen, 20·36; nitrogen, 33·52.

A PLAN, to make all railroad cars throughout Germany of one pattern, so that repairs may be facilitated and prices equalized, has been proposed by a scientific association of railroads in that country. The question of "typical locomotives" has been thoroughly ventilated by the same parties, without favorable results. We doubt whether, aside from the practical side of the idea, the same could be successfully carried out, since it adoption would prevent sound competition and forbid the introduction of improvements.

BEACH'S SPARK CATCHER AND CONSUMER.

It is entirely unnecessary to say anything in reference to the value of a good spark catcher and consumer. So much property has been destroyed in dry weather, by sparks from chimneys and locomotives, that the lesson has been sufficiently enforced. Our engraving illustrates an improved device of this kind, which has, we are informed, been quite extensively adopted, and has given universal satisfaction wherever used, being found especially serviceable in connection with sawing and planing mills, and, where steam is used, for thrashing grain.

The arrester, B, is placed in the uptake, A, at an angle of 80° from the horizontal; it is of wire gauze, and cut of oval



form to correspond with the section of the uptake made at the same angle. While the smoke and gases of combustion pass freely through it, it stops the sparks, which are directed by the upward current along its under inclined surface through the opening, C, into the flue, D, leading downward to the fire box. Falling upon a counterpoised valve, E, they accumulate till they are dropped, through F, into the fire box, where they are consumed.

The lower part of the spark flue is contracted, as shown.

It is proper to say, however, that the counterpoised valve is only needed for stacks into which the steam does not exhaust, as when the steam exhausts into the stack it creates a downward draft in the spark flue, so that the valve, the office of which is to stop the upward current, may be dispensed with.

When the valve is used, it should be merely balanced, the best thing for the purpose being a cup containing shot. We regard this as a good invention and worthy the attention of manufacturers employing steam as a motor.

Patented November 8, 1870, by Darwin Beach, whom address, for further information, Oshkosh, Wis.

Connect your Lightning Rods with the Water and Gas Mains.

Mr. Henry Wilde, a distinguished electrician, recently read a paper, before the Literary and Philosophical Society in London, upon the inductive influence of gas and water pipes in determining the direction of a discharge of lightning. In the course of his remarks, he gave several very interesting examples of this inductive influence, in the case of churches and other buildings which were furnished with lightning rods which terminated, as they usually do, a few feet down in the earth. In these examples, when the lightning struck it had followed the rod until within a short distance of the gas pipes, and had then leaped from the rod to follow the superior conducting path offered by the pipes. He said:

In my experiments on the electrical condition of the terrestrial globe I have already directed attention to the powerful influence which lines of metal, extended in contact with moist ground, exercise in promoting the discharge of electric currents of comparatively low tension into the earth's substance, and also that the amount of the discharge from an electromotor into the earth increases conjointly with the tension of the current and the length of the conductor extended in contact with the earth. It is not, therefore, surprising that atmospheric electricity, of a tension sufficient to strike through a stratum of air several hundred yards thick, should find an easier path to the earth by leaping from a lightning conductor through a few feet of air or stone to a great system of gas and water mains, extending in large towns for miles, than by the short line of metal extended in the ground which forms the usual termination of a lightning conductor.

It deserves to be noticed that, in the cases of lightning discharge which I have cited, the lightning conductors acted efficiently in protecting the buildings from damage of a mechanical nature, the trifling injury to the church tower at Kersal Moor being directly attributable to the presence of the gas pipe in proximity to the conductor. Nor would there have been any danger from fire by the ignition of the gas if all the pipes used in the interior of the buildings had been made of iron or brass instead of lead; for all the cases of the ignition of gas by lightning which have come under my observation have been brought about by the fusion of lead pipes in the line of discharge. I have, therefore, recommended that in all cases where lightning conductors are attached to buildings fitted up with gas and water pipes, the lower extremity of the lightning conductor should be bound in good metallic contact with one or other of such pipes outside the building. By attending to this precaution, the disruptive discharge between the lightning conductor and the gas and water pipes is prevented, and the fusible metal pipes in the interior of the building are placed out of the influence of the lightning discharge.

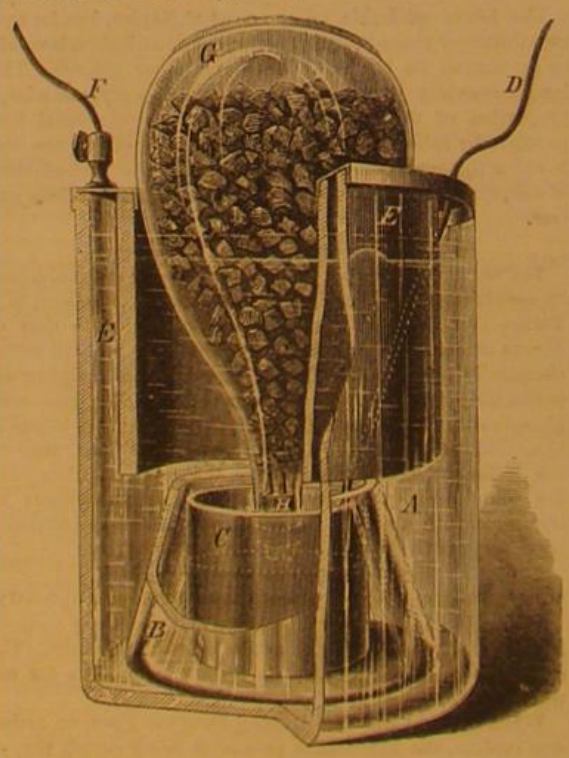
Objections have been raised, by some corporations, to the establishment of metallic connection between lightning conductors and gas mains, on the ground that damage might arise from ignition and explosion. These objections are most irrational, as gas will not ignite and explode unless mixed with atmospheric air, and the passage of lightning along continuous metallic conductors will not ignite gas even when mixed with air. Moreover, in every case of the ignition of gas by lightning, the discharge is actually transmitted along the mains, such objections notwithstanding. A grave responsibility, therefore, rests upon those who, after introducing a source of danger into a building, raise obstacles to the adoption of measures for averting this danger.

HIMMER'S ELECTRIC BATTERY.

On page 305, Vol. XXV., we gave a description of this battery without an illustration; we herewith give an engraving which will convey a better idea of the improvement.

A is the outside cup, containing and supporting all the other parts of the battery. Within the cup, A, is placed a smaller cup, B, of truncated conical form, which rests upon the bottom of A, and in which is placed the copper element, C, having the form of a thin hollow cylinder, to which the wire, D, passes. E is the zinc element, to which is attached a screw cup, for the reception of the wire, F.

The zinc element is cylindrical in form, and has an annular rim, which supports it from the top of the cup, A. A flask or bottle, G, of conoid form, is inverted, and supported by the internal edge of the rim of the zinc element, so that its neck enters the cup, B, as shown; the neck is supplied with a cork, H, having two glass tubes passed through it, the upper ends of the tubes being drawn down quite small, to prevent the dropping of the copper salt.



This flask is supplied with sulphate of copper, in crystals, and water, as shown. The outside cup is then filled with a solution of magnesium sulphate. The flask is then inverted into the position shown.

The water in the flask gradually dissolves the sulphate of copper which flows out into the cup, B, where, on account of balanced pressure, it can rise no higher than the ends of the glass tubes which pass through the perforated cork, H. That amount of the copper thus actually brought into contact with the solution of the sulphate will be active in the battery. The copper salt undergoes decomposition by electrolysis, its copper passing to the copper plate, which is thus thickened.

The zinc sulphate, which deposits outside of the cup, B, in the bottom of the exterior cup, A. The battery is thus only exhausted when the copper salt has been wholly decomposed, provided the zinc has not been wholly consumed.

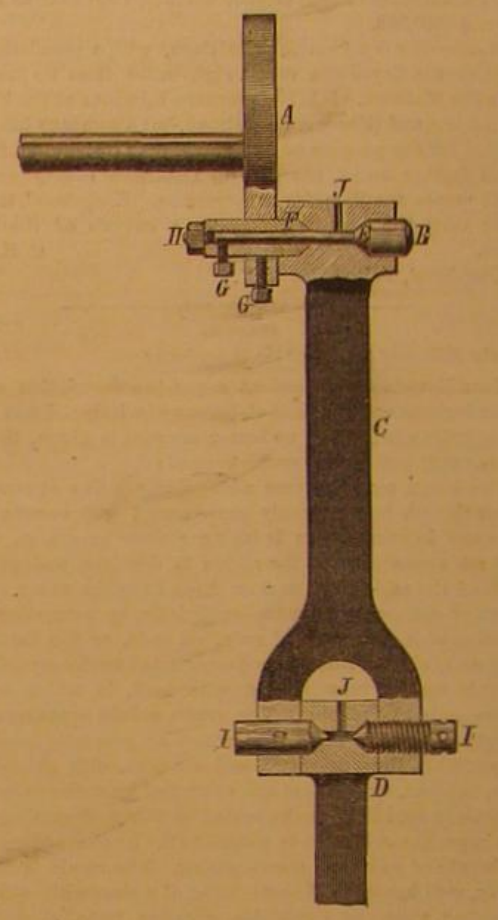
If, just previous to this period, the flask be removed and supplied with sulphate of copper crystals, enough of the solution of the latter will remain in the cup, B, to maintain the action of the battery during the process of filling, so that the duration of the action is practically limited only by the consumption of the zinc.

A battery of this kind has run for eighteen months without stopping, driving an electric clock during the period named. For all purposes where continuous and uniform action is desirable, it is doubtless an excellent arrangement.

Patented through the Scientific American Patent Agency Oct. 10, 1871. For further particulars, address Autenrieth & Himmer, 371 Pearl street, New York.

KETCHUM'S PITMAN CONNECTION.

Our engraving exhibits a method of constructing connections of pitmans, for harvesters or other machinery, so as to make and maintain a positive action therein, and prevent the



working loose of the parts. The construction obviates the jar consequent upon loose connections, and also affords ease in repairing, providing for ample and continuous lubrication and protection of the bearing parts from grit and dust.

In the engraving, A is the crank wheel, B the wrist, C the pitman, and D the connection of the pitman to the cutter bar or other reciprocating part of machinery.

The wrist consists of two parts, E and F, held from turning in their bearings by set screws, G. The inner end of F is conical, coresponding in form to the shoulder on E, opposite it. F also has a longitudinal hole, through which the smaller part of E passes and is secured by the nut, H, the turning of which takes up all the wear which may occur in the conical shoulders of the connection.

The connection of the pitman at the other end also consists of two conical pointed center bearings, I, one of which is held by a pin or set screw, while the other is screwed in to adjust the bearing and render the motion positive.

Oil holes, J, are formed in the pitman and cutter bar, in which oil being placed, the oil flows to the bearing surfaces as required. Thus noiseless and thoroughly lubricated bearings are secured.

We are told that a pitman of this kind has run in the shop of the inventor for four months, and the connections are as perfect as when first started, although the motion is excessively rapid. The improvement is applicable to eccentric pitmans, cut off valve rods, etc., in which great accuracy of movement is desired.

The invention was patented through the Scientific American Patent Agency, Dec. 12, 1871, by Amos Ketchum, of Estherville, Emmet Co., Iowa. Address as above for further information.

THE GREAT PYRAMID OF EGYPT.—At a recent meeting of the King's College Engineering Society, a paper by Mr. Jacob "On the Great Pyramid" was read. The author first gave a general description of the pyramid, as to its position, foundation, internal and external masonry, and the chambers and passages which it contains. He then propounded the theory originated by Mr. Taylor, of London, and which has been recently more fully developed by the Astronomer Royal for Scotland. This theory supposes the Great Pyramid to have been built for a standard of weights and measures, from the wonderful relations, existing in the dimensions of this stupendous structure, almost inexplicable on any other hypothesis.

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Contents:

(Illustrated articles are marked with an asterisk.)

An Asiatic Railroad 194
A Navigable Balloon 192
A New Explosive 197
Answers to Correspondents 200
Borax 197
*Bridge over the Mississippi, at Brainerd, Minn 191
Buckskin Leather and Glove Making 196
Business and Personal 200
*Car Doors 194
*Collecting and Removing Scums from Boilers 191
Connect your Lightning Rods with Water and Gas Mains 198
*Counterbalancing Saws and other Machinery 195
*Detection of Arsenic by Marsh's Test 193
*Determination of High Degrees of Heat by the Melting of Ice.. 195
Elastic Backing for Armor Plates. 196
*Electric Battery 198
Hydrofluoric Acid on Glass 197
Ignition of Explosives 197
Inventions Patented in England by Americans 201
Light versus Heavy Shafting 199
Meerschaum 193
Narrow Gage 194
New Books and Publications 192
Nitro-Glycerin 197
Notes and Queries 200
Official List of Patents, Extensions, Designs, etc 202
Oxalic Acid 197
*Pitman Connection 198
Prussian Steel Field Guns 197
Recent American and Foreign Patents 201
*Rotary Engines 191
Scientific and Practical Information 197
Small Pox Remedies 196
*Spark Catcher and Consumer.... 198
Steam Traction on Canals 197
Technical Education 197
The Electro-Magnetic Telegraph. 193
The Great Pyramid of Egypt 198
The Models in the Patent Office... 196
The Parkes Silver Extracting Process in Germany 193
The Problem of Flight 199
The Ostrich 193
*Wire Rope Tramway for Transporting Ores 195

THE ELECTRO-MAGNETIC TELEGRAPH.

We have had occasion of late to call attention to the brilliant discoveries of Professor Joseph Henry in electricity, of which one of the prominent results was the production of a practicable electric telegraph, the main features of which were adopted and introduced by Morse, upon whom so much of honor, fame, and wealth have been bestowed, and in whose renown we, in common with all his countrymen, justly take pride. But while we heartily rejoice in the worldwide, substantial celebrity that Professor Morse enjoys, we perceive no good reason why it should be deemed a detraction from his honors, to notice and praise the labors of those whose achievements preceded him in the same field.

The *Journal of the Telegraph*, we are sorry to observe, goes off into a spasm of indignation whenever the mere suggestion is thrown out that some other person than Morse may have had a hand in the production of the telegraph. In its last number, it also presents a recent opinion by Dr. L. D. Gale, formerly an examiner in the Patent Office, now advanced in years, who thinks that Henry is entitled to credit as the discoverer of a new *fact in science*, while Morse, by putting that fact into *a machine*, is entitled to be called the first inventor of the telegraph. According to the reasoning of Dr. Gale, it is the *making of the machine* that is of the greatest importance and entitles a man to the greatest honors. We wish we could have persuaded the old gentleman to think in some such way as this years ago, when he was in the Patent Office. He used then to say it was the principle of the invention, or the new fact in science, that was the grand point, not the mere form in which it was expressed, and he used to reject applications for patents unmercifully unless they contained a new principle. The editor of the *Journal* coincides with Dr. Gale's new way of thinking, and in an editorial article under the heading "What is Invention?" assumes that it is *not* the discovery of a principle of Nature, but it is the application and successful adaptation of the discovery to the production of novel practical results. Professor Morse himself defines invention as the combination of things known to produce a new effect. Still other definitions even more comprehensive might be given, although no one will dissent from those above mentioned as far as they go.

Assuming then, as all these gentlemen admit, that the invention of the telegraph consisted not in a fact in science, but in *the form of a machine by which telegraph signals could be communicated at long distances*, who was the inventor of the telegraph?

Whoever first made such a machine is, according to Dr. Gale and the *Journal*, and Professor Morse himself, the real and true inventor, and the man to whom they ought not to hesitate to do honor and justice. The following we believe to be undeniable truths in telegraphic history:

1st. That Joseph Henry was the first inventor and maker of the electro-magnet in the form substantially as now used in nearly all telegraph instruments, that of Morse included.

2nd. That this same electro-magnet is the motor or actuating power of nearly all electric telegraphs and other electric machinery, and without it they could not operate.

3d. That Joseph Henry was the first to discover that the use of the intensity current galvanic battery, in combination with his magnet, was necessary to produce a practicable electro-magnetic telegraph.

4th. That Joseph Henry was the first to announce, and to point out how to make, a practicable electro-magnetic telegraph instrument.

5th. That Joseph Henry was the first to construct and put into actual operation a practicable electro-magnetic telegraph instrument.

6th. That Joseph Henry was the first to construct and put into operation an electro-magnetic telegraph instrument in which his magnet and the intensity current battery were used in combination.

7th. That in 1831 an electro-magnetic telegraph machine was put into operation by Henry, and intelligible signals made by the movement of a bar operated by his electro-magnet, which latter he used in combination with the intensity current battery.

8th. That Henry's electro-magnet and a signalling bar working in combination therewith, and the use of the intensity battery in combination with the magnet (all of which improvements were discovered by Henry) constitute the essential features of Morse's and nearly all other electro-magnetic telegraph instruments.

9th. That Morse, in making his instrument, copied every essential part thereof from Henry's operating instrument, to wit: Morse copied, 1, Henry's electro-magnet; 2, Henry's combination of a signalling bar with that magnet; 3, Henry's use of the intensity current battery in combination with the magnet.

The real status of the case, then, as between Henry and and Morse, appears to be this:—Henry was the *first inventor* of the telegraph, and Morse was the *introducer of Henry's inventions*, and also a secondary inventor.

Those who object to this view of the case may ask themselves the following question:

Suppose Congress, in its wisdom, should see fit now to grant to Joseph Henry a patent for his electro-magnetic inventions of 1831, for the production of telegraph signals and other useful purposes: what would then become of the Morse instrument, which was not patented until 1840? The answer is plain. The use of the Morse instrument would be a clear infringement of Henry's patent, the Morse machine being a secondary invention.

Congress has already given us an example of its willingness to recognize at any time the real origin of important inventions, as evinced in its grant of the Page patent, for electrical devices, that had for years been in public use. Time works wonders, and it is not the most improbable thing in the world that the *Journal* will yet have occasion to assist in the support of a patent to Joseph Henry as the legitimate and first inventor of the Electro-magnetic Telegraph.

THE PROBLEM OF FLIGHT.

To dangle, helpless, from the tail of a gas ball is as yet the utmost extent to which "birds without feathers" have been able to successfully essay aerial navigation, unless we make an exception in favor of M. Dupuy de Lôme, whose machine we will allude to anon. Floating awkwardly passively, at the mercy of ever shifting winds, only able to descend or ascend by the rude methods of letting out gas or throwing out ballast, the balloonist sees birds skimming away with ease and rapidity at will, with or against air currents, and feels humiliated at the long list of failures which stand on record in the history of aeronautics.

By nature comparatively a slow moving animal, man has contrived ways to distance the fleetest land and marine creatures. He plunges boldly into the deep, moves about in it, or rapidly skims its surface; but in the atmospheric ocean, all he can yet do is to dive and float. The moment he disconnects himself from land or water, he loses the power of locomotion, and the power even to guide the motion of the bubble which supports him. Like the down of the thistle, he is tossed about by every capricious air current, thrown into the tops of trees, dropped upon desert wastes, or soused into water at the sport of wind sprites. Going up, he knows he must come down, but where he will alight, or whether he will come down easy, he cannot determine.

Aeronautical societies have been formed, thousands of devices have been tried and abandoned, yet man, who has ran sacked his resources, must still envy the birds that possess a power yet unattained by him. Is it beyond human skill to solve this problem?

There are many who still retain faith in the possibility of aerial navigation by the human race. We do not deny this possibility, but judging from past failures, it would, to say the least, seem remote.

Yet there is only one thing lacking. Could we guide a balloon by means independent of the winds, we could go where we wish through the air. In sailing vessels, the water floats us, the winds propel, and the rudder guides. In balloons, the air floats, the winds propel, but nothing guides.

On page 100, Vol. XIX, a correspondent of this paper made a suggestion which, we think, was at least a hint at one means of securing the long needed control over the course of balloons, though it could only be applied to balloons designed to traverse over water. He proposed to provide a balloon with a perpendicular mast extending through its central axis to some distance above and below the balloon proper. To this mast he would attach, at right angles, a spar which should extend to some considerable distance fore and aft of the balloon. From this spar he would extend ropes to a keel floating upon the water, which keel was to serve the two-fold purpose of ballast, rudder, and storage chamber for materials out of which to generate a fresh supply of gas, when needed to replenish the balloon.

Now we consider it more than probable that the machine, as described by our correspondent, would have added one more to the list of failures, had it been tried. There were faults in detail all too plainly evident, but the principle, of guiding a body floating in air by a device acting upon water, does not appear to us chimerical. In order to make use of one body guiding another, supported by still a third, it is necessary that the third body should be at rest, or moving with less velocity than the first. The suspended body, thus carried along by the suspending or supporting body at a higher speed than that of the guiding body, will, if brought into contact with the latter, be reacted upon, and have the direction of its motion changed according to the nature of the reaction.

This is precisely the principle of the rudder. The vessel moves faster than the water, and carries the rudder along at the same velocity, so that if the direction of the rudder be changed, it is reacted upon by the water, and the stern of the vessel is forced to the right or left according as the rudder is deflected.

Now if two balloons were attached to a floating keel that would prevent them moving to leeward (one balloon at each end of the keel), and the keel were supplied with a rudder to change its direction, and if between the two balloons were extended a spar and a sail of proper dimensions, we should have a machine that could be guided, and which, with a wind directly aft, would have to overcome only the resistance due to the displacement of water by the keel and the skin friction thereon. With a thin keel, the sum of these resistances would be small and a high velocity could undoubtedly be attained. With side winds, there would be but little drifting, and we think a fair rate of speed could be made, and that beating to windward might be successfully accomplished.

But if this principle cannot be thus successfully applied, there are perhaps other and better ways to accomplish the desired result, and we are confident this is the most promising direction in which to look for any immediate advance in aeronautics. We are not aware that experiments have been tried to test the feasibility of guiding balloons by the resistance of water, though it has been proposed to ballast them by floating weights.

It is stated that M. Dupuy de Lôme has made an application of a double screw and a rudder to the basket of a balloon, by which he can guide the entire machine to some extent. Glowing accounts have been published in regard to the success of the trial made with this machine, but the following statement, from the columns of a cotemporary, gives probably as full credit to the experiment as it deserves:

"The machine was brought head to the wind at a hight of about a thousand feet; but, although the screw was kept hard at work, the voyagers were taken northward in obedience to a southerly wind, very much as if they were in a balloon of the old fashioned sort. They landed at last, in safety, at Noyon in Picardy, and the trip is regarded as having proved that if M. de Lôme cannot sail with his 'air ship directly against the wind, he can considerably retard the usual progress to leeward, and possibly change the direction of progress so as to make it a few points more favorable than an ordinary balloon. This is something gained, although we should like more evidence as regards the alleged facts."

LIGHT VERSUS HEAVY SHAFTING.

Much as has been thought and written upon the subject of shafting, our observation leads us to believe there yet remains a great lack of general information upon it. The laws of transmission of power are, as a rule, well understood by professional engineers, but the majority of those who use shafting, in comparatively small establishments, have only a very imperfect comprehension of these principles. With a view to present them as clearly as we can to the comprehension of all such, this article is penned.

The transmission of power always takes place by pressure acting through distance. Time enters as an element in calculating the amount of power transmitted compared with some fixed standard, as the horse power, or 33,000 pounds raised one foot in one minute. Pressure may act for any length of time without the transfer of motion, and as motion or heat is always the result of transmission of power from one body to another, it follows that, by observing whether motion or heat (or both) take place, we may determine whether any power has been transmitted. A weight resting upon a fixed support exerts pressure, but transmits no power. A body moving in absolute space exerts no pressure, and consequently transmits no motion to any other body. Its velocity neither increases nor diminishes, unless it receives some impulse or check from contact with other bodies moving either faster or slower than *it* moves. Two bodies in contact, moving in space with the same velocity and in the same direction, exert no pressure on each other except that caused by their mutual attraction. Let the forward ball meet with resistance and instantly pressure is generated between the two balls, and the product of this pressure in pounds, multiplied by the distance in feet the resistance must be encountered, is the power which will be transmitted by one ball to the other, and from the latter to the resistance.

The elements of power referred to the above standard are, then, pressure, distance, and time. The unit of pressure is that equal to such action of gravity as is measured by a pound. We therefore speak of the unit of pressure as being one pound. The unit of distance is one foot. When any number of units of pressure is multiplied by a number of units of distance, physicists have agreed to give the product the denomination of *foot pounds*, which represents the work performed as compared with the unit of work, namely, one pound raised one foot against the action of gravity, or the *foot pound*. The elements of velocity are distance and time. The greater the velocity with which power is transmitted, the less will be the constant pressure required to transmit a given amount of power and perform a specific amount of work in a given time.

To sustain great pressure requires great strength, and increased strength of a given material having a specified form implies increased weight. Increased weight implies increased friction. It is, therefore, a theoretical fact proved in

practice that the heavier a line of shafting is, the greater will be the loss in friction during the transmission of power through it. It is also a fact that light shafting running at high speed will perform work that would break heavier shafting running at lower speed.

We have here a plain argument in favor of light shafting. In the application of these principles, however, we often see errors committed which tend to render some people skeptical as to their truth.

One of these errors is that light shafting is often not properly supported. The lighter the shafting, the more apt it is to spring by its own weight, the weight of pulleys and gears, and the tension of belts. Light shafting will require, therefore, more frequent support from hangers than heavy shafting. Besides, with high velocities, there is more fiddle-string vibration, aided by centrifugal force, which consumes more or less power, generally more than is suspected. The obviation of this also calls for frequent supports along the lines of shafting, with accurate fitting of couplings, journals and boxes, and as perfect alligament of the shafting as possible.

To keep everything in perfect order will also require constant watchfulness. Slight settling of buildings, springing of floors, from the placing of new and heavy machinery or other cause, alterations which cannot be prevented, will often throw a shaft out of line, no matter how perfectly it may have been hung.

A cognate subject is the size of pulleys. We reserve this for a future article.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Dry Steam, dries green lumber in 2 days; tobacco, in 3 hours; and is the best House Furnace. H. G. Bulkley, Patentee, Cleveland, Ohio.

Wanted—Parties to manufacture a newly patented Wrench Address Bradshaw & Lyon, Delphi, Indiana.

Improved Fruit Box. S. P. Tolman, Perrysburg, O., patentee.

Grindstones for Axe Manufacturers. Worthington & Sons, North Amherst, Ohio.

Right, for Sale, of a valuable improvement in Sad Irons. Address, H. W. Seaman, Millport, N. Y.

Williamson's Road Steamer and Steam Plow, with Rubber Tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1809.

Send Brick Machine Circulars to Box 6001, New York city.

Something New. Shaping Machine Attachment for Lathes. Wm. E. Cass, 61 & 63 Hamilton Street, Newark, N. J.

Edge tool Makers' Grindstones—J. E. Mitchell—Phila., Pa.

Bay Chaleur Grindstones, very superior—Mitchell, Phila., Pa.

Pattern Molding Letters (metallic), to letter or number the patterns of castings. All sizes. H. W. Knight, Seneca Falls, N. Y.

Parties letting steam power can have the amount determined, by the application of the Indicator. Address Richard H. Buel, Consulting Mechanical Engineer, 7 Warren Street, New York.

50 Hand Drilling Machines, the best in the market, for sale at half price, $30. Hoffman & Finney, 215 Water Street, Brooklyn, N. Y.

We want Ten more good Patents, of sensible, practical Tools, to manufacture in connection with our Star Tools. Will either buy, make on contract, or royalty. G. W. Hallett & Co., Star Tool Works, West Meriden, Conn.

Safety Steam Generators for Common Stoves. ½ to 2-horse, $25 to $100. A. D. Brock, Washington, D. C.

$5,000. The right party with Five Thousand Dollars can secure a profitable investment, without chance of loss, by addressing C. W. Hermance, Schuylerville, N. Y.

Nickel Plating.—For the best Apparatus and Solutions, apply to George W. Beardslee, 82 Fulton Street, Brooklyn, N. Y.

Wanted—Two good second hand engines and boilers, 10 to 15 horse power. Send description and price to Lane, Pitkin & Brock, Montpelier, Vermont.

Wanted—One first class Engine with all modern improvements, either new or second hand, from 150 to 200 Horse Power. Address Box 237, Buffalo, N. Y.

D. F. Shields, Auburn, N. Y., wishes to purchase two Carpet Beater Machines.

$3.00 Microscope sent prepaid for $3.00. Useful and amusing. Well worth the money. Frank Blockley, 552 Lafayette Av., Brooklyn, N. Y.

Wanted—A position as Superintendent or Agent of a Sash, Door and Blind Factory—12 years' experience. Good references. Address Agent, 50 State Street, Albany, N. Y.

For the best and cheapest Water Wheel Regulator "in all creation," address Sullivan Machine Co., Claremont, N. H.

Blake's Belt Studs. The best fastening for Leather or Rubber Belts. 40 000 Manufacturers use them. Greene, Tweed & Co., 18 Park Place New York

Manufacturers and Mill Supplies of all kinds. Greene, Tweed & Co., 18 Park Place, New York.

The "Safety" Hold Back for Carriages prevents runaway accidents. See Sci. Am. Feb. 24, 1872. Undivided Interest, or State and County Rights, for sale. Address N. W. Simons, Williamsfield, Ohio.

Lord's improved Screen or Separator—also Watchman's Time Detector. For particulars, address Geo. W. Lord, 232 Arch St., Phila., Pa.

Walrus Leather for Polishing Steel, Brass, and Plated Ware Greene, Tweed & Co., 18 Park Place, New York.

The Exeter Machine Works, Exeter, N. H., manufacturers of Sectional Boilers and Steam Engines, will soon open, in Boston, Mass., a centrally located sales room, in connection with their works; and are willing to take the agency of a few first class Machines and Tools not already introduced in that city.

Standard Twist Drills, every size, in lots from one drill to 10,000, at ¼ manufacturer's price. Sample and circular mailed for 25c. Hamilton E. Towle, 176 Broadway, New York.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin. $4 00 a year. Advertisements 17c. a line.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms $4.00 a year.

Enameled and Tinned Hollow-Ware and job work of all kinds. Warranted to give satisfaction, by A. G. Patton, Troy, N. Y.

For Circular of the largest variety of Wood Planing and Mitre Dovetailing Machinery, send to A. Davis, Lowell, Mass.

Rubber Valves—Finest quality, cut at once for delivery; or moulded to order. Address, Gutta Percha & Rubber Mf'g Co., 9 & 11 Park Place, New York.

Best and Cheapest—The Jones Scale Works, Binghamton, N Y

Grist Mills, New Patents. Edward Harrison, New Haven, Conn.

Taft's Portable Hot Air Vapor and Shower Bathing Apparatus Address Portable Bath Co., Sag Harbor, N. Y. Send for Circular.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

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

Belting as is Belting—Best Philadelphia Oak Tanned. C. W. Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

Boynton's Lightning Saws. The genuine $500 challenge. Will cut five times as fast as an ax. A 6 foot cross cut and buck saw, $6. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

Presses, Dies & all can tools. Ferracute Mch Wks, Bridgeton, N.J.

For 2 & 4 Horse Engines, address Twiss Bros., New Haven, Ct

Hydraulic Jacks and Presses, New or Second Hand, Bought and sold, send for circular to E. Lyon, 470 Grand Street, New York.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro, 414 Water st., N. Y

Presses, Dies, and Tinners' Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N. Y.

Over 1,000 Tanners, Paper-makers, Contractors, &c., use the Pumps of Heald, Sisco & Co. See advertisement.

In the Wakefield Earth Closet are combined Health, Cleanliness and Comfort. Send to 36 Dey St., New York, for descriptive pamphlet.

For Diamond Turning Tools for Truing Emery Wheels and Grindstones, address Sullivan Machine Co., Claremont, N. Hamp.

Boiler and Pipe Covering manufactured by the Chalmers Spence Non-Conductor Co. In use in the principal mills and factories. Claims—Economy, Safety, and Durability. Offices and Manufactories, foot E. 9th street, New York, and 1202 N. 3d street, St. Louis, Mo.

For Best Galvanized Iron Cornice Machines in the United States, for both straight and circular work, address Calvin Carr & Co., 36 Merwin St., Cleveland, Ohio.

Peck's Patent Drop Press. For circulars address the sole manufacturers, Milo, Peck & Co., New Haven, Ct.

Power Punching and Shearing Machines.
For car builders, smith shops, rail mills, boiler makers, etc. Greenleaf Machine Works, Indianapolis, Ind.

Hoisting Engines. Simplest, cheapest, and best. Send to John A. Lighthall, Beekman & Co., Office 5 Bowling Green, New York.

L. & J. W. Feuchtwanger, 55 Cedar St., New York, Manufacturers of Silicates, Soda and Potash, Soluble Glass, Importers of Chemicals and Drugs for Manufacturers' use.

New & Improved Bolt Forging Machines, J.R.Abbe, Prov., R.I.

Improved Foot Lathes, Hand Planers, etc. Many a reader of this paper has one of them. Selling in all parts of the country, Canada, Europe, etc. Catalogue free. N. H. Baldwin, Laconia, N. H.

Wanted, to correspond with owners of Patents—Picture Frames, Hangers, or other light metal work—view to manufacturing. Address H. J. Dorchester, 618 North Main Street, St. Louis, Mo.

Get your steam boilers and pipes covered with the best non-conductor in the world. Call for Circular. Asbestos Felting Company, 45 Jay Street, New York City.

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—MELTING ASPHALTUM.—Can you inform me of any process by which I can melt asphaltum economically?—H. E. W.

2.—CURE FOR RED NOSE.—Will some one be so kind as to tell me how to take the Bacchanalian hue out of my nose?—B. A. B.

3.—SCALE IN TEA KETTLE.—Will some correspondent inform me how to take the scale off an iron tea kettle, and how to prevent its accumulation?—D. E. S.

4.—HORSE POWER OF BOILER.—Will some one of your many correspondents give me a rule for computing the horse power of boilers?—D. A. M.

5.—MELTING POINTS OF PLATINUM AND CAST STEEL.—What degrees of heat are required to melt, respectively, platinum and cast steel?—J. A. H.

6.—FROSTING GLASS.—What is the best method of frosting glass for windows?—G. P.

7.—MAKING RULES.—How can I prepare shellac for this purpose, to make it waterproof and durable? With what can I black the figures?—J. E. M.

8.—COPYING PRINTS BY PRESSURE.—Is there any way of preparing paper so that, when pressed on a plate in a book of designs, it will copy the plate without damage to the book?—S. O. C.

9.—COLORING GOLD.—Will you please inform me the best method of coloring fine jewelry, and how the satin finish is produced?—J. L. D.

10.—PREPARING SKELETON.—Will one of your numerous correspondents inform me what chemical or other compound will eat the flesh from a dead animal, and leave the bones uninjured?—G. L. F.

11.—LAKE DWELLING RACES.—Will you please inform me where I can get any information about the prehistoric lake dwellers of Switzerland?—C.

12.—QUESTIONS IN OPTICS.—Does the power of a refracting telescope depend to any considerable extent upon the size of the object glass, or on the convex eye piece? Is the microscope affected by the shapes and sizes of similar lenses?—J. A. H.

13.—IRON IN WATER.—I have in my cistern an iron submerged pump which, I think, excels all others for doing good work. But the water tastes so strong of iron that we can hardly use it. Is it deleterious to health?—M. M.

14.—FUSIBLE METAL.—Is there not a composition, into which bismuth enters largely, which readily melts when subjected to heat? I believe the spoons, made for a trick, which melt on immersion in hot tea etc., were formed of such a substance. I wish to know its component parts, and how its fusibility can be regulated, and whether it is strong and will bear a tensile strain.—O. E.

15.—FLY PREVENTING WASH.—Can any of the readers of the SCIENTIFIC AMERICAN inform me if there is a wash, to be applied to a new ceiling (painted white), which will prevent flies from alighting on same?—A. H. S., Jr.

16.—BED BUGS.—I am unfortunate enough to live in a house that is full of bed bugs from top to bottom. The walls are full of cracks, and they are full of bugs. Is there any thing that can be put in white wash to kill them?—J. P.

17.—DEMAGNETIZING STEEL.—Will some of your readers tell me how I can demagnetize iron or steel without using heat? Some of my tools (jeweller's) have accidentally been magnetized, and it renders them almost useless.—J. B. W.

18.—DISINFECTING WATER.—Will some one suggest a mode of disinfecting a well of water made foul by leakage from bating vats of a tannery? The well is about thirty feet deep, twenty of which are blasted in solid rock. In blasting, fissures were made, and they are now filled with putrid matter from the vats, which consists of *excreta* from a hen house. We are anxious to have the well purified that it may be used for family purposes; the water was originally very good.—J. G. W. & N.

19.—BRASS FOUNDING.—Will some one please give me the process of melting and molding brass in small quantities? Will ordinary sand crucibles break in a blacksmith's fire, and are they the best for melting brass? I melted some old brass, and while melted, a light blue smoke arose from it, and one of its component parts seemed to pass off, leaving what I will call quite white ashes mixed with the remaining metal. What was the matter? The brass had some grease on it when put into the crucible. It seemed difficult for me to heat the metal hot enough to run freely. Is there any work on the subject in question?—D. G.

20.—MATERIAL FOR GLASS POTS.—I wish to know if there is any mixture that will resist the destructive properties of the flux of soda and lime in the manufacture of glass. At present we are using the German clay pots, but they wear at the top very fast. If a mixture could be produced to coat the inside of the pots with, they might be made to last three or four months.—D. F.

21.—PISTON PACKING.—Can some of your many readers inform me how to manufacture the best packing for the piston rod and valve stems of an engine?—C. E. S.

22.—CUT WORMS.—Will some of your readers tell me how to get rid of those pests the cut worms, that are so troublesome, in the gardens, to cabbage and lettuce plants?—D. U. B.

23.—SHELLAC VARNISH WITH LINSEED OIL.—I would like to ask if I can mix shellac varnish with linseed oil, and if so, in what proportions. The same question was asked by W. W. in No. 4, page 58, current volume, but has not been answered.—J. C.

24.—CLEANING TIN WARE.—What is the best preparation, in form of a powder, for cleaning tin ware?—P. T.

25.—CLEANSING SOAPY FELTS.—How can I get rid of the soap in a felt that has been fulled by soap? Is there any material for this purpose that I can add to the water while washing the felt?—W. H. P.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1·00 a line, under the head of "Business and Personal.

ALL reference to back numbers must be by volume and page.

A. D. O., of Tenn.—The black speck noticed by you as floating across the field of vision is probably nothing more than an air bubble in the fluid (tears) which lubricate the external surface of the eyeball. It is a thing of common occurrence, and will probably never give you any serious trouble.

O. G. O., of Ohio.—If you use artificial means to ventilate your dry kiln heated by steam pipes at the bottom, it will matter little where you draw out the saturated air. If, however, you depend upon natural circulation, you should give free admission of air over the surfaces of the heated pipes, and free egress at the top of the kiln. The kiln should not be so high that the air will cool much in making the passage.

SPEED OF CIRCULAR SAWS.—D. S. B., query 11, Feb. 3, asks for the right speed for a 52 inch circular saw. Seven thousand feet a minute for the edge of a saw is generally allowed to be the right speed.—L. C. K., of N. H.

SCENE PAINTING.—Y. R. can use any powder paint for this purpose, if he will grind it with a size made of isinglass. It should not be too strong, or the painting will look as if it had been varnished.—E. E. S. of O.

TEMPERING SPRINGS.—W. R. H. wishes to know how to temper trap and other springs. A very good way is to harden them in oil, or water not too cold; if in water, dip them in edgeways and hold still till cooled; and to draw the temper right, heat them gradually till you can see the red color come in them when held in the dark; and lay away to cool. I think steel is less liable to have cracks in it if hardened in raw linseed oil.—G. P., of N. Y.

PAPER FRICTION PULLEYS.—Query 13, page 154, present volume. These are nearly equal to iron, and better than any other material except that metal. They are made of bookbinder's tar board of gasket paper, the sheets being cut the size needed for the pulley, and firmly bolted together. The friction comes on the edges of the sheets, which soon glaze, and are almost as hard as iron.—B. T., of ——.

INCOMBUSTIBLE WHITEWASH.—In answer to query No. 1, January 27, 1872, I would give the following recipe for an incombustible wash. Slake some stone lime, in a large tub or box, with boiling water; when slaked pass six quarts of it through a fine sieve; to this lime add one quart of salt and one gallon of water. Then boil the mixture and skim it clean. To every five gallons of this mixture add one pound of alum half a pound of copperas, and, by slow degrees, three fourths of a pound of potash, and four quarts of white sand or hard wood ashes sifted. This solution will admit of the introduction of any coloring matter, and may be applied with a brush. It is more durable than paint.—J. A. H., of Kas.

PERMANENT PENCIL MARKS.—Query 10, page 154, Vol. XXVI. A very weak solution of gum arabic, passed over the drawing with a soft brush, will render pencil marks permanent.—B. T. of ——

SOOT IN STOVE PIPES.—Query 11, page 154, present volume. If your Iowa correspondent will raise up the bottom of his pipe, where it is attached to the stove, and burn it out by inserting half a newspaper saturated with coal oil, the soot will give him very little trouble. A pipe more than twenty feet long is thus cleared out in an instant. It should be done when there is very little fire.—R. T., of ——.

PRESERVING NATURAL FLOWERS.—R. A. L. can preserve flowers much better by drying and fastening them on paper than by using gum or paraffin. The flowers should be dried by putting several newspapers between each specimen, and keeping them under a very heavy weight until dry; the papers should be changed each day. To prevent insects, a little corrosive sublimate (chloride of mercury) should be added to the paste that is used to fasten them on the paper.—E. E., of O.

FACING OIL STONES.—I have tried sand paper, as described in your issue of March 2, 1872. I have tried both sand paper and emery paper glued to a face plate, revolving, but I have found none of these so effectual to the purpose as the following: Take a piece of iron with even or straight face (it ought to be planed); scatter a little emery or fine sand about as coarse as No. 1½ sand paper on the iron plate, add a little water and rub the face of the stone, renewing the emery or sand and water as requisites, finishing with an addition of water without emery or sand. This is the quickest and truest way, making the stone perfectly straight and occupying from five to ten minutes' time.—J. W., of N. Y.

TRUEING GRINDSTONE.—Query No. 2, March 2, 1872.—Trueing a grindstone by means of a gas pipe means to use the latter as we use a tool in turning. A piece of soft iron will do as well. It must be so long that the end may be held steady against the stone while the latter is in motion.—P. K., of N. Y.

COPAL VARNISH.—Query No. 3, March 2, 1872.—Pure gum copal, resembling amber in color and perfectly clear, should be selected. Break it in small pieces, and put it in an iron pot; a wrought iron is the best, as it will stand the heat. Melt the gum, over a coal, coke, or charcoal fire, slowly, taking care that it does not get hot enough to ignite oil of turpentine when the latter is poured in. The pot should be covered with a lid, having in it a hole sufficiently large to admit the stick for stirring. When the gum is melted, remove the pot away from the fire, that the turpentine may be added without danger of ignition. Pour the turpentine in through the hole in the lid, stirring the mixture all the while till it is of the proper consistency. The precautions against fire must be strictly observed, as the vapor of the turpentine is highly inflammable.—P. J., of N. Y.

SPLITTING OF HORSES' HOOFS.—In regard to E. E. G.'s inquiry about splitting of horses' hoofs, I would say: Let him use small nails for his horse shoes, and drive them more towards the toe than the heel of the hoof, and also have lips drawn on the toe of the shoe. There is no particular remedy for it; horses having white hoofs (called chalk feet) are more or less apt to have soft hoofs, and shoes are more liable to get loose on such hoofs. The best remedy I have found in twenty-eight years' experience is to let the animal go barefoot on a farm a whole season, and Nature will take care of it itself. If the horse is a roadster or very flat-footed, he should by all means be kept shod, with the nail holes not too close together in the shoes.—C. H. J., of Iowa.

E. P. W. sends us a specimen of mineral matter in very finely divided particles, and says: The inclosed powder was scraped from the bottom and sides of an iron kettle which has been used to hold filtered water. Can you tell me of what it is composed? Do you think it perfectly safe to use the water for domestic purposes? Also, how can lead be detected in water?—E. P. W. Answer: It is nothing but oxide of iron (rust); it does not contain a particle of lead. The water, so far as this sediment is concerned, is perfectly safe; but we would recommend something better to keep it in than an iron kettle. Sulphuretted hydrogen is the most delicate test of lead.

E. E. T., of Missouri, sends us a mineral specimen, and says: Will you be so kind as to tell me if the inclosed specimens are lead, silver, nickel, tin, iron, or any other metal? If so, what, and what is their value? Answer: The specimen you send is very pure galenite (sulphuret of lead), the source of the lead of commerce. It contains eighty per cent of the metal, and yields at the furnace seventy per cent. The smelting of the ore costs above $6 per ton. If the ore occurs in narrow veins, it may pay to assay for silver, as such galenite is usually highly argentiferous.

ASBESTOS PACKING.—I noticed in a late number of the SCIENTIFIC AMERICAN an article on the use of asbestos for packing steam engines, from which it appeared that the idea was a new one. A few days ago I came across an article in an old book of scientific lectures, published in 1829, in which it was stated that asbestos had been used for packing high pressure engines, but it gave nothing in regard to the manner of using or as to its success.—W. B. D. The earliest American patent that we notice connected with the use of asbestos for steam packing was that granted to William Peters, in 1802. In this patent, the claim rests upon the combination of asbestos with flax or other fibrous material, so as to form a steam packing.

COPAL VARNISH.—Query 3, March 2, 1872. Linseed oil is the principal solvent for gum copal. The best varnish is made from old oil which has stood for years and has deposited all its impurities and become defecated. The gum is also carefully selected, and both are mixed by heat. The more gum melted, the thicker the varnish, which is diluted in using with benzine or spirits of turpentine, the latter being best. The longer the varnish stands after making, without disturbance, the better, for all its impurities are deposited. Time and a large capital are necessary to make the best copal varnish, and so much depends upon skill, acquired by long experience in the business, that it will not be easy for an inexperienced person to make it even with the most minute directions. The best quality of varnish sells at $5 to $8 a gallon, and is probably ten years old.—B. T., of ——.

LIGHT ENGINES FOR SAW MILLS.—To NEMO, query 16, January 20. I have a ten horse thrashing engine, running a fifty inch Emerson's movable toothed saw, and have sawed over 4,000 logs and thrashed over 100,000 bushels of grain during the past six years. I think, with a practical sawyer and engineer, you would succeed. There are but few, of the many sawyers and engineers, who are competent to fill the positions they claim. From six to ten teeth in saw, with half an inch feed to each revolution in hard wood, will do; and your engine should be run as nearly as possible to one half the revolutions of saw, which should run 450 to 500 per minute. You will have no lack of steam if your boiler and engine are properly proportioned, using your steam expansively and keeping the piston packing snugly out, filling the cylinder. I cut from 2,000 to 4,000 feet inch lumber per day.—J. P. A., of Ill.

HYDROGEN LAMP.—L. G. G. can construct a hydrogen lamp as follows: Introduce into a suitable jar (of bottle glass or earthenware) a small quantity of sheet zinc, or, in the absence of zinc, scraps of iron, nails, etc., cut in small pieces, together with water sufficient to cover the same and to the depth of half the jar. Then add a small quantity of strong sulphuric acid, and the evolution of gas immediately commences. By inserting, into the mouth of the jar or bottle, a close fitting cork perforated with glass or metallic tube, the gas will be ejected in the form of a jet, which, being directed on a piece of platinum sponge, instantly ignites, and the hydrogen lamp is finished. Particular care should be taken (until the atmospheric air is forced out of the jar) not to ignite it; if you should the consequence would be a violent explosion. The above mentioned process is the simplest way to construct the lamp; but if L. G. G. wishes something nicer and more complete, he should get a Doebereiner's inflammable lamp from a maker of philosphical and chemical apparatus.—E. X., of Mass.

CLEANING GUTTA PERCHA.—Query No. 12, March 2, 1872.—This can be done by using a mixture of soap and powdered charcoal, polishing afterwards with a dry cloth with a little of the charcoal on it.—P. J., of N. Y.

Detective Pinkerton's Last Case.

The well-known vigilant and moral guardian, Allan Pinkerton, spies out "cases" as quickly and as correctly as the sharpest of the lynx-eyed fraternity of which he is the acknowledged head and king. He is as keen at detecting true merit as he is criminality, and he has now made a strong point, professionally, in the case of the HERRING SAFE. Six of Pinkerton's safes went in the fiery ordeal at Chicago, *but only two came out, and these two were Herring's;* the other four (not Herring's) were burned to ashes; therefore, Pinkerton may well say: "*I shall in future use none but Herring's Safes.*"—[N. Y. Day Book.

Examples for the Ladies.

MRS. J. R. BOWEN, Wellsboro, Pa., has used her Wheeler & Wilson Machine almost constantly since 1859 on all kinds of material, without any repairs or personal instruction.

MRS. T. M. SCULLIN, Troy, N. Y., has used her "dear friend," a Wheeler & Wilson Machine, since 1858, in dress and cloak-making. The last six months she earned $332, and the year before, $417.

To Cure Asthma.—Whitcomb's Remedy acts more directly than any other known panacea.

Watch No. 1105, Stem Winder—bearing Trade Mark "Frederic Atherton & Co., Marion, N. J."—manufactured by United States Watch Co., (Giles, Wales & Co.,) has been carried by me eleven months; its total variation from mean time being only seven seconds in the entire time.—A. H. KING, Vice-Pres't Elastic Cone Sp'g Co., N. J. Car Sp'g & R. Co.' 7 Park Place, New York.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

COMBINED WARDROBE AND BEDSTEAD.—John A. Morgan, Bloomfield, Iowa.—The invention consists in a new way of combining a wardrobe and bedstead so that the latter can be pushed in and folded up within the former, while the wardrobe can be aired, as well as made to receive a writing desk, glass and drawers on top.

WASHING MACHINE.—James E. Connolly, Dublin, Md.—The invention consists in a washing machine that embodies a new mode of rubbing the clothes between cloth-flapped rubbers which constantly retain them in the most eligible position for receiving friction and for allowing the water to percolate therethrough. It seems to be peculiarly well adapted to family use, and supplies a want which has long been felt by the public.

RAILROAD CHAIR.—J. C. Wands, Nashville, Tenn.—The invention consists in a new mode of fastening chairs to railroad rails, so as to give both a perpendicular and lateral pressure upon the rail. This serves the double purpose of a fish bar and chair, and prevents either end of rail from getting higher than the other. The rail is also, by this device, debarred any movement whatever, except the longitudinal play which is necessary for expansion and contraction.

HYDROSTATIC WEIGHING MACHINE.—Frederic Eliot Duckham, of Millwall, Middlesex, Eng.—This invention relates to improvements in weighing apparatus in which a cylinder containing water or other liquid is employed, the weight of the goods being ascertained by the pressure of the piston on the liquid indicated on a pressure gage suitably attached. The object of the invention is to provide a portable apparatus for ascertaining the weight of materials in general, and more particularly heavy goods, during shipment or otherwise, it being also applicable for denoting strains on chains and for other similar purposes. The improved apparatus consists of a smooth bored cylinder, in which is fitted a piston and rod, made watertight by means of cupped leathers or other suitable packing. The apparatus or cylinder is suspended by means of a suitable stirrup piece or sling connected to a link from a crane, or in other convenient position. The goods to be weighed are suspended from the center of the piston by means of a piston rod which passes through a suitable watertight gland or packing in the bottom of the cylinder, and to the lower end of which the goods to be weighed are attached. A pressure gage, preferably that known as the Bourdon gage, communicates as usual with the liquid in the cylinder for the purpose of indicating the degree of pressure on such liquid, or, in other words, the weight of the goods suspended, or the amount of the strain applied. Instead of employing a central piston rod passing through the bottom of the cylinder, the goods may be suspended by means of an inverted stirrup piece, similar to that by which the apparatus is sustained, and which is passed over the top of the piston and down through guides placed on the outside of the cylinder, below which it is united in a link to which the goods may be attached. In this case, the top of the piston should be rounded and made sufficiently large to project slightly over the top of the cylinder. Instead of suspending the apparatus by means of a sling or stirrup piece, as hereinbefore described, it may be mounted in gimbals or trunnions supported by a bracket or shelf, or the apparatus may be bolted securely thereto, the goods being attached as previously described. When employed to denote strains and for other testing purposes, the cylinder is attached in a vertical or other position, and tension applied to the piston rod or stirrup piece, the strain being denoted on the pressure gage as before.

BUGGY TOP.—Robert Bower, of Lima, O.—This invention relates to a new extension joint iron for carriage or buggy tops, and, also, to a new shifting rail for the same. The extension joint has a projecting bracket by means of which it can be connected with the upright joint or disconnected at pleasure. The shifting rail has an oval headed bolt which connects it with the seat iron and is locked by a spring lever, by which it can also be turned to release the rail from the seat.

BAILS FOR KETTLES, BOILERS, ETC.—William M. Stratton, of West Troy, N. Y.—This invention has for its object to improve the construction of boilers, kettles, etc., so as to place them more fully under the control of the person handling them, enabling him to handle them with ease and safety; and it consists in the bail so constructed as to become rigidly connected with the body of the kettle or boiler, when the weight of said vessel is upon said bail, and to become like an ordinary bail when the weight is taken off said bail. The bail has end slots and shoulders combined with the kettle body, having lugs and notched, shouldered, and curved flanges by which, when the bail is raised, it forms the rigid connection above specified. This is an ingenious and very useful improvement.

AWNING SLIDE.—Thomas F. Darcy, New York city.—The invention consists in slide rods, which are attached to the window casing, and upon which the frame of the awning slides up and down, there being a base rod or frame to which the awning is attached. The slides are screwed upon or otherwise attached to the ends of the base rod. The slides project upward at an obtuse angle, and have a hole formed in them for the passage of the slide rods; said hole being made wider at its lower part. This construction of the slides enables the base rod to be turned up, so that its side arms may be parallel with the slide rods, and to slide up and down upon said rods. This construction also, when the awning is lowered and extended, causes the slides to grasp the slide rods, and thus causes the awning to be held steadily by its own weight, so that there can be no shaking and rattling.

QUILTING FRAME.—Robert J. Gillham, Columbia, Tenn.—This invention relates to a mode of adjusting the movable parts of quilting frames, whereby, it is claimed, they are made more convenient and useful than they have hitherto been. By the arrangement employed, the side rails and rollers may be used without the end bars, should the latter be in the way.

CUT-OFF FOR WATER PIPES.—Francis H. Goddard, of Omaha, Nebraska, assignor to himself and W. T. Warner, of the same place.—This invention has for its object to furnish a simple and convenient device for changing the direction of liquids and other materials usually delivered through pipes by gravity—as, for instance, for transferring or changing the direction of a liquid from a pipe leading to one cistern to a pipe leading to another cistern, for discharging the water used in rinsing off a roof, outside of the pipe before the water from the roof is allowed to flow into the cistern for cutting off the water when the cistern becomes full—and for other uses where the direction of a substance passing through a pipe or spout requires to be changed; and it consists in a hinged joint and rocker, constructed and operated in connection with a single or branched pipe or spout.

FEED WATER HEATER FOR STEAM BOILERS.—Gregory M. Mullen, Baltimore, Md.—This invention consists in so combining the engine of a sea-going ship and a donkey engine with a system of pipes that sea water may be economically and conveniently intermixed with the boiler water before it passes through the feed pipe; and that too whether the vessel is at sea or in port.

WATER ELEVATOR.—John L. Burch, Franklin, Tenn.—This invention relates to an endless chain water elevator of simple and convenient arrangement of parts whereby it may be readily taken apart for transportation or more easily placed in or removed from a well than others heretofore employed.

HAY MOWER, OR APPARATUS FOR HOISTING AND STOWING AWAY HAY OR LONG FEED.—Samuel K. Paden, Pulaski, Pa.—This invention consists in a rail for supporting the hoisting apparatus, formed of a light strip of wood braced by a lapping strip of iron on top and bottom, and clamped firmly at each end. This is cheap, easily handled, and withal very strong. It also consists in combining a pulley lock and carriage lock with the same pivoted bolt, in such a manner that one is automatically unlocked as the other is locked.

HORSE HAY FORK.—Samuel K. Paden, Pulaski, Pa.—This invention consists of two arc shaped forks, having concentric shanks provided with lever arms. The shanks themselves fold on the forks while the lever arms fold on the shanks. It appears to be a very convenient and useful improvement in implements of this class.

RAILWAY TRACK CLEANER.—Alexander Blakely, Fairfield, Iowa.—This invention consists in removing the sand which is spread in front of locomotive wheels to produce traction, by means of a brush arranged in rear of the hindmost drive wheel and rotated by said wheel. This brush is raised or lowered and held to or away from the track by simple and convenient mechanism.

PULLEY AND WHEEL FASTENER.—Augustus Newell, of Chicago Ill.—This invention has for its object to furnish a simple and reliable means of fastening pulleys and wheels of suitable kinds to shafts or axles. It consists in the use, for that purpose, of a split, conical, tubular screw, which, by means of a nut, is clamped to the shaft, and crowded against the inner edge of the wheel or pulley. By the use of this improved holder pulleys may be secured entirely concentric, which heretofore was exceedingly difficult, and almost impossible. Wooden pulleys may also be secured upon shafts, as well as those made of metal.

SAND PAPER HOLDER.—John D. Gernez, New York city.—This invention has for its object to furnish an improved device for holding sand paper while being used, which shall be so constructed as to hold the sand paper securely, and at the same time in such a way that it will not injure the fingers of the operator, and may be shifted as it becomes worn, so that all the paper may be used up. A cork block, with a recessed and slotted hand piece, flanged end plates, shaft, crank or crank wheel, hand locking nut, and pivoted clamp bar, combined with each other, to adapt them to receive and hold a strip of sand paper, are the features of the invention.

LATCH.—J. Hyde Fisher, Chicago, Ill.—This invention has for its object to furnish an improved lever latch and handle, designed especially for refrigerator doors, but which may be used with advantage upon closet and other doors, and which shall be so constructed as to take up the wear, holding the door at all times tightly closed. It consists in a latch, a hinged bar or catch and a rubber block and its holding socket, combined to operate as specified.

CARRIAGE WHEEL.—Alexander M. Ocobock, Toledo, Ohio.—This invention consists of a pair of metal collars for fitting on the wood hub and clamping the spokes at the edges, the spokes being arranged alternately right and left, or "dodged," which collars have recesses or projections with undercut faces, and each receives the alternate spokes in its recesses, while the other spokes fit in the recesses of the other, and the projections of one collar bear against the spokes in the recesses of the other in such manner that each spoke is clamped between a projection of one collar and a recess of another. The spokes are so dovetailed as to prevent them from working out; and the spaces between each two spokes circumferentially are filled by the projections.

IRONING MACHINE.—Anson G. Gardner, Troy, N. Y.—This invention consists in a heated smoothing wheel, swinging over the ironing table in a plane parallel with it, and rolling on the goods to be ironed when moving forward, but sliding on them when moving back to do the smoothing, the rotary motion being arrested when the backward swinging motion begins; but the wheel may revolve continuously, if desired. In ironing small articles with this machine, two attendants can be kept busy, one on each side, each applying and removing the goods as the wheel recedes from him. In this respect, the machine is claimed to be better than those in which the table or bed oscillates or reciprocates, and is not always in the right position for the attendant.

LEADER BRACKET.—Stephen J. Dwyer, Albany, N. Y.—This invention has for its object to furnish an improved bracket for leaders or conductor spouts, which shall be simple in construction, conveniently applied, and reliable in use. It consists in the construction and combination of a spike having a slotted arm, formed upon its outer end to adapt it to receive a band and wedge.

WATER CUT-OFF.—John W. Burkholder, of Rushford, Minn.—This is an improved filter for attachment to rain water leaders or conductor pipes, so constructed as to allow the first water from the roof to run off into a waste pipe, and then adjust itself to receive the rest of the water and conduct it into the cistern or other receiver. A combination of a short pipe, pivoted oscillating pipe, weight case, water case, small pipe, and wire gauze filter with each other, said parts being constructed and operating in connection with each other in a peculiar manner, constitute the claim on which a patent has issued.

FASTENER FOR MEETING RAIL OF SASHES.—John B. Whitney, New York city.—This invention relates to the class of locks used for fastening the sashes of windows together, for preventing the raising of the lower sash or lowering of the upper sash; and consists in a fastening bar and spring, constructed and arranged to operate in the lock shell. The spring operates to force the bar longitudinally, so that the shank of the knob will enter the recess, and thereby lock the bar so that it cannot be moved by a knife blade or other thin instrument inserted between the sashes from the outside. When the sashes are thus locked the bar cannot be moved, except by first pressing the knob either inward or outward, thus rendering the fastening secure.

CORN HUSKING AND SHELLING MACHINE.—Alexander Lane, of Moscow Ky.—A feeding spout is used, suitable for introducing the ears of corn with the husks on, through the case to the interior, so as to hang down by the side of a rotating disk, which carries knives for pulling or cutting off the husks, the ears being prevented from falling from the spout beyond the disk by a roughened or notched spring hanging down in front of and below the end of the spout, and by the side of the disk, so as to receive the ends of the ears and cramp them across the end of the spout, and press them against the end of the disk, until they are forced from the spout by those thrust in behind them by the attendant. A guard also holds the ears against the face of the shelling wheel after the husks are removed, and this wheel removes the grain from the cob, being assisted, somewhat, by the disk and the knives thereon, against which the ear is caused to bear by the oblique face of a wheel which descends toward it. The shelled grain, husks, and cobs, fall upon a screen which is shaken by a fan shaft, crank, and connecting rod, the said screen being suspended on rods, so that it may swing to and fro. The grain falls through the screen into a cavity, and escapes through a spout, while the chaff, cobs, etc., are blown out through a passage by a fan. Three or more sets of these husking and shelling wheels, and the spouts and guards therefor, are placed in one case, to be driven by one set of gear.

ANIMAL TRAP.—Hudson H. C. Arnold, Burlington, Kan.—This invention has for its object to furnish an improved trap for catching rats, mice, moles, etc. In setting the trap for moles certain parts are detached. The soil thrown up by the mole is smoothed off level with the surface of the ground; the trap is then placed longitudinally in the passage way of the mole, and a bait hook forced down into the said passage way. The trap may be secured in place when adjusted by passing a rod down in the ground through holes in the frame. With this arrangement, when the mole finds his passage way obstructed by the end of the lever, he attempts to remove it, which springs the trap, and the pointed rods are forced into or through him.

STEAM PUMP.—Samuel Stanton, New York city.—This invention relates to improvements in valve gear for steam pumps; and it consists in a novel arrangement of apparatus for setting and tripping a couple of springs, by which the valve is shifted; the object being to provide a liberating apparatus in connection with a direct acting steam pump, whereby the whole movement of the valve in either direction can be effected instantaneously at each end of the stroke, and that the valve so liberated will be instantly shifted throughout the whole extent of its movement. To effect this, a combination with the valve, which is balanced, of notched spring pins, tappets, shaft and crank or cam, and also notched spring rods, combined with a toe and a slide provided with two inclines and slot, and operated by the piston rod, are employed, and covered by the claims allowed in the patent.

ELECTRIC CLOCK.—Elisha Wilson, Elizabeth, N. J.—This invention relates to a new mechanism for transmitting motion from the vibrating pendulum of an electric clock to the train of wheels that connects with the hands; also, to a new arrangement of compensating pendulum magnet and compensating coil. The invention consists, first, in providing the lever, which is directly vibrated by the pendulum, with a projecting stop, that extends directly toward the ratchet wheel of the works, and holds the same arrested after every motion imparted to it by the pawl. The invention also consists in the use of a simple and adjustable rest for the pawl, whereby it can be set to take into a suitable desired number of teeth at every stroke. The invention also consists in the arranging the parts of a compound permanent magnet on the pendulum in two or more consecutive polar sections, both to increase its magnetic force, and also to obtain an automatic compensating arrangement; and in the application of different metals at the contact of breaking points of the electric circuit.

CLOTHES WRINGER.—Joseph S. Maughlin and William C. Marr, of Onawa, Iowa.—This invention has for its object to furnish an improved machine for wringing clothes, which shall be simple and compact in construction, convenient in use, and effective in operation in either capacity; and it consists in the construction and combination of various parts, upon which five claims have been allowed in the patent which has been issued to the inventors.

DITCHING MACHINE.—Jordan W. McAlister and John C. Poffenberger, of Jacksonville, Ill.—This invention consists of a plow, an elevating wheel, guide, and discharging spout, all mounted on a truck by means of a vertically adjustable frame, and arranged in such a manner that the furrow slice is turned into the wheel at the side and carried by its rim and buckets thereon up past the fixed guide, which keeps it from falling out to a point above the axle, where it falls from the wheel and is received by a spout which conducts it to the bank at the side of the ditch. The machine is run back and forth along the ditch, the elevating wheel running in the last furrow made, while the plow makes the one at the side deeper, thus working the ditch to a depth of about three feet, for which a wheel of about seven feet diameter will be required. It will be understood that the wheel is allowed to rest with its whole weight on the surface of the ground when the first furrow is being turned, and subsequently at the bottom of the furrow set turned; and, since the plow necessarily always runs deeper than the wheel, it follows that every furrow slice after the first will be double the thickness of the first. In order to dress the vertical walls of the ditch better than the land side of the plow will do, a cutter is placed on the heel of the land side to dress off an inch or more of the land, as the heel of the plow passes, and deposit it in the bottom of the furrow to be turned up with the furrow slice at the next round. This seems a very simple and effective machine.

SHINGLE MACHINE.—Jerome V. Gue and George I. Anderson, of North Western, N. Y.—A large horizontally revolving saw is mounted at the center of a suitable frame, on the top of a mandrel. The carriage carries a bolt at each end, and feeds one up to the saw at one side at the same time it is moving the other away at the other side, the said carriage being arranged over the saw, and carrying the bolts above it as the shingles are cut off the under sides and discharged down chutes. This carriage is wide enough to receive the bolts endwise between the sides and holding dogs, one of which is permanently fixed on the carriage, and the other is part of a long bar, pivoted to swing toward and from the fixed dog for engaging and releasing the bolt. It is pressed against the bolt by a spring, and away from it by its inclined end acting on a stud pin, just previous to the end of the movement of the bolt away from the saw. This releases the bolt at the ends, and lets it fall upon a frame which stands as much below the saw as the thickness of one shingle, so that the falling of the bolt on said frame sets it for the next cut. The bolt is confined again between the dogs as soon as the carriage moves backward. In order to shift the bolts for alternately cutting heads and points, suitable mechanism is employed. It is claimed that by this plan the feeding and setting apparatus is rendered extremely cheap.

COCK.—Thomas Prosser, of Brooklyn, N. Y.—This invention consists in a combination of an elastic packing ring with a stem, having an enlargement arranged for closing with said ring, when the valve is opened to prevent the escape of water through the gland. The essential object of this device is to have a practicable self closing cock, and thus guard against wasting of the water and damage by flooding the rooms when accidentally left open. It is alike useful for barrels, casks, and the like, but it is mainly designed for use on water service pipes.

BRACED CHAIN.—George H. Edwards, of Lanark, Ill.—This invention consists of a braced chain, to be used for endless carriers and the like, in which two sets of links and braces connecting them are used, one set of links being jointed together in the ordinary manner, and the others having one end slotted for the joint pin to allow the chain to contract for going around the drums. The two sets are connected by the braces, which are connected to the joints of each set of links in pairs by the pins which connect the links, but the braces connected at one end are connected in like manner at the other end to members of two other pairs in a manner to be diagonal to the chain of links.

IRON FENCE.—Oscar Wilson, of Middleburg, N. Y.—The posts are iron rods, the lower ends of which are leaded into stone blocks set in the ground. The horizontal rails, two or more of which may be used, are narrow and thin or round iron bars or rods. They are secured to the sides of the posts by links which pass around the posts and through slots in the bars and are secured in place, clamping the bars securely to the posts by wedge keys driven through the end of the links across the outer side of the bars. The sides of the posts are flattened or notched to receive the rails so that the shoulders or sides of said notches may hold the rails from slipping up or down. The ends of the rails that meet and overlap are halved with square ends and shoulders, so as to support the said bars or rails from sagging, and thus stiffen the fence. In the rougher and cheaper styles of fence, the ends of the bars need not be halved, but may be simply overlapped. The uprights or pickets are preferably iron rods bent into a U-shape. The arms of the uprights or pickets are secured to the rails by links which cross the rails, and the ends of which are bent at right angles across the edges of the rails to receive the pickets which pass across the other side of said rails. By this construction, the links are made to clamp the pickets firmly by forcing the opposite ends of said links toward each other. There are also braces, the lower ends of which are leaded into blocks of stone set in the ground. They are made of iron rods, and their upper ends are bent inward and have eyes or loops formed upon them through which the posts pass, and are secured to said posts after the fence has been plumbed by wedge keys driven through said eyes or loops along the sides of the posts. The corner posts, gate posts, or any desired number of the posts, may be inclosed with a box or case which is made of iron and in two parts. The adjacent edges of the box or casing are notched to receive and fit upon the rails. An ornamental cap or top is added, the base or shank of which is made larger or of dovetail form to fit into a dovetail space or recess formed between the upper ends of the parts of the box or casing.

COTTON AND HAY PRESS.—Adam W. Clarkson, of Due West, S. C.—This invention consists in combining the follower of the press with toggle levers, and with sliding side pieces, and with an operating capstan. When rotary motion is, by suitable means, imparted to the capstan, so that it will actuate the ropes or chains, the follower will, by the expanding toggles, be forced to compress whatever is between it and the fixed end piece. After a bale has been thus formed, the sides of the press can be withdrawn, the bottom and top also opened, and the bale tied.

BRAKE SHOE.—John S. Whitworth, of Norfolk, Va.—The arched block or body of the brake is made of wood or other material, with a concave outer or brake surface. The cast metal shoe for holding the block is made with a back plate curved to fit the convex back of the block, and with projecting side flanges which embrace the sides, and with a projecting lip, at the lower part, supporting the lower end of said block. The shoe is in suitable manner fastened to a beam or other device. An angle iron, as wide as the shoe, is fitted into the upper part of said shoe so as to be on the upper end of the block, and is, by a bolt, fastened to the shoe. A nut, which is applied to the bolt for securing it, may be locked by a pin or ring drawn through the end of said bolt. The flanges at the sides of the shoe are recessed to admit the lower plate of the angle iron, and aid thus in holding the latter in place. Thus fastened by means of the angle iron, the block is securely held to the shoe, but may be conveniently removed when worn, and replaced.

HORSE POWER FRAME.—Thomas C. Churchman, of Sacramento, Cal.—A frame of three bed pieces, two end pieces, and three top pieces is firmly held together by bolts, the end pieces being arranged upon the ends of the bed pieces perpendicular to them, and the top pieces being parallel to the bed pieces and above them, the pieces being suitably "boxed" or notched where they match or fit upon each other. The end pieces have elevations at the center of the upper sides for supporting the center top piece above the master wheel high enough to provide room for said wheel. The pinion shaft under the master wheel is extended to the step of the vertical shaft, and thus provided with a bearing in addition to the outer one commonly used, thereby greatly relieving the outer bearing, and supporting the said shaft more permanently than when only one is used. This improved construction of the frame is very simple and cheap, and also strong and durable.

ANTI-CONCUSSION WATER COCK.—Mifflin W. Bally, of Pottstown, Pa.—This invention has for its object to furnish an improved cock for attachment to a water pipe, so constructed as to prevent the concussion when the cock is closed and the movement of the column of water checked. It consists in the combination of an air chamber with the cock, so that, when the plug is turned to shut off the water, a passage is opened into the air chamber; the movement of the column of water may be checked by the air within said air chamber, and the cock thus relieved from the concussion. When the plug is turned into such a position as to close the passage leading to the air chamber, the water in said chamber is forced out through a waste hole by the compressed air, and more air passes in to again form a cushion for the water, when the cock is again closed.

SPRING BED BOTTOM.—George Brownlee, of Princeton, Ind.—Cord bearers are attached by means of screws or otherwise to the side rails. The slats rest upon double cords between the bearers, the cord being laced around the ends of the slats, and resting on the bearers at the points of intersection. A spring is attached to one or both of the end rails by a rivet or bolt, around the ends of which spring the double cords pass. A button is placed at the ends of the spring, which may be turned against the spring so as to confine the ends and prevent elasticity, and increase the rigidity of the slats thereby when desired. The cord bearers are small grooved pulleys, which turn on their screws and prevent friction when the cords are strained by a weight on the slats. Stay cords are attached to each of the slats, which serve to keep the slats in place. To increase the elasticity of the slats they may be made double, the two parts being confined together by loops, or in any other suitable manner.

BROOM.—Robert F. Dobson, of Darlington, Wis.—This invention relates to an improvement in the manufacture of brooms, whereby, it is claimed, they are made stronger and more durable than brooms of ordinary construction. It consists in the construction and arrangement of wire bands, around the brush, of sufficient size to inclose the requisite quantity of corn for a broom, and to give the desired shape to the broom. The corn, with the band, is compressed by a press of peculiar construction. The handle is sharpened and driven into the brush. A hook is formed on the ends of the wire which forms the bands, and they are hooked together. When the press is removed the corn expands, so that the bands tightly compress it and make a very strong and durable broom. The handle is secured in place by a nail through the hook fastening of the upper band.

CANAL BOAT.—Dennis Hinchy, of Santiago, Chili.—This invention relates to improvements on canal boats of that kind where a central longitudinal channel is provided for the reception of the propeller; and it consists in connecting the two hulls thus formed at their bottoms by a hollow air tight case, which, it is claimed, strengthens and buoys the boat, and improves the same throughout.

STEAM CONDENSER.—Archibald Kennedy and John H. Berkshire, of Muscatine, Iowa.—This apparatus is claimed to be very efficient in condensing the steam, also in heating and purifying the feed water. It is also claimed to be very useful as a filter alone for purifying cold water for the supply of railroad tanks for filling the tenders. A perforated steam receiver and spreader under the water spout consists in distributing the exhaust steam more freely without those sudden puffs at the commencement of the exhaust. The receiver and spreader is also claimed to ease the first injection of the exhaust from the cylinder (by the operation of condensation) and ameliorate the exhaust, and at the same time more thoroughly bring into contact and heat the falling water; and, in conjunction with partially perforated rings and an angular flange projecting downward outside of said ring, prevents the falling water from being forced up the escape pipe, whereby the outward escape is made more easy and even, and is more thoroughly brought into contact with the cold water than it would be were the steam exhausted directly through an open mouthed pipe into the heater. The steam is not sent back, or made to increase the pressure upon the engine; but is more easily absorbed by the cold water shower. The device does not require cleaning or repacking more than once in ten weeks.

METALLIC COUNTER FOR BOOTS AND SHOES.—Almond B. Spaulding, of Clinton, Me.—The object of this invention is to strengthen the heels of boots and shoes, and thereby prevent them from "running down" at the heel. It consists in inserting, between the outer leather counter and the lining in the heel or back portion of the boot or shoe, a metallic counter curved to fit the heel. The counter, which is made of thin steel or of some other suitable metal, is bent or curved to fit the size of the back end of the boot or shoe, so as to surround the back portion of the heel. Teeth are formed on the lower edge of the counter, which are turned up so as to enter the under side of the insole of the boot or shoe, and thereby be made self fastening. The upper edge of the counter is slotted, so as to render it elastic. This metallic counter is placed between the outer leather counter and the lining of the boot or shoe, thus stiffening and, it is claimed, effectually preventing the heel from running over on one side.

COAL SCUTTLE.—George Smith, of Williamsburg, N. Y.—The object of this invention is to simplify and cheapen coal hods or "scuttles," and at the same time render them more convenient for discharging the coal therefrom, more durable, and much easier repaired when injured by wear than coal hods of ordinary construction. This coal hod is made mainly of a single piece of sheet metal, and resembles in its outline an inverted hollow cone, the apex of the cone being the bottom and center of the hod. The ordinary horizontal bottom is consequently dispensed with. The top of the hod is contracted on one side to form a delivery spout, and the bottom of this spout or the delivery side of the hod stands at an angle of about forty-five degrees with a horizontal line. This gives a free and easy delivery of the coal when the hod is slightly tilted. The bottom may form nearly a point. In the ordinary coal hod, the bottom is the first to fail and the most difficult to repair. When, from either wear or corrosion, this coal hod fails, the process of repairing is very simple. A single piece of sheet metal is coiled, fitted and fastened in the hod, and the work is done. These hods can be made without stamping or other expensive machinery, by any ordinary workman.

AUTOMATIC FAN.—John B. Williamson, of Louisville, Ky.—Clock work made of suitable form, is provided with a train of gear wheels, with a spring or weight for actuating the same. A wheel is applied to the last shaft of the train and rotated by the same. It has a star shaped slot, or groove, cut through or formed in its face. A lever, pivoted, by a pin, to the frame, carries a little pin or roller, which enters the star slot of the wheel. The rotation of the latter serves to impart oscillating motion to the lever. Whenever the roller passes one of the angles of the star slot there is a momentary arrest, the "escapement" being thus produced. The stem of the fan is connected in suitable manner with the pin or lever, and is oscillated by the motion of the same. The fan is to be used in hot weather either to produce the desired change of air or to expel insects.

INSECT TRAP.—John H. Welch and John Baker, of Fort Wayne, Ind.—A pan or dish of sheet metal or other suitable material, has an upright rim or flange, at the base of which are a number of small apertures, through which the insect can enter the pan. A wire cone closed on top, surmounts the rim. A second smaller wire cone is arranged within, joining the first at the bottom, but not reaching the top. In top of the cone are a number of slots or apertures, formed through the wire, the loose ends of the wire projecting outwardly. Suitable substance for attracting the insects being placed in the pan, they will enter the same through the apertures in the rim. The lower part of the pan being dark, they will ascend toward the light in the inner cone, and finally pass through the apertures at its top. When once in the space between the cones, they are caught, as there are no means of escape except the upper holes, to which access is prevented by the outwardly protruding ends of wire.

FLY FAN.—George A. Goodrich and Peter Miller, of Hope, Ohio.—This invention relates to a new arrangement of parts in an apparatus consisting essentially of a combination of fly brushes and operating clock mechanism. It consists in the arrangement of a spring and screw arranged on the clock work of a fly brush to serve as brake. The arrangement is designed to be placed on a table to keep flies away from the same, and is provided with a suitable stand for its support.

WASHING MACHINE.—Chauncey P. Remington, of Smith's Mills, New York.—This invention has for its object to improve the construction of an improved washing machine, for which letters patent were granted to the same inventor May 23, 1871, so as to make it more effective in operation. Three claims have been allowed. By this construction, as the plunger is raised the valve will close, and the suction thus produced will loosen the clothes, and at the same time the partial revolution of the plunger will move them from their place. As the plunger descends its partial revolution will move the clothes further through the suds, and will then press them against the false bottom with a turning movement so as to slightly rub them, and thus hasten the operation of cleaning them.

BROADCAST SEED SOWER.—Charles L. Story, of Calhoun, Ky., assignor to Mark Stull, William T. Oldham, and James M. Loving, of same place.—This invention consists in the peculiar construction of a distributing wheel, whereby the seed can be scattered broadcast with uniformity and in such quantity as may be desired.

PROPELLING AND STEERING APPARATUS FOR VESSELS.—Charles Hemje, of Hoboken, N. J.—An inclosure or cylinder, somewhat larger than the propeller wheel and open at both ends, is made of sheet metal or other suitable material. It is arranged so as to embrace the propeller, and thereby obviate the swell created by the propeller wheel when in motion. The water entering the inclosure or cylinder and passing the propeller wheel will be forced back through the inclosure or cylinder, and will not wash the banks of the canal, creek, or river. The cylinder is pivoted by vertical pins, which enable it to be also used as a rudder. The forward edge of the inclosure or cylinder should be cut according to the shape of the boat aft, so as to give the easiest possible access of the water to the propeller wheel. The after edge of it can be shortened more or less toward the bottom, according to the steering power required. The steering is accomplished by the column of water passing the propeller wheel, which is forced back through the inclosure or cylinder when the boat is in motion, which column of water can be directed at such angles with the center line of the boat as to give the most perfect steering power—claimed to be much more powerful than any ordinary rudder, and more easily handled than the same. To make the enclosure or cylinder movable, it is, at the under side, provided with a projecting gudgeon, which stands and moves on a step on a shoe, extending aft from the keel or bottom of the boat. Vertically above the gudgeon is fastened, to the upper side of the inclosure or cylinder, a shaft or pin, extending upward through the stern or fan-tail of the boat. The inclosure or cylinder has to be placed so that the shaft of the same stands vertically over the center of the propeller wheel, (measured fore and aft) or at least as near as practicable to that position, as in case of a great variation therefrom the inclosure or cylinder could not be moved enough, but would come in contact with the blades of the propeller wheel. The steering gear can be attached in the same manner as on any ordinary rudder. By means of an eye bolt (through the eye of which the above named shaft passes at nearly right angles,) which goes through a post inside the boat, and on the end of which a thread is cut, the inclosure or cylinder can easily be so adjusted, by merely screwing up or unscrewing the respective nuts, so as to be level with the surface of the water in case the boat should draw more water aft than forward. Through the use of the inclosure or cylinder, it is claimed, the speed is increased, and if the same is properly made and adjusted it is expected the increase in speed will come up to or exceed five per cent, and it is claimed that by means of the inclosure or cylinder the slip of the propeller wheel is decreased, because it works in a solid body of water, with no chance for the latter to escape to the surface; whereas, with an unprotected propeller wheel considerable power is lost when the blades of the same pass near the surface of the water. It is further claimed that all dangerous or injurious results to the banks of a canal, creek, or river, which would arise from an unprotected propeller wheel, are completely overcome, as the water entering the front opening of the inclosure or cylinder and passing the propeller wheel goes out of the same in a solid mass, taking only one direction, which is that of the center line of the inclosure or cylinder. In places where there are bends or turns in the canal, creek, or river, no injury can be done to the banks, as, for the purpose of effecting these turns, the inclosure or cylinder has to be moved so as to always leave the current in the middle of the canal.

METHOD OF MANUFACTURING FURNITURE SPRINGS.—Joseph Lloyd Haigh, of New York city, assignor to Eagleton Manufacturing Company, of same place.—This improvement pertains to that portion of the manufacture of springs, for furniture, mattresses, etc., which relates to the compressing or condensation of the spring after it is coiled; and the improvement consists in effecting the required compression of the spring after it has been tempered, whereby a stronger and better article is produced. The inventor says: "In carrying out my invention, I employ the usual sizes and qualities of material; and I coil the wire of which the spring is to be composed upon a block, in the usual manner. After removing the coil from the block, it is then in a very long or open condition; and the common method is to subject the spring to powerful compression in a press, so as to condense the coils and give the spring the proper set. After this compression, the springs are tempered and finished, and are then ready for use. My improvement differs from the ordinary method in this that, after I have coiled the spring on the block in the usual manner, I then temper the spring in the ordinary way, and after the tempering I submit the spring to the compressing operation by the usual means, thus giving it the proper set; after which I finish and dress the spring in the ordinary manner. The result of my improvement—which, as before stated, consists in giving it the set or compression after it is tempered instead of before tempering—is to increase the stiffness and strength of the spring. I find by actual experiment that—as between springs made of precisely the same size of wire coiled, compressed, tempered, and treated alike in all respects, except in regard to the compression after tempering, as described—that the springs that are set or compressed subsequent to the tempering are at least fifteen per cent stronger and better than those made in the ordinary manner."

SCREW WRENCH.—Charles Neil, of Trippet Lane, Sheffield, assignor to Frederick Brittain, of St. George's Works, Sheffield, Eng.—The object of this invention is to improve the form of the parts constituting a screw wrench so as to obtain greater strength, and permit making the jaws and handle of malleable cast iron. The wrench will thereby be durable and not expensive. The head of the wrench is formed on or attached to the handle and carries a fixed jaw and a movable jaw, the latter being L shaped, as its shank is at right angles to its lip. The shank of the movable jaw fits in a slot, which is cut diametrically through the head, and is toothed along its lower edge to mesh into the threads of a worm, hung in the lower part of the head, in a recess provided in the latter. A top projects from the head under the worm and protects it, the operator taking hold of the worm at the sides for turning it.

MECHANISM FOR OPERATING BOBBIN WINDING ATTACHMENTS FOR SEWING MACHINES.—Warren N. Fish, of Newark, N. J.—The object of this invention is to devise means for operating a bobbin winder on a sewing machine without at the same time necessarily operating the machine itself. Usually bobbin winding attachments are so arranged that they can at any time be thrown into gear with the operating mechanism of the machine, and all parts of the machine are moved whenever the bobbin winder is operated, and if the thread gives out while sewing the work is removed from the machine to permit the winding of a new bobbin. Apart from this inconvenience, much power is wasted in thus unnecessarily moving parts of the machine. This invention consists in the arrangement of means whereby the driving power of the machine can be transferred to the bobbin winder, so that the machine will be at rest while the latter is in operation, and *vice versa*. The object is principally attained by the application of a loose pulley, fast pulley and bobbin pulley, arranged, with respect to each other and to the crank shaft pulley, so as to enable the same belt to operate the sewing mechanism and the bobbin winder at different times, and in the manner set forth.

HARVESTER.—Daniel Thayer, of Ludlowville, N. Y.—The following advantages are secured by this invention: The sickle bar can be easily and quickly attached and detached when required. The shoe may be conveniently adjusted to run closer to or farther from the ground, as may be desired. A wheel also serves as a guard to keep the inner end of the shoe from being obstructed or clogged. The draft is distributed, part being applied to the shoe and part being applied through the tongue to the main frame of the machine. The draft strain is thus divided between the main frame and cutting mechanism, thereby producing an easy draft, and also raising the traces to prevent the horses from getting their legs over them. The whole forms an apparently simple and effective machine.

[OFFICIAL.]

Index of Inventions

For which Letters Patent of the United States were granted

FOR THE WEEK ENDING MARCH 12, 1872, AND EACH BEARING THAT DATE.

Bag, striking, S. D. Kehoe 124,388
Baggage check, M. N. Coe 124,418
Batting or wadding for upholstery, elastic, Lindsley and Mackintosh 124,508
Bed bottom, spring, S. M. Guest 124,456
Bed bottom, spring, Owen and Harter 124,507
Bedstead and wardrobe, combined, J. A. Morgan 124,609
Beer and water cooler, J. Weinberger 124,465
Boat, canal, I. M. Perry 124,622
Boat detaching apparatus, C. Quaritius 124,511
Boiler, wash, Moreland, Reay, and Lazier 124,608
Boiler, wash, J. T. Maxson 124,603
Boiler tube scraper, J. Collicott 124,421
Bolt, M. D. Kinkade 124,442
Bolt for double doors, D. B. Conklin 124,422
Book support, J. Densmore 124,423
Boot and shoe, miner's, Latham and Burton 124,498
Boot and shoe shave, B. A. Stockwell 124,638
Boot and shoe stretcher, W. Holden, (reissue) 4,799
Boot and shoe seams, apparatus for rolling, J. C. White, (reissue) .. 4,805
Boot and shoe heels, machine for dressing, W. H. Bush 124,482
Boots and shoes, elastic goring for, C. Winslow 124,527
Boots and shoes, burnishing shanks of, Blanchard, Hunt, and Carey 124,479
Boring mill, J. Wheelock 124,647
Brace, back, E. P. Banning, Jr 124,473
Brick kiln, F. F. Boudrye 124,598
Brick machine, P. H. Kells 124,590
Broom holder, H. B. McCool 124,445
Brush, dust, A. Shelling 124,634
Buckle, R. Russel 124,514
Building, fire proof, Sisson and Wetmore 124,452
Burner, hydrocarbon vapor, Dopp and Stark 124,425
Cages, manufacture of bird, J. Hepp 124,570
Can, sheet metal, J. Widgery 124,466
Cans, barrels, etc., apparatus for testing, W. D. Brooks, (reissue) .. 4,796
Car brake, J. W. Jacobs 124,581
Car coupling, H. Hawley 124,496
Car coupling, A. C. Fell 124,430
Car coupling, H. E. Wolcott 124,648
Car, stock, A. Rank 124,625, 124,626
Cars, door for grain, J. Bassler 124,535
Cars, safety shoe for railway, Emery and Doyen 124,560
Cars by stationary power, propelling, A. R. Crihfield 124,551
Carriage seat, S. P. Graham 124,433
Carriage wheel, J. Woodburn 124,468
Cask and barrel, J. Marshall 124,601
Cement for mending china, etc., R. W. Patten 124,617
Centrifugal machine for draining sugar, etc., J. Corby 124,484
Chandelier, reflecting, C. F. Jacobsen 124,582
Cigar holder, J. K. Chase 124,545
Cigar machine, R. B. Robbins 124,629
Cloth, apparatus for sponging, E. Utley 124,461
Cloth, steam cylinder for finishing, A. Brown 124,481
Clutch, friction, H. Aiken 124,529
Clutch for machinery, F. G. Bates 124,476
Composition for journal bearings, S. Croll 124,485
Compound from gun cotton, explosive, R. Punshon 124,510
Cord clamp, S. W. Meredith 124,604
Cornice window, Cony and Norcross 124,549
Cracker box, C. F. Thurston 124,459
Dies, manufacture of, F. W. Arvine 124,414
Digger, potato, M. Johnson 124,585
Door securer, B. H. Melendy 124,503
Dough, machine for sheeting, D. B. Fuller 124,431
Dryer, clothes, J. Caffrey 124,543
Dyeing starsfor flags, apparatus for press, D. W. C. Farrington 124,428
Elevator connected to wagon bodies, M. G. Balfour 124,531
Engine, atmospheric, S. E. Tuttle 124,530
Engine, rotary, W. Hall 124,572
Engine, traction, W. W. Hanscom 124,574
Engine, ammonia gas, E. Lamm 124,496
Engine, chloride of calcium, E. Lamm 124,594
Engine, steam and gas, J. A. H. Ellis (reissue) 4,806
Equalizer, three horse, J. Blackwood 124,537
Fabric for head coverings, H. Loewenberg 124,599
Fastener, sash, W. E. Sparks 124,515
Faucet, W. Cleveland 124,546
Fence, A. C. Betts 124,477
Fence, J. McKnight 124,502
Fence, J. H. Stone 124,516
Fertilizer, J. and A. Fox 124,487
Fiber to imitate hair, W. Stauf 124,652
Fire extinguisher, E. Barrett 124,534
Fire extinguisher, J. Gardner 124,565
Fire lighter, J. R. Murphy 124,505
Fire escape ladder, C. G. Buttkereit 124,541
Fishing seine, H. Smith 124,635
Flock grinder, J. Waterhouse 124,463
Fruit gatherer, J. Waters 124,464
Fuel, artificial, H. Cutler 124,553
Furnace, smelting, P. M. Wilson 124,467
Furnitur button, H. Howeroft 124,577
Gas from coal tar, J. Kidd 124,441
Gas, apparatus for manufacture of, E. Jones, (reissue) 4,800
Gas apparatus, sealing dip pipe of, R. B. Chapman, (reissue) 4,797
Gate, J. C. Long 124,600
Gate, W. H. Phillips 124,508
Gate for railways, automatic safety, Emmons and Lee 124,561
Governor, J. S. Warren 124,523
Hackling machine, Lannay and Webb 124,497
Hair restorative, E. W. Barnes 124,533
Hair, fiber to imitate, W. Stauf 124,652
Harness, ornamenting, F. Meinberg 124,446
Harness snap, S. Reynolds 124,628
Harrow, A. Jones 124,586
Harrow teeth, die for forging, Pedder and Abel 124,619
Harvester, J. H. Jones 124,587
Heating and evaporating liquids by steam, B. T. Babbitt 124,530
Hinge, V. Rathknecht 124,627
Hinge for tables, etc., lock, E. E. Hendricks 124,438
Hitching and sign post, C. F. Barnard 124,532
Hod, brick and mortar, C. Roehl 124,448
Hoisting apparatus and safety hatch, J. W. Osgood 124,614
Hoisting apparatus for coal barges, etc., J. A. Preston, (reissue) 4,801
Hook and buckle, snap, L. B. Jackson 124,580
Horse blanket adjuster, A. Z. Neff 124,506
Horse collar cap, A. P. Mason 124,444
Horseshoeing jack, J. Shimer 124,452
Husker, corn, J. M. Everts 124,486
Ink, manufacture of writing, J. W. Carter 124,544
Jack, lifting, B. B. Tomlinson 124,519
Journal, anti-friction, Hall and Dayton 124,573
Journal bearings, composition for, S. Croll 124,485
Kettle, tea, J. W. Ward 124,462
Ladder, G. W. Willis 124,526
Ladder, step, O. M. Sweet 124,518
Lamp extinguisher, J. M. Goodridge 124,567
Lathing, metallic, K. Nirison 124,611
Link, G. W. Dyer 124,556
Lock, door, W. P. Dodson 124,424
Lock, permutation, W. C. Bassey 124,540
Locomotives, throttle valve lever for, J. Mills 124,606
Looms, shuttle mechanism for, T. Martin 124,501
Looms, let off mechanism for, C. R. Saatweber 124,632
Lubricating wheel or pulley, R. V. Laney 124,596
Lubricating axles or journals, mode of, R. V. Laney 124,596
Lubricating loose pulleys, device for, F. Keifel 124,589
Lubricator, car axle, T. H. Paul 124,618
Lubricator for car axle boxes, J. Trent 124,642
Marble, manufacture of imitation, El lot and Wood 124,557
Marble, manufacture of imitation, A. Fischer 124,562
Measures, funnel attachment for liquid, C. C. Jadwin 124,492
Medical compound, T. H. Thompson 124,458
Medical compound or coffee antidote, E. D. H. Saint Cyr, (reissue) 4,798
Medicine chest for veterinary surgeons, J. W. Gadsden 124,432
Milk cans, securing covers of, N. C. Burnap 124,539
Mill, quartz, W. C. Stiles 124,637
Millstones, manufacture of, Elliott and Wood 124,559
Millstones, process of preparing, Elliott and Wood 124,560
Movement, mechanical, S. J. Baird, (reissue) 4,795
Mowing machine, W. G. Kenyon 124,440
Mucilage holder, A. H. Fatzinger 124,429
Ores, separating, Huet and Geyler 124,578
Ornamenting furniture, J. E. Rogers 124,630
Ornamenting wood, metal, etc., R. Parke 124,616
Overshoe, J. Wild 124,525
Painters' easel, holder for, S. J. Newell 124,610
Painting wire cloth, machine for, S. Graves 124,569
Pan, dust, R. S. Jennings 124,581
Paper cutting machine, J. Worrell 124,650
Paper feeding machine, A. M. Crane 124,550
Paper making machinery, T. Nugent 124,612
Pavement, composition, T. Price 124,509
Pavement, concrete, A. H. Perkins 124,620
Pawl attachment, N. A. Baker 124,416
Photographic apparatus, R. H. Mims 124,607
Piano, upright, O. Altenberg 124 470
Pipe, water and sewer, J. S. Pierson 124,624
Pipe, machine for making tin lined lead, J. E. Granniss 124,568
Planes and hollows, brake for inclined, L. Klee 124,592
Planter, corn, J. M. E. Valk 124,643
Planter, cotton, N. F. Sandelin 124,450
Plow, gang, Bowen and Abbott 124,480
Plow, gang, G. W. Haines 124,571
Poke, animal, B. E. Blakslee 124,478
Pot, coffee, W. N. Hutchinson 124,579
Pot, coffee, J. B. Smith 124,454
Power, mechanical, N. A. Baker 124,415
Printing press, S. D. Tucker 124,460
Pruning shears, O. Snell 124,455
Pump, E. Graser 124,434
Pump, P. Foley 124,563
Pump, garden, C. G. Korth 124,593
Pump, rotary, A. Sluthour (reissue) 4,802
Pump, steam, C. Swinscoe 124,639
Rack for hats, etc., C. A. Young 124,469
Rack and umbrella stand, combined hat, J. W. Currier 124,552
Rafts, construction of, Moore and Hawley 124,504
Railway frog, D. C. Pierce 124,623
Railway rail chair, J. C. Wands 124,646
Railways, girder for, R. M. Upjohn 124,521
Rubber cloth goods, manufacture of India, W. Cable 124,542
Sash bearing, window, J. B. Hornbake 124,491
Sash holder, H. P. Tenant 124,640
Sash supporter, window, R. L. Young 124,528
Satchels, staple for, W. Roemer 124,449
Saw mill, S. Weymouth 124,524
Saw set, Harper and Wurffiein 124,489
Scale, tailor's, H. Matheson 124,602
Screws and bolts, machine for threading metallic, B. L. Walker 124,645
Sewing machines, attachment for, J. C. Jensen 124,493
Sewing machines, button hole attachment for, S. J. Baird (reissue) .. 4,794
Shelf or bracket, extension, A. Rosenfield 124,631
Ship and steamboat building, steam, A. W. Thompson 124,641
Shoe, J. P. Rand 124,512
Sled, bob, J. Wampach 124 522
Soap cooler, J. D. Sturges 124,457
Spinning machines, spindle for, T. H. Gray 124,488
Spoke shave, J. Groben 124,435
Stacker, straw, S. Fullen 124,564
Stand for windows, show, J. P. Doughton 124,555
Staves, machine for cutting, A. Cook 124,483
Steam generator, D. Renshaw 124,513
Steamer, oyster, W. A. Jones 124,494
Stone, manufacture of artificial, T. A. Jebb 124,581
Stove, heating, W. H. Landon 124,496
Stove pipe damper, J. Spear 124,456
Stuffing box, metallic, W. H. Holland 124,439
Sugar, etc., centrifugal machine for draining, J. Corby 124,484
Supporter, uterine, E. P. Banning, Jr 124,474
Table, extension, E. Pond, Jr 124,447
Tap and cutter, combined, J. Gunn 124,570
Tassel, fur, J. Schmid 124,633
Toaster, bread, D. Miller 124,605
Tobacco cutter, J. Eiberweiser 124,426
Tool, combined, T. Garrick 124,566
Tool handle, W. M. Knight 124,443
Tool handle fastening, A. R. Sweet 124,517
Toy, J. M. Hartz 124,575
Traces, attachment for, F. J. Schmitz 124,451
Trap, animal, L. F. C. Chamberlin 124,417
Truss, E. B. Banning, Jr 124,475
Varnish, imitation gold, R. Parke 124,615
Vehicles, wheel for, J. Davis 124,554
Velocipede, D. Martin 124,599
Velocipede, L. G. Perreaux 124,621
Ventilator, car, R. L. Omensetter 124,613
Wagon brake, A. Snyder 124,636
Washer, lock, W. H. Van Cleve 124,644
Washing machine, J. E. Connolly 124,548
Washing machine, A. E. Worden 124,649
Washing machine, J. E. North 124,651
Water wheel, V. M. Baker 124,471, 124,472
Water closets, deodorizing, G. E. Waring, Jr., (reissue) 4,803, 4,804
Wheels and journals, box and sleeve for, R. V. Laney 124,597
Windmill, G. Mable 124,499
Wood, preserving, S. L. Cole 124,419, 124,420
Writing machine, type, B. Halstead 124,43
Yoke, horse, G. P. Cole 124,54

DESIGNS PATENTED.

5,639 to 5,645.—CARPETS.—A. J. Bonet, Kidderminster, England.
5,646 and 5,647.—CARPETS.—A. McCallum, Halifax, England.
5,648.—METAL PAIL OR CAN.—G. C. Napheys, Philadelphia, Pa.
5,649 and 5,650.—CARPETS.—E. Poole, Halifax, England.
5,651 and 5,652.—CARPETS.—H. Robinson, Halifax, England.

TRADE MARKS REGISTERED.

694.—"AMERICAN STERLING" METAL.—American Sterling Company, New York city.
695.—BOOTS.—Clement, Colburn & Co., Boston, Mass.
696.—WHISKY.—Frieberg & Workum, Cincinnati, O.
697.—HAMS, ETC.—J. Morrison & Co., Cincinnati, O.
698.—BRONZE ALLOYS.—Phosphor Bronze Company, Pittsburgh, Pa.
699.—BRONZE ALLOY BEARINGS.—Phosphor Bronze Company, Pittsburgh, Pa.
700 and 701.—CANNED VEGETABLES, ETC.—Sleeper, Wells and Aldrich, Burlington, N. J.
702.—WHISKY.—Walsh, Brooks and Kellogg, Cincinnati, O.

SCHEDULE OF PATENT FEES:

On each Caveat $10
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APPLICATIONS FOR EXTENSIONS.

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

20,522.—GRAIN SEPARATOR.—A. J. Vandegrift. May 22, 1872.
20,402.—PLATFORM SCALES.—J. F. Keeler. May 22, 1872.
20,515.—HARVESTER.—W. H. Seymour and D. S. Morgan. May 22, 1872.
20,519.—PRESSING MACHINE.—L. B. Storrs. May 22, 1872.
20,527.—PLANING MACHINE.—J. A. Woodbury. May 22, 1872.
20,557.—SEWING MACHINE.—A. C. Herron. May 29, 1872.
20,638.—COMBINATION LOCK.—S. Perry. June 5, 1872.
20,756.—ORE SEPARATOR.—H. Bradford. June 12, 1872.
20,834.—EAR MUFF, ETC.—W. P. Ware. June 19, 1872.

EXTENSIONS GRANTED.

19,487.—METALLIC LATHING.—B. Cornell. March 2, 1858.
19,462.—STRAW CUTTER.—T. H. and D. T. Willson. February 23, 1858.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From February 16 to February 22, 1872, inclusive.

BOILER FURNACE.—G. H. Diehl, Chicago, Ill.
BOOTS, ETC.—W. J. B. Mills, Phila., Pa., D. W. C. Taylor, Elizabeth, N. J
BOOT STIFFENINGS.—N. J. Simonds, Woburn, Mass.
CAR COUPLING.—F. F. Taylor, H. W. Larkin, San Francisco, Cal.
CUTTING MACHINE.—A. Warth, Stapleton, N. Y., W. F. Jobbins, N. Y. city
CUTTING STONE, ETC.—A. S. Gear, Boston, Mass.
DUST SHIELD, ETC.—W. M. Thornton, T. A. Buckland, St. Louis, Mo.
FIRE ARM.—G. H. Earnest, Springfield, Ohio.
HARVESTER RAKE, ETC.—D. M. Osborne, Auburn, N. Y.
HOIST, ETC.—H. Osgood, M. F. Storer, C. G. Keys, New York city.
LAWN MOWER.—E. G. Passmore, Philadelphia, Pa.
LEATHER MANUFACTURE, ETC.—J. C. White, Quincy, Ill.
LEVER PUNCH, ETC.—N. Thompson, Brooklyn, N. Y.
LITHOGRAPHIC PRINTING MACHINE.—R. M. Hoe, New York city.
PENCILS, ETC.—J. Reckendorfer, New York city.
POTTERY, ETC.—S. R. Thompson, Portsmouth, N. H.
RAILWAY SIGNAL.—L. W. Coe, Auburn, N. Y.
SAIL HANK.—D. G. Low, Chelsea, Mass.
SHUTTLE.—J. Martin, Lowell, Mass.
SHUTTLE.—T. Isherwood, Westerly, Conn.
STEEL MANUFACTURE, ETC.—J. Henderson (of N. Y. city), Glasgow, Scotland
OPERATING MECHANISM.—A. G. Myers, New York city.
VESSELS FOR ACIDS, ETC.—J. H. Selbert, Philadelphia, Pa.

FOREIGN PATENTS---A HINT TO PATENTEES.

It is generally much better to apply for foreign patents simultaneously with the application in the United States. If this cannot be conveniently done, as little time as possible should be lost after the patent is issued, as the laws in some foreign countries allow patents to any who first makes the application, and in this way many inventors are deprived of valid patents for their own inventions. It should also be borne in mind that a patent is issued in England to the first *introducer*, without regard to the rights of the *real* inventor; therefore, it is important that all applications should be entrusted to responsible agents in this country, who can assure parties that their valuable inventions will not be misappropriated. The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address

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How Can I Obtain a Patent?

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

How Can I Best Secure My Invention?

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

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

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention, susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing

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SCIENTIFIC AMERICAN

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

Vol. XXVI.—No. 14. [NEW SERIES.] NEW YORK, MARCH 30, 1872. $3 per Annum [IN ADVANCE.]

Machine for Testing the Strength of Metals, Wire, Rope, Chain, Cast Iron Columns, Bridge Bolts, and Boiler Plates.

The present age is one in which only accurate knowledge can insure advancement. Experimental methods, having proved their superiority in the attainment of accurate knowledge, are constantly growing in favor. No matter to what extent mathematical theories may be applied to the computation of the strength of building materials, there are so many varying conditions which cannot be formulated that only actual test can determine the strains to which such materials can be safely subjected. There have been numerous testing machines constructed, but many have been cumbersome, and some so inaccurate as to prevent that refinement which should characterize every scientific experiment. We recently illustrated and described a refined arrangement calculated to insure the desired delicacy in this kind of tests, and we herewith give an engraving of still another, which, having been for several years in use, and having, we are told, been subjected to frequent comparison with what is known as the "Government machine," as well as those manufactured by other parties, has given entire satisfaction.

It is claimed for this machine that it possesses great strength, combined with much simplicity and accuracy, and that it can be furnished at less cost than other machines of corresponding capacity.

Its construction will be readily understood on reference to the accompanying engravings, the largest of which represents a machine of 100,000 lbs. capacity.

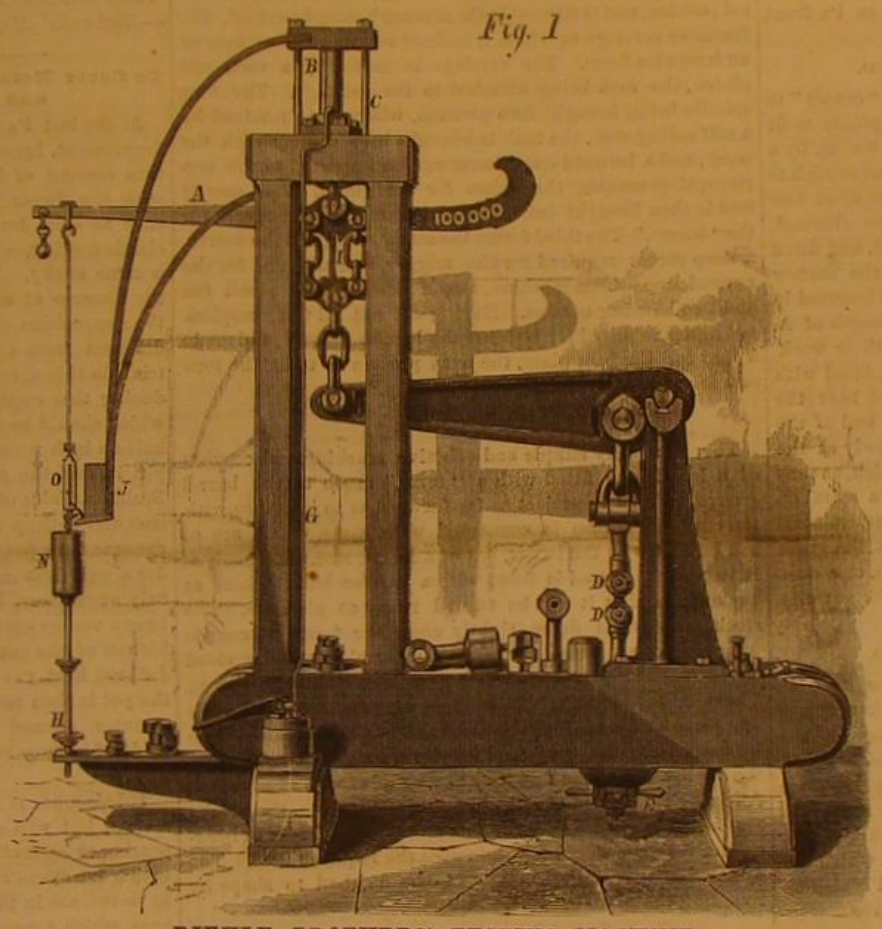
The crane beam, A, Fig. 1, is suspended from the hydraulic jack, B, by a yoke, C, and connected with this small end of the main lever by a clevis and fulcrum. The piece for testing is placed in the clutches at D D. All the bearing parts of the machine rest upon steel knife edges, and when ready for operating, the whole machine is in perfect equipoise, and so nicely adjusted that a half ounce weight placed upon the weight dish will, it is stated, turn the beam. Before the strain is applied, the slack is taken up by means of a screw and a nut at E; the beam is then raised by the jack and pump. The pump, is connected by the tube, G G, to the jack, and as the strain is applied, the beam is kept in equilibrium by placing weights on the dish, at H. The indicating finger, I, vibrates freely in the slotted place in the crane beam. Now, as the crane beam is placed between the small end of the main lever and the pulling jack, the strain is actually weighed by the beam, and not indicated by pressure in the hydraulic jack, as in some machines. In order to obtain a very accurate result, an ingenious self-feeding arrangement is applied, consisting of a reservoir, J (more clearly shown in Fig. 2), containing mustard seed shot, which is suspended from the jack, B, Fig. 1. A valve, M, Fig. 2, at the base of the reservoir, is opened by a pin attached to the beam rod, when the beam raises, which allows the shot to flow into the cup, N, on the beam rod. This cup, N, is suspended to a spring balance, O, which is secured to the rod. When the test piece breaks, the beam falls, and the small valve, M, closes, stopping the flow of the shot. The weight of the shot poured into the cup, N, is seen on the dial, which is marked in such a manner as to indicate twenty-five pounds (or even less, to ten or fifteen pounds, if necessary).

This machine, without the last improvement, is in successful operation in a number of places, and gives, as above stated, the most unqualified satisfaction.

The two figures, marked D, Fig. 1, represent a grip or vise, that holds the steel in a particularly firm manner, causing a fair and square break, and a correct test. In each end of the test pieces is bored a one and three eighths inch hole, and the piece is placed in the clutches with the thimble lightened up by the bolt which passes through, having a head and nut pressing on each side, so as to prevent bending of any kind. This system of combining a crane beam, with levers, hydraulic jack, or screw, can be adapted for testing material of any description and of any desired form—tensile strength of bridge bolts, rope, wire, chain of any required length; transverse strain for girders, etc., crushing strain for columns, specimens of metals, stone, etc., as also for torsional strain.

For further particulars address Riehle Brothers, Ninth and Coates streets, Philadelphia, Pa., or 93, 95, and 97 Liberty street, New York.

Fig. 1



RIEHLE BROTHERS' TESTING MACHINE.

Fig. 2

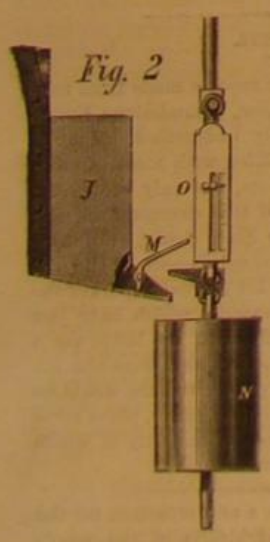


Fig. 3



ROUND TEST PIECE

Fig. 4



BOILER PLATE TEST PIECE

Junction of the Black and Caspian Seas.

An Italian journal, *L'Osservatore Triestino*, is responsible for the statement that the object of the recent visit of the Russian Czar to the southern part of his empire had particular reference to the projected junction of the Caspian sea with the Black sea. On page 336, Vol. XXV., of the SCIENTIFIC AMERICAN, attention was called to the same enterprise, and some of its difficulties and advantages were pointed out. We are now able to furnish the following additional details. The entire length of the canal would be 630 Russian versts, about 400 miles, though the mountainous chain to be pierced only measures eight versts, or about five miles. It is calculated that 32,000 laborers will have to be employed for fully six years in order to complete the undertaking. Quite apart from the direct commercial advantages which would result from the completion of this canal, it would serve to replenish the Caspian sea with water, a highly important consideration. During the last decade, and even longer, a remarkable reduction of water was noticed, so much so that the final extinction, that is, exsiccation of the sea, was apprehended. The results would not only be malarious in the extreme, but also destructive of a great source of wealth namely, the sturgeon, sterlet, and seal fisheries. Many thousand persons are at present employed in these fisheries (chiefly at Astrakhan), by whom 800,000 lbs. of caviar alone are annually obtained. An insurance of water supply to those persons would, therefore, give renewed stimulus to their local enterprise, though the same may not be nearly as important as the effect on commerce at large.

Delprino's Mode of Treating Silk Worms.

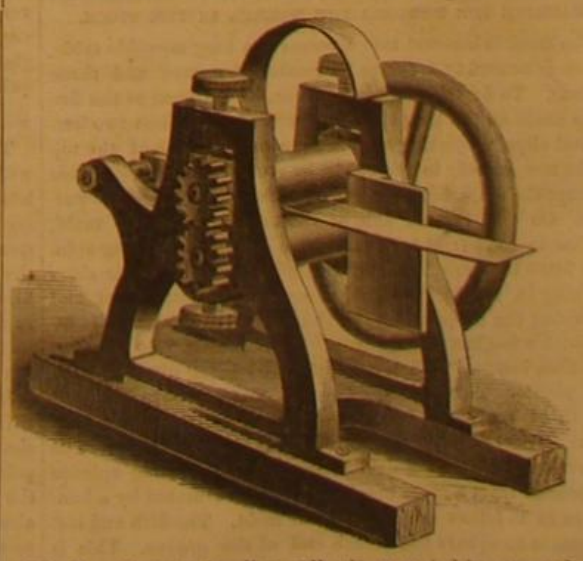
The attention of visitors to the Italian section of the French Exposition of 1867 was attracted to certain small wooden pigeon holes, each of which contained a silk worm, where it was occupied in constructing its cocoon without disturbance from its neighbors. This was an invention of Dr. Delprino, of Vesime, in Piedmont, and which, although very simple in itself, formed an important innovation in the art of raising silk worms. Since that time, this and other peculiar inventions of the same gentleman have been widely adopted, and have done much toward protecting the silk interest from the losses which the recent multiplication of diseases and other casualties have brought about.

The difficulty in the ordinary magnaneries, or worm houses, is that the worms are mixed together, the strong oppressing the weak, and heaped upon each other in a mass, so as to produce greater or less injury. In Delprinos' system, a life in common is interdicted as much as possible, although during the feeding of the worms it is impossible to isolate them entirely. During that period they are keep together, but allowed ample room for moving about—being placed on small movable hurdles which can easily be changed. This produces constant ventilation, and prevents the danger of a great agglomeration, in consequence of which the transformations marking the different ages involve much less loss. When they have attained the proper period for transformation to chrysalids, the worms are placed in what Delprino calls the cocoonry, the pigeon holes (large enough to receive them) being placed on each side on tables, in which the worm is able to move about with freedom, and protected from injury. By the cocoon's not being attached to a branch, a saving of twenty per cent of silk is secured.

Another of Dr. Delprino's methods consists in securing a perfect union of the two sexes, and a more certain fertilization of the eggs. This is done by placing the fly in a cell covered with a board and keeping it there in darkness and solitude for half an hour, at the expiration of which, to each male is given a female, and the board replaced until the nuptial operations have been accomplished. By another arrangement every female lays her eggs separately, so that those of two individuals are not mixed, and so that the imperfectly matured eggs (such as can easily be detected by examination) can be readily removed and destroyed, thereby improving the general quality of the grains. The general idea of Dr. Delprino's system consists in the isolation of the insects, and although this may require a special arrangement and be somewhat troublesome, yet it is maintained that the result sufficiently vindicates the propriety of the process, and that in the greater perfection of the eggs, and the improved health of the worms, and better quality and quantity of the silk, there is a decided superiority in the new system.

MACHINE FOR BENDING PRINTERS' LEADS AND RULES.

This invention consists of a roller bending machine, in



which the adjustable bending roller is mounted in one end of a long swinging frame whose other end is at such distance from the roller as to allow of the wide range necessary for adapting the machine to form curves of any radii required for the leads and rules used in printing; and the said

swinging frame is supported at the end next the rollers by the temper screw, by which it is adjusted, the whole being a simple and inexpensive arrangement.

Patented March 5, 1872, through the Scientific American Patent Agency, by Frank C. Smith and Henry McCollum.

G. P. Rowell & Co. 41 Park Row, New York, the celebrated advertising agents, have an interest in this invention, and will be prepared to supply the trade with the machines in a short time.

GUNMAKING BY MACHINERY.

The ordinary rough walnut stocks are used, being thoroughly dried before operated upon. The first operation is that of the

SLABBING MACHINE.

The stock is placed on a slide flatwise, and by means of a revolving disk, a straight cut is taken along that edge in which the barrel groove is eventually formed. This surface, which we shall call A, serves as a guide for the future work. Cuts are next taken across the "butt" and fore end to bring the stock to the standard length.

CENTERING MACHINE.

In this the stock is placed again on its flat upon a plate and pressed tightly against an iron form, which fits the face, A. Attached to the same plate, towards the butt end of the stock, is a slide fitted with four projecting points. By a blow the four points are driven into the butt end, making four holes in their proper relative position to the prepared face. A center is then bored with a small cone drill in its front end.

MACHINE FOR TURNING THE FORE END.

This machine comprises an iron form with a "center" to fit the front hole in the stock, a plate with four points to fit into the holes at the other end, which is drawn up by a screw clip passing over the end, and also a flat narrow plate running down the surface A. This form revolves upon two bearings, one placed near where the lock will be situated, being hollow to admit of the stock being inserted, and fitted with a screw to press the true face down on to the narrow plate, and another at the fore end. The stock is inserted in this, and screwed tight in the direction of the length of A. The narrow plate clears the cutters as they do their work. These cutters consist of a pair of revolving disks, fitted with hooked teeth and mounted on levers, pivoted near the ground line. An iron mold or copy of the fore end of the stock is placed below the latter—revolving slowly at the same speed. The levers carry friction rollers, which, as they travel over the irregular surface of the copy in a spiral direction, impart a corresponding motion to the cutters—and thus the form of the copy is repeated in the stock. A great economy of time is attained by using two cutters, one commencing in the middle while the other starts at the extreme end.

MACHINE FOR SHAPING THE BUTT END.

The general arrangement of this machine is the same as the one described above, excepting that the stock revolves on a center line, running nearly through the length of the butt, its fore end being passed through and clipped in a hollow tube supported at the farther end by an oblong face plate carried by a small spindle from which the rotary motion is given. There is only one cutting disk, and the cutting block is fitted with hooked cutter teeth of different forms, which are used successively for the roughing, middle, and finishing cut. The cutters revolve about 3,000 times a minute.

The next process is that of "spotting" the stock or preparing upon the sides certain perfectly true spots or planes, necessary in the accurate fixing required in the finishing machinery.

THE SPOTTING MACHINE.

In this machine the stock is held down by two spring clips upon a plate the width of the surface A. This plate works in vertical guides, and is made to descend by means of a treadle, thus bringing the stock into contact with seven small circular saws so disposed as to form the seven spots required, one on each side of the butt, one on each side of the extreme fore end, and three intermediate spots on one side. This completes the roughing process.

MACHINE FOR BEDDING THE BARREL IN THE STOCK.

The stock is inserted into a recess in a long movable table, which is caused to traverse by means of a rack and three pinions. To fix the stock in position, it is clipped at the five spots made on the long side, and pressed up against two horizontal clips, projecting a little over on each side of the top of the recess made to receive it, by studs from below. This ensures the stock being in line and level with the trued surface. On the further side of the table is a form or mold, similar to the barrel bed, and three upright revolving spindles fitted to a cross frame, with guide pins at their sides working in the form, which ensure their cutting out and following the proper shape in the stock. The spindle is fitted with a hooked nosed cutter. It is brought into position, and then lowered by a handle, the feed being given by rack and pinion. This process forms a taper groove, the full length of the barrel bed. The next spindle cuts the hole for the "breech pin;" the third, the bed for the tang. The groove receives the finished taper from a cutting spindle suspended from a cross bracket, which is vibrated by a handle, so as to follow the curve of the mold. The fifth and last process is to square the breech end of the groove. This is done by a horizontal revolving spindle which can be lowered into the groove. The fore end may be now cut to the finished length.

BEDDING THE LOCK.

This machine is complicated, carrying five small vertical cutter spindles in a frame revolving round a central axis. Each spindle is brought in succession to the work. The stock is fixed upon a slide, its position being regulated by a form against which the barrel groove is pressed. Alongside of the stock is an iron counterpart of the recess to be made, and each cutting spindle has, alongside, a tracing spindle, which is made to follow the said counterpart in all its details, the cutting spindle repeating the pattern in the wood of the stock. A fan and a couple of nozzles are used to blow away the chips, so as not to interfere with the cutters or the tracer. The first spindle cuts the recess for the lock plate, the depth being regulated by a cross bar on the tracer; the second, recesses for the screw heads; the third, the hole for the "sear" tang; the fourth, the recess for the mainspring; and the fifth, which carries a very small tool, finishes the same.

MACHINE FOR BEDDING THE TRIGGER AND GUARD.

This consists of an iron bed, with cast iron brackets on each side, connected by a horizontal bar which forms a bearing for the central axis of a revolving frame carrying four cutting spindles, very much the same as that used for recessing for the lock, and like it, provided with guide pins and levers having a vertical and horizontal motion. A similar arrangement has also been adopted as regards the driving strap, which runs horizontally above, and which can be brought down over any of the pulleys required as soon as they are in place. The stock in this case is secured in a vertical position, and is clipped in the manner before described. The frame or carriage to which it is fixed rests upon two bars of an irregular form. The carriage is moved by a rack and pinion, the rack being attached to the carriage. The first spindle being brought into position, where it is retained by a self acting stop, the tool is brought into contact with the work, and a forward curvilinear motion imparted to the carriage, thus making the recess for the guard. The second tool is then brought into play, which makes the recess for the "bosses." The third forms the screw holes, and the fourth, a deep recess required for the trigger, and also one for the ramrod stop. This machine, too, is fitted with a small fan and two blowing nozzles. Having cut out all the complicated figure required for bedding the lock and guard, and made a bed for the butt plate, the next process is to fit the fore end to receive the bands and "nose cap."

BAND MACHINE.

This is a very simple and effective machine, and consists of a low frame fitted with a "form," made to the barrel groove, and not to project so far forward as to interfere with the cut. This form is connected with cams, which are of similar shape to the bands, but of a larger size. It revolves in two bearings, and is fitted with a wooden hand wheel at one end, so that it can be turned round at pleasure. The stock is screwed down tightly upon the form, concentric with the hollow cams. Revolving cutter blocks are provided of the required width to cut the band and nose cap recesses. These cutter blocks can be brought forward at will, and are hung upon vibrating levers, weighted so as to cause them to lie away from the work, and fitted with treadles so that on the application of the foot they can be advanced at pleasure. All being ready, and the stock fixed in its place, the blocks are brought forward, and the man, having his hands at liberty, can turn the wheel round to give the required feed. The fore end of the stock has now to be finished to shape by rounding the parts between the bands.

THE MACHINE FOR CUTTING AWAY THE WOOD BETWEEN THE BANDS.

This is similar in many respects to the last, consisting of a barrel mold to which the stock is clipped, and vibrating cutters to follow a form. As the amount to be taken away is large, the length between each band is finished by two cutter blocks, one placed in front and one behind the stock. The front and back pair are alternately brought into action, and the whole length smoothed down and finished by the rotating motion given by the hand wheel. This does away with much of the vibration which would inevitably take place were the whole length of the cut taken at one time. All the tools and cutter blocks of these machines run at very high velocities, and the surfaces which they leave are very good, and in fact, a slight friction with a piece of glass paper, placed upon a cork rubber, is all that is required.

MACHINE FOR SECOND TURNING.

This machine consists of a strong cast iron open frame, with a planed top surface fitted with two long projecting fillets, on which slides a double head stock, with its connecting gear. Resting upon a plate, which carries its other extremity, is a hollow spindle for clipping the lower end of the forepart of the stock. This plate is moved along the fillets by means of a screw which is driven from a shaft running below. The cutter block is fitted with hooked teeth, and has a guard over it. It is also driven by the lower shaft, and the frame on which it vibrates is fitted with a light friction wheel which runs upon the form, revolving with a similar motion to the stock itself. To retain the sharp angles, the mold or form is at the corresponding points brought out so as to lead the cutter block beyond the flat surface, which, it should have been remarked, has already been produced by a simple planing cutter. By this means, the friction wheel can be allowed to travel over a rounded surface, which is a better motion for it, while at the same time the angles of the stock are left sharp. On taking the stock out of this machine, its outward form is perfect, but it has still to pass through two or three machines.

MACHINE FOR GROOVING FOR THE RAMROD.

This consists of a planed plate, working upon Vs and moved forwards by means of a rack and pinion. On this plate is fixed a mold to fit the barrel groove. The stock is clipped down to this, which ensures its position; and the first groove, which has parall l sides and a semicircular bottom, is cut in the fore end by means of a small cutter-block fitted with round nosed teeth. After this it becomes necessary to undercut it, and for this purpose a spherical tool is used, the spindle of which works through the top of the groove already formed.

MACHINE FOR BEDDING THE ROD SPRING.

This consists of a plate on which is bolted a form which fits the barrel groove. This is raised from its surface so as to allow the stock to bed horizontally. The tool for cutting the recess is horizontal, and we find here also the same arrangement of guide pin and mold to insure the right form being made. After the recess is cut, the hole for fastening the pin is made. The hole being very small, it has been found advisable to drill it from both sides, and this is effected by means of two vertical spindles with drills placed in line and running at great velocity. There are some other small holes to be drilled. This is done in a machine similar to the above, and the stock is then complete.

The above description refers more particularly to the stocking machinery used at Messrs. Tranters', of Birmingham, which is similar in many respects to the Enfield machinery. —*Mechanics' Magazine.*

To Cover Metallic Utensils with a Cheap, Durable and Lustrous Black Coating.

At the last Paris Exposition could be seen, in the French department, furnaces and ovens, covered with a lustrous and thin coating of lacquer, which could not be scratched off with the finger nail. Other metallic articles from Paris, such as steel for corsets, for example, possessed the same elastic coating, which, on heating, neither emitted odor nor became sticky. The perfect evenness of this lacquer and the absence of any marks caused by a brush gave rise to the supposition that it might have been produced in a way different from that of painting or dipping, and repeated trials in this direction led to the following method for producing this coating. The bottom of a cylindrical iron pot, which should be about eighteen inches in height, is covered half an inch with powdered bituminous coal; a grate is then put in and the pot filled with the articles to be varnished. Besides articles of cast iron, iron wire, brass, zinc, steel, tinned iron and pottery were subjected to the same treatment. The cover is then put on and the pot heated over a coke fire under a well drawing chimney. In the beginning the moisture only evaporates, but soon the coking commences and deep brown vapors escape, which irritate the throat. When the bottom of the pot has been heated for fifteen minutes to a dull red heat, the coal has been mostly converted into coke; the pot is then removed from the fire and, after standing ten minutes, opened for evaporation, all articles except those made of pottery being covered with the above described coating.

This lacquer is not only a protection against oxidation of metals, but will stand also a considerable heat, only disappearing at beginning redness; and therefore is its useful application for ovens and furnaces. Fine iron ware articles, such as sieves, are in this manner coated with remarkable evenness, which cannot be accomplished in any other way. Articles made of tin or soldered cannot be subjected to this process, as they would fuse. During the coking of the coal in the manner described, the peculiar smelling products of dry distillation, which we observe in the gas manufacture, do not make their appearance, and this is the cause of the absence of odor in the lacquer. If the heating be continued too long or too high, the coating will be of a dull blackness and not so elastic and durable. Smaller articles, like hooks and eyes, receive this coating by heating them together with small pieces of coal in a cylindrical sheet iron drum like that used for roasting coffee, until they present the desired appearance. These hints will be sufficient for every manufacturer to construct an apparatus suitable to his purposes.

STATE REPORTS.

The importance and worth of the reports made from time to time, by different State committees, commissions, boards of works, etc., is, we think, generally underrated. Many of these documents that reach us are filled with most interesting and valuable statements of facts, not only of use for present but for future reference. Of this character are now before us the Annual Report of the State Geologist of New Jersey for 1871, the Twentieth Annual Report of the Detroit Water Commission, and the Third Annual Report of the State Board of Health of Massachusetts, which have just come to hand. The statistics contained in the latter are a valuable contribution to sanitary science; and, were the lessons they teach better regarded, the public welfare would be greatly promoted. We shall, as occasion offers, place some of these facts before our readers, to the majority of whom these documents will not be easily accessible.

THE new German Empire wants a new structure for the Parliament of the nations. The architects of the whole world are invited to submit their plans and proposals at Berlin, on or before the fifteenth day of April. A prize of 21,000 francs is offered for the best project, and one of 4,500 francs for each of the four next best.

TERRA COTTA.

Terra cotta in its application to architecture still has its advocates and opponents. When properly manufactured, it is one of the most durable materials which can be employed; but, like stone or any building material, it requires inspection before use.

Very fine specimens of terra cotta made in London one hundred years ago, and exposed to the weather since, are still perfect. In Northern Italy, many fine examples of brick and terra cotta exist, and the extensive revival in England and Germany of this method of building is worthy of note.

The strength of well made terra cotta is surprising. A piece of four inch column, made by Jas. Pulham and tested at the 1851 Exhibition, required a pressure of 400 tuns to the square foot to crush it, or as much as good granite, and two to three times as much as most building stone. In a paper recently read at the Architectural Conference in London, Mr. C. Barry gave some valuable results of experiments on terra cotta, showing the crushing strength of this material to be seven and a half times greater than that of average brick.

A simple test of the texture of terra cotta is the point of a pen knife, which should not penetrate the surface, and will sometimes strike fire upon it. A clear and bell like ring is also an evidence of homogeneity and compactness, and a clean close fracture shows strength. The texture of the body and the precision of the forms are further indications of accurate firing and homogeneous material.

The true qualities of terra cotta in its application to architecture consist in its merits as a decorative fire proof material, possessing the three essentials of color, durability and economy.

When treated with due regard to construction, so as to fulfil its part in the building as honestly as the brickwork of the wall itself, the high capacities of the material to receive artistic treatment admit of the impress of original art being reproduced for the uses of the architect, in an almost imperishable substance.

Fine works in hard stone are exceedingly difficult of execution, and in soft stone soon crumble away; the labor of the artist may be saved by taking a mold of his work, and reproducing it in terra cotta as often as may be required; indeed, the great economy in the use of terra cotta lies in producing a great number of articles of the same pattern.

Where original art is required, the subject can be modelled in the actual terra cotta clay, and passed through the kiln, from which it issues an original work of the sculptor, without the intervention of mechanical copying, molding, pointing or carving.

Modern examples of the extensive use of terra cotta are seen in the Dulwich School, (from designs by C. Barry, Jr.,) costing $500,000, and accommodating 700 boys; the Kensington and other Museums; various hotels and stores, and the great Albert Hall, which cost one million dollars. This building is of brick and terra cotta, contains seats for 8,000 persons, and is capable of accommodating 16,000 without discomfort. The same structures, decorated in stone, would have cost much more.

TERRA COTTA MATERIALS.

Terra cotta, or literally "burnt clay," would seem from its name to be very simple in its manufacture; yet to produce a material as strong, more durable, and less expensive than stone requires an exact scientific knowledge of the properties of many varieties of clay, and accurate observations upon their behavior in the oven.

In the terra cotta manufactures of the North of England and Scotland, the purest lumps of fire clay are selected by their color and texture, and used alone without any other clay, while the firms near London prepare more carefully a mixture of clays, which produces a body of better texture

There seems to be in every case advantage in using a mixture of clays, as a more compact, homogeneous, and better vitrified body is obtained, although at the cost of extra labor and care. One of the chief difficulties met in manufacturing terra cotta figures and ornamental works is the contraction the clay suffers after it has left the mold—first, in drying, and still more in the subsequent process of firing. By mixing the clays, a further advantage is gained in the diminished shrinkage, as fire clay terra cotta (that is, unmixed) shrinks in lineal dimensions about 12 per cent from the time it leaves the mold until it leaves the kiln; the mixed clay terra cotta shrinks 6 per cent or less, and red clays shrink 3 per cent.

To enhance the durability of the body of terra cotta, a partial vitrification of the mass is aimed at, by adding clays which, like the Dorset, contain a small amount of alkalies, which act as a flux to fuse the body harder.

Also vitrifying ingredients, pure white river sand, old fire brick ground fine, previously burned clay, called "grog," are added in various proportions, amounting even to twenty-five per cent. They counteract excessive shrinkage, act as vitrifying elements, and keep the color lighter.

The efflorescence of the alkaline salts in the clays, acting on the silicates of the surface, tend to vitrify more particularly the exterior of the block, and to form a harder surface, which should be left intact.

MANUFACTURE.

The mixture of clays is ground under an edge runner to the consistency of flour. The mills have either revolving or stationary pans; the former do the most work.

In order thoroughly to mix and incorporate the different clays, a subsequent careful pugging is required, for which hot water is sometimes used.

The mixture, when brought to the proper homogeneous consistency, is placed in a plaster mold, withdrawn, dried near the kilns or otherwise, and baked in a kiln for 5 to 7 days, during which time it is slowly brought to a white heat, and as gradually cooled down again.

In order to avoid twisting and warping during the firing, it is necessary, besides complete mixing of clays, that the mold be shaped so as to give a uniform thickness of material throughout; and if the temperature of the kiln be well graded, the homogeneous body will not warp.

To cheapen terra cotta building blocks, they are made hollow, and filled, during the construction, with concrete or cement.

Although in the kilns the products of combustion are separated from the wares, it is found that the use of sulphurous fuel darkens and tarnishes the surface, and it is to be avoided.

REPRODUCTIONS.

One of the advantages of terra cotta is the facility with which it lends itself to the reproduction at home of features of architectural merit, wherever found in distant countries. By taking on the spot a plaster cast of a detail of cornice, bracket, column, or other object, and sending this cast from abroad, it may be used for the reproduction of as many similar objects in terra cotta as the architect requires for a new building.

A practical difficulty is met in taking many casts from plaster cast, as it requires some skill, and deteriorates the model. This difficulty is overcome by the process of gelatin molding, as follows:

The plaster is coated with oil and soap, to prevent adhesion, and covered with a canvas for protection. Rolls of modeling clay are then laid on over the canvas, until the whole surface is covered to a suitable thickness, say 4 to 6 inches; and against this a plaster coating or wall is built up, in, say, two parts, to form a backing for the mold. The two parts are then opened, the canvas and clay are taken out and thrown away, the two parts are replaced, and a hollow interval of the thickness of the clay will exist, into which hot liquid gelatin is poured. After twelve hours, the gelatin will have attained a semi-solid elastic consistency, which will allow of the mold being opened and the gelatin impression peeled from the face of the model. The gelatin impression is replaced on the plaster wall which previously supported it, and a plaster cast is taken from it. From the latter, about four terra cotta reproductions can be made without sensible deterioration.

The advantage of gelatin is that it reproduces minutely without deterioration every mark of the plaster model; its elastic nature makes it especially useful for "undercut" carving, as it yields, while being released from the cut, and immediately again resumes its shape with perfect accuracy. —*Beckwith on Pottery.*

Leaden Water Pipes.

Lead is by far the most common material used in the construction of service pipes for water, and this metal is the one which is the most easily dissolved by water, and at the same most poisonous in minute quantities, being a cumulative poison. A celebrated case occurred in the royal family of France, at Claremont, where one third of the persons who drank of the water were affected. This water contained only one tenth of a grain of lead in a gallon. As little as one hundredth of a grain of lead to the gallon has been known to produce palsy in persons who habitually drank it. It is a great pity that the peculiar advantages of lead as a material for the manufacture of water pipes are more than counterbalanced by the danger of lead poisoning.

When the Croton water was first introduced into New York, it contained considerable lime, derived from the mortar of the recently constructed aqueduct. This prevented, to a considerable extent, the action of the water on the lead pipes, and it was stated at that time that no lead was taken up by the Croton water; but as the lime of the mortar became carbonated, the water ceased to dissolve it and began to act upon the lead pipes. Recently, the attention of the Metropolitan Board of Health having been called to the frequent cases of chronic lead poisoning which occurred in the city, I was requested to investigate Croton water which had been in contact with lead for different lengths of time, under usually occurring circumstances, of which the following are the results:

1. A gallon of Croton water from a lead lined cistern, in which it had stood several weeks, was found to contain 0·06 grain of metallic lead.

2. A gallon of water which had remained six hours in the lead pipes of my residence yielded 0·11 grain metallic lead, a considerable portion of which was visible to the eye, in the form of minute white spangles of the hydrated oxycarbonate ($PbO,HO + PbO,Co_2$).

3. Water drawn from one of the hydrants of the School of Mines laboratory, in the middle of the day when the water was in constant motion, yielded traces of lead. This water reaches the school through about 100 to 150 feet of lead pipe.

These results indicate the source of many hitherto unaccountable cases of lead poisoning, and are of a character to alarm the residents of New York, and to lead them to adopt precautionary measures for protection against this insidious cause of disease.

Certainly no pains should be spared to impress upon servants the importance of allowing the water to run for a few minutes before taking it for drinking or cooking purposes, especially early in the morning after the water has stood all night in the pipes. The habit of filling the kettle from the boiler, or of using water from the boiler for any purpose except washing, is very dangerous.

My second experiment explains a case which recently occurred in New York. An elderly gentleman was completely prostrated with paralysis or palsy. His physician at once suspected lead poisoning from his symptoms, and instituted inquiries which developed the fact that the patient had been using wheaten grits for dyspepsia, and that the first duty of the cook in the morning had been to soak them, preparatory to boiling them. She had therefore used daily the water which had stood all night in the pipes. The occurrence of a considerable portion of the lead in experiment No. 2, in suspension instead of solution, is an additional argument for the use of filters, though it will of course be useless to employ them unless they are frequently reversed, that they may be cleansed.

Manufacturers of lead pipe have frequently appeared in the New York papers with theoretical arguments to prove that the Croton water cannot possibly dissolve lead, but I believe that my simple facts outweigh folios of theory.

Various substitutes have been suggested for lead, as, for instance, wrought iron, which generally makes the water rusty; galvanized iron, which is said to be objectionable on account of the zinc, which is readily taken up by the water, rendering it unwholesome, numerous cases of zinc poisoning by these pipes having occurred in New England, where this pipe is much used; gutta percha, which is not durable: brass, which, I fear, is not wholesome; glass, porcelain, etc. None of these substances possess the peculiar flexibility, softness, and other desirable qualities of lead, which makes it so easy to cut and bend and join and fit pipes of this metal. The problem, therefore, is to provide a pipe which shall possess all the good qualities of lead, and be free from the one great objection, namely, the danger of lead poisoning from its use. This has been achieved by the invention of the lead incased block tin pipe, or, as some call it, the tin lined lead pipe.

I do not think this pipe is well adapted for hot water, as tin is very sensitive to heat, and should recommend that its use be confined to cold water. This is no objection, as the hot water from boilers should not be used for any purpose save washing.—*Professor Charles F. Chandler, in the American Chemist.*

Yaupon.

Yaupon is the name given by the Indians to the leaves of the *Ilex Cassine*, a plant indigenous to the Southern States, but found only along the coast, from Florida to North Carolina. Mixed with the leaves of other species of the same plant, *Ilex vomitoria* and *Ilex dahoon*, it formed "Cassena," the basis of their famous "black drink," which was used by the red men as a medicine, and as a state drink at some of their religious festivals.

Its constituents are, by analysis, as follows:

Volatile oil	0·011
Wax and tar	0·466
Resin	3·404
Chlorophyll	2·491
Caffein	0·122
Tannic acid	2·409
Brown coloring matter	4·844
Gum, pectin, etc.	8·244
Extractive matter	10·149
Extractive matter (starch, pictose, tannin, etc.)	15·277
Nitrogenous matter	8·138
Woody matter	34·854
Moisture	7·595
Ash	3·935
Total	101·939

The volatile oil has a very agreeable odor, perhaps faintly resembling that of raw tobacco, but having also a tea-like smell. The quantity obtained was too small to determine its physical characteristics, but it was quite soluble in water, and a very small quantity gave a decided odor to a large volume of that fluid. The large quantity of resin is worthy of attention, as it is probably derived in large part from the oxidation of the volatile oil; and it suggests that aroma and medicinal properties of the tea might be improved by a more careful preparation of the leaves.

The amount of caffein is small, ordinary tea containing 2·5 to 6 per cent. Stenhouse found 0·13 per cent in Paraguay tea (*Ilex Paraguayensis*) which agrees very closely with the amount found in Yaupon. A trace of caffein was found in the distillate, with the volatile oil, proving that this alkaloid is carried off mechanically when tea or coffee is boiled.

The percentage of tannic acid does not include that rendered insoluble by combination with legumin, etc.

The large amount of woody matter shows that the tea might be improved by more careful picking and manipulation of the leaves.

Yaupon is largely used in the South as a substitute for tea, coffee, and other stimulants; and it is reported to be very beneficial to inebriates who wish to cure themselves of their love of liquor.—*Henry M. Smith.*

GALVANIC BATTERIES.—The annual expenditure of the Western Union Telegraph Company for maintenance of galvanic batteries is over one hundred and twenty-five thousand dollars per annum. Any improvement, by which this immense outlay could be reduced without diminishing the supply of electricity or increasing the labor of maintenance, would be of value and importance. Here is a grand opportunity for students in electricity. A simple battery, more easy and economical to maintain than those now in use, is what is wanted.

TO ADVERTISERS.—We are receiving inquiries where lead-stone can be purchased, also for spark and cinder arresters for chimneys, for machines to chip logwood, and for machines for sawing off stumps close to the ground.

Sleep and Dreams.

While the functions of the tissues are in full activity, says Professor Humphrey, F.R.S., slight deterioration of structure takes place, which, affecting the volun ary system—the muscles and the hemispheres of the brain—causes the sense of tiring, and necessitates a period of rest for the restoration of the tissue to its former condition.

In the case of the muscles, this rest is provided for by periods, quickly alternating periods of action and cessation of action. But in the case of the brain, the actions upon which consciousness, volition, etc., depend, cannot be thus freely suspended. Their continuance is needed for the safety of the body during long periods, through the whole day, for instance; and longer periods are therefore required for repair. These are the periods of sleep.

Of the nervous system, it is the upper region of the brain which ministers to consciousness and volition, the intellectual operations, etc. And the functions of these regions not only can be long suspended without interfering with the action of the lower parts of the brain, which are more immediately necessary to life, but they are very easily suspended—slight causes, such as a jar or a shock, or an alteration in the blood current, being sufficient to stop the action of these parts and deprive the person of consciousness.

The spontaneous stoppage of their action, consequent on the slight deterioration of their structure from the continuance of their functions during the day, is the proximate cause of sleep during the night; and the periodic recurrence of sleep is in accordance with the periodicity observed in several of the nutritive functions, and indeed witnessed in many of the other operations of nature.

Dreams, Dr. Humphrey does not regard, as has been supposed by some, to be a necessary attendant on, or feature of, sleep, but rather to be the result of an abnormal condition. In the natural state, we should pass from wakefulness to complete unconsciousness, and *vice versâ*, quickly, almost instaneously; and many persons habitually do so. But the transition period is sometimes prolonged, and stages are observable.

The first thing that occurs is the lowering or cessation of that control over the mental processes which is the highest of our powers, the one requiring the greatest effort and the most easily lost. In this condition, the thoughts ramble unchecked, chase one another confusedly over the mental field, and give rise to all sorts of incongruities of the imagination.

At the same time, being unrestrained, they are excited, and evince efforts of memory, and even of combination, which, in the regular state of wakefulness, they are quite incapable of.

In this way the images of persons and places, of events and items of knowledge, long forgotten in the ordinary state, are recalled with distinctness, and we fancy that new information has been acquired when it is only forgotten facts that are recalled.

Some physiologists conceive that dreaming depends upon the inequality in the condition of different parts of the brain, some being excited or wakeful while others are quiescent or asleep; from this Dr. Humphrey dissents. He rather takes the view that all parts of the cerebral hemispheres combine in each of the efforts of control, consciousness, memory, and other mental acts, that all suffer alike from these effects, alike need the restoring changes which take place in sleep, and together *pari passu*, pass through the stages on the way to and from sleep, in which dreaming, sleep-walking, etc., occur.

The Uses of Ammonia.

The *Country Gentleman* thus discourses: Spirits of ammonia are nearly as useful in housekeeping as soap, and its cheapness brings it within the reach of all. For many household purposes it is invaluable; yet its manifold uses are not as generally known as they should be. It is a most refreshing agent at the toilet table; a few drops in a basin of water will make a better bath than pure water, and if the skin is oily, it will remove all glossiness and also disagreeable odors. Added to a foot bath, it entirely absorbs all noxious smell so often arising from the feet in warm weather, and nothing is better for cleansing the hair from dandruff and dust. For the headache it is also a desirable stimulant, and frequent inhaling of its pungent odors will often entirely remove catarrhal cold. For cleansing paint, it is very useful. Put a teaspoonful of ammonia to a quart of warm soap suds, dip in a flannel cloth, and wipe off the dust and fly specks, grime and smoke, and see for yourselves how much labor it will save you. No scrubbing will be needful. It will cleanse and brighten silver wonderfully; to a pint of hot suds mix a teaspoonful of the spirits, dip in your silver spoons, forks, etc., rub with a brush, and then polish on chamois skin. For washing mirrors and windows, it is also very desirable; put a few drops of ammonia upon a piece of newspaper, and you will readily take off every spot or finger mark on the glass. It will take out grease spots from any fabric; put on the ammonia nearly clear, lay blotting paper over the place, and press a hot flat iron on it for a few moments. A few drops in water will clean laces and whiten them finely; also muslins.

For cleaning hair and nail brushes it is equally good. Put a teaspoonful of ammonia into one pint of warm or cold water and shake the brushes through the water; when the bristles look white, rinse them in cold water, and put into the sunshine or in a warm place to dry. The dirtiest brushes will come out from this bath white and clean. There is no better remedy for heartburn and dyspepsia, and the aromatic spirit of ammonia is especially prepared for these troubles. Ten drops of it in a wineglass of water are often a great relief. The spirits of ammonia can be taken in the same way; but it is not as palatable a dose. Farmers and chemists are well aware of the beneficial effects of ammonia on all kinds of vegetation; and if you desire your roses, geraniums, fuchsias, etc., to become more flourishing, you can try it upon them, by adding five or six drops of it to every pint of warm water that you give them; but don't repeat the dose oftener than once in every five or six days, lest you stimulate them too highly. Rain water is impregnated with ammonia and thus it refreshes and vivifies vegetable life. So be sure and keep a large bottle of it in the house, and have a glass stopper for it, as it is very evanescent and also injurious to corks, eating them away.

JOHNSON'S RENEWABLE TOOTH COMB.

We illustrate herewith an improvement in combs, the advantage of which to manufacturers is that the material may be worked up much closer than in the old way, and that, at the same time, a tasty and graceful appearance may be given to the article. To consumers, it offers the advantage that, when any of the teeth are broken in use, they may be easily replaced, at a very small expense as compared to that of the purchase of a new comb.

Fig.1 *Fig.2*



In the engraving, A represents the plate of the comb, formed of a piece of sheet metal doubled and confined at the ends by a block or end piece, B, in which the screws, C, work. The end teeth, D, extend entirely through, as shown.

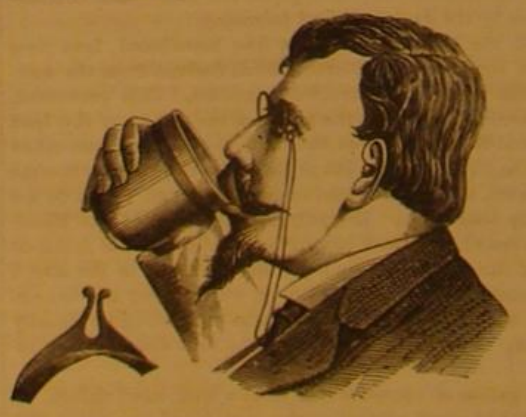
The middle of the plate, A, has impressed in it an indentation or groove formed lengthwise and constituting a rib in the inside, or a ledge upon which the bases of the teeth abut, the butts of the teeth being notched to fit the ledge.

The teeth, being inserted as shown, are firmly held by turning up the screws, C. When a tooth breaks, it may be replaced by loosening the screws, inserting the tooth in its proper place, and then turning up the screws again.

The invention was patented through the Scientific American Patent Agency, January 30, 1872, by Orange Johnson, of Grand Ledge, Mich., who may be addressed for further information.

MOUSTACHE GUARD.

In these days, when an unshaved lip is the rule, except among clergymen, it is hardly necessary to dwell upon the advantages or disadvantages of the moustache. Suffice it to say that, in our changeable climate, physicians are agreed that it conduces to health; and the inconvenience it offers, to the imbibation of the various fluids with which the human animal regales himself, has not been found sufficient to destroy the favor with which this popular hirsute appendage is regarded. In fact, it may be questioned whether it is not looked on with feelings of envy by certain strong-minded individuals of the sex to whose faces Nature has denied the manly attribute of beard.



The man who has invented a means, whereby those "bearded like the pard" may sip their wines, mixed drinks, and the milder beverages which "cheer but not inebriate," may justly be ranked in the long list of the eminent benefactors of mankind; and in virtue of his having conferred this inestimable boon upon mustachioed humanity, we therefore record, among the latest and brightest of these benefactors, the name of Eli J. F. Randolph, of New York, who patented (Feb. 20, 1872), through the Scientific American Patent Agency, the device which is illustrated in the accompanying engraving.

The nose has long been employed to support eyeglasses and spectacles. It is said it was once employed by a celebrated musician to execute a note, inserted by an ingenious joker, in a piece of music, the exigencies of which extended the hands to the ends of the keyboard, while the note in question required the manipulation of a key in the middle.

Surely the nose, after having performed such a feat, must be equal to the keeping of one's moustache out of one's mush and milk, when provided with a proper instrument for the purpose.

Such an instrument is provided in Mr. Randolph's invention. It is a curved plate, of hard rubber or other suitable material, adapted to the form of the upper lip, so that, being suspended in front thereof, the flange will take under the moustache, and hold it so as not to interfere with eating and drinking. Kissing, although not claimed in the patent, might perhaps also be rendered more easy and satisfactory by its use.

The plate has two curved prongs with rounded edges, so as not to injure the parts with which they come in contact, and adapted to enter the nostrils and suspend the plate from the thick part of the nasal septum, by grasping the latter, the prongs being inserted at the front of the septum, and pressed backward till they get a good hold.

The moustache is thus held, as shown in the engraving, with the attendant advantages above set forth.

Tungsten Compounds.

Professor Roscoe, F. R. S., recently read a paper, before the London Chemical Society, "On the Study of some Tungsten Compounds." He had prepared and examined a number of tungsten compounds which appeared to establish definitely that this element had the atomic weight 184. Four chlorides had been obtained, WCl_6, WCl_5, WCl_4, and WCl_2, of which the first three corresponded to the oxides WO_3, W_2O_5 and WO_2. The hexachloride, a solid crystalline substance, was formed by passing chlorine over heated metallic tungsten prepared from pure tungstic acid, taking great care to exclude moisture and oxygen, which would give rise to the formation of oxychlorides. In order to obtain tungstic acid pure and free from sodium, it was found necessary to convert the acid from commercially "pure tungstate of sodium" into the ammonium compound, which was then repeatedly crystallized; the presence of even a trace of sodium is easily detected in tungstic acid, as when ignited, it acquires a green tinge from formation of some lower oxide of tungsten, whilst the acid in a pure state is of a yellow color, without any shade of green. The vapor density of the hexachloride, taken at 440°, gave numbers considerably too low for the atomic weight 184. whilst, at 350°, the results corresponded to it, showing that at the higher temperature dissociation or decomposition took place, which was confirmed by the fact that, when the hexachloride was heated to a high temperature in a current of carbonic anhydride, chlorine was taken off. This tungsten compound may be crystallized from carbon bisulphide, and is not deliquescent when quite free from the pentachloride and oxychloride. The pentachloride WCl_5 which is also a crystalline solid, was obtained from the hexachloride by heating it in a current of hydrogen and then distilling off the volatile pentachloride from the non-volatile tungsten compounds containing less chlorine formed. At the same time, tungsten tetrachloride and tungsten dichloride are not crystallizable. Tungsten oxychloride, $WOCl_4$ and tungsten dioxychloride, WO_2Cl_2, both crystalline compounds, have been known for some time: the former forms scarlet needles and laminæ; the latter is pale yellow. Professor Roscoe has also examined the two bromides, the pentabromide and the dibromide, and believes that a tribromide exists, although he has as yet been unable to isolate it. Tungsten pentabromide was most conveniently prepared by passing carbonic anhydride, saturated with bromide vapor, over heated metallic tungsten. It forms very dark colored crystals which undergo slight decomposition when kept, bromine being liberated. The dibromide is not crystalline. He had also prepared and examined the dioxybromide WO_2Br_2, the oxybromide $WOBr_4$, a substance crystalling in red needles somewhat resembling potassium chlorochromate, and the di iodide WI_2, which is the only iodine compound of tungsten he had succeeded in obtaining. From numerous analyses of these different compounds, and from vapor density determinations, Dr. Roscoe has succeeded in establishing that tungsten is a hexad, and, from careful determination made with the hexachloride, has found the atomic weight to be 184·04 Tungstic acid, being exceedingly difficult to obtain in the pure state, gave a slightly lower number. A series of very fine specimens of the substances were exhibited.

Professor Roscoe further said that the splitting up of the hexachloride under the influence of heat showed that the pentachloride could be formed without the use of hydrogen; moreover the highest tungsten compound of bromine known, the pentabromide, which was quite analagous to the pentachloride, was formed directly from tungsten and bromine without the intervention of hydrogen.

Poisonous Hair Dyes.

With but few exceptions, all the concoctions, sold for the purpose of "restoring" the color of the hair or for dyeing the hair, contain the salts of lead, a deadly poison, highly injurious to the health when applied to the scalp or other portions of the body, even in minute quantities. Professor Charles F. Chandler, of Columbia College, N. A., has examined a variety of these preparations; and, in each fluid ounce of the following popular articles, finds lead as follows:

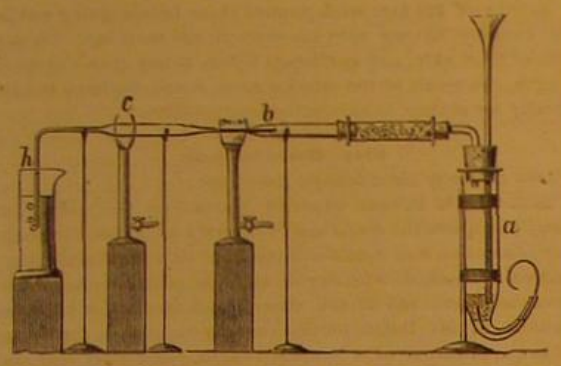
Clark's Distilled Restorative for the Hair	0·11
Chevalier's Life for the Hair	1·02
Circassian Hair Rejuvenator	2·71
Ayer's Hair Vigor	2·89
Professor Wood's Hair Restorative	3·08
O'Brien's Hair Restorer America	3·28
Gray's Celebrated Hair Restorative	3·29
Phalon's Vitalia	4·69
Ring's Vegetable Ambrosia	5·00
Mrs. S. A. Allen's World's Hair Restorer	5·57
L. Knittel's Indian Hair Tonique	6·29
Hall's Vegetable Sicilian Hair Renewer	7·13
Dr. Tebbett's Physiological Hair Regenerator	7·44
Martha Washington Hair Restorative	9·80
Singer's Hair Restorative	16·39

THE QUANTITATIVE DETERMINATION OF ARSENIC.

BY JOHN C. DRAPER, M.D., PROFESSOR OF CHEMISTRY, UNIVERSITY MEDICAL COLLEGE, NEW YORK.

In a paper in the last number of the SCIENTIFIC AMERICAN, attention was directed to the difficulty of completely separating arsenic from the arsenide of hydrogen by the action of heat; it is my purpose in the present paper to show that this may be accomplished in the most satisfactory manner by the introduction of a faggot or bundle of platinum wire into the reduction tube.

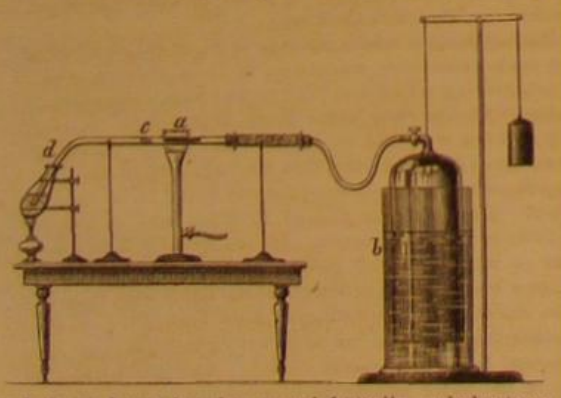
Many explanations of the action of the platinum will at once suggest themselves, but it is probably owing to the ease with which this metal unites with arsenic, especially in an atmosphere of hydrogen; at all events, I may for the present accept this hypothesis in the description of the process I am now to lay before the reader.



The arrangement I have employed may be described as a modification of the reduction or ignition tube of the hydrogen apparatus, *a*. It consists of a hard lime glass tube, *b c*, one quarter of an inch in diameter and drawn down at *b* to form a tube about two inches long and one tenth of an inch in diameter. A weighed faggot or bundle of clean platinum wire, about two inches long and made of ten or a dozen pieces of the metal, is then dropped into the narrow portion of the tube, *b*, which it should fit closely in the manner shown in the figure. The end *h* of the tube is drawn down and bent to deliver the escaping gas into a dilute nitrate of silver solution.

A sufficient quantity of hydrogen gas having been evolved in the decomposition flask to fill the whole apparatus, a flame is applied at *c*, and if, after passing the gas slowly for half an hour, no deposit of arsenic appears in the narrow tube between *c* and *h*, the materials may be considered as being sufficiently pure. A Bunsen flame, from an elongated opening $\frac{1}{16}$ of an inch wide and one inch long, is then applied at *b*; and the arsenical solution is introduced into the decomposition tube, *a*. After a few moments, a change may be noticed in the hot platinum faggot, its exterior becoming rough and crystalline from the deposition of arsenic; and even though the arsenical solution be very strong and the rate of evolution of the gas quite rapid, the precipitation of the arsenic is complete, no trace of a deposit appearing at the second flame and the silver solution remaining unchanged.

After the whole of the arsenical solution has been introduced into the decomposition tube, the gas may be passed over the hot platinum for an hour, when its freedom from arsenic may be tested by removing the flame from *b* for a few moments. If any arsenide of hydrogen is still passing, its presence is indicated by the appearance of a stain at *c*, and the flame must be restored at once at *b*. Moving the flame, *c*, nearer to the bend of the tube will drive the stain to or beyond *h*, and leave the portion at *c* ready for another trial test. The use of the second flame, *c*, is therefore to test the purity of the materials at the outset, to show that the operation of



the platinum faggot is going on satisfactorily, and also to enable the experimenter to determine when the evolution of the arsenide of hydrogen ceases.

All the arsenic being thus deposited on the platinum the faggot is removed from the tube; its weight is again determined, when the increase will represent the quantity of metallic arsenic that has been precipitated on it. The conversion of this by a simple calculation, into its equivalent of arsenious acid, completes this portion of the operation.

The next step is the actual transformation of the arsenic, on and united with the platinum, into arsenious acid, in which form it may be either kept or employed for the application of other tests. The method, by which I have accomplished this, is to heat the platinum faggot in a tube, *a c d*, through which a current of dry oxygen is passing from the gasometer, *b*. In an atmosphere of this gas, nearly the whole of the arsenic is volatilized from the platinum at a dull red heat as arsenious acid, which recondenses at *c*. A small portion of the arsenious acid is drifted on towards the open end of the tube, but this may be arrested if necessary by passing the escaping gas through water which is kept boiling at a moderate rate in the flask, *d*.

When the formation and volatilization of the arsenious acid is completed, the tube may be cut through the middle of the stain, *c*, and the portion, *c d*, divided into small pieces and placed in the flask, *d*. To the solution thus formed other tests may be applied.

Not only is the use of the platinum faggot applicable in medico-legal investigations, but it may also be employed for the quantitative determination of arsenic in many metals and their ores. For this purpose, various methods will be required in the treatment of such materials before they can be introduced into the decomposition flask; but these will readily suggest themselves to the practical chemist.

Improvement in Saws.

This invention consists in having the back formed of a bar or rod of iron, preferably round, with one end fitting in a hole in the handle, so as to shift forward and back, with a nut screwing on to it against the handle to force the back outward, to strain the saw, which is connected to the handle in the ordinary way, the other end of the back being extended to or toward the outer end of the saw blade, and connected to it for straining it. The rod or bar forming the back is not grooved, and the back edge of the saw is let into it, as in the case of the ordinary back saws, but is intended to fit as snugly against the side of the back rod as it may and be free of it.

The principal object of the invention is economy in the expense of the construction; but it has other advantages which will be pointed out.

This mode of attaching the back to the wood handle is claimed to be much cheaper than the connection of the ordinary flat back, for the hole is formed by boring, while a recess or cavity must be worked into the handle, by chisels, for the flat back, which requires much more labor and time. The flat backs are very expensive to make, whereas in this invention any suitable bar or rod of the right size is completed by forming the screw thread for the nut and shaping the outer end for connecting the saw blade to it, both of which are simple operations.

Again, when the back is formed in the old way, the saw, being placed in the groove in the back for it, is secured by hammering the sides of the back to pinch them upon the blade to hold it. This warps and buckles the saw to a considerable extent, for it is impossible to hammer the sides alike throughout their length, and this buckling of the saw must be hammered out after it is connected to the back, all of which is avoided by this improvement.

When the saw is once connected to the back in the old way, it cannot be disconnected for filing and setting, which is objectionable because the back and the handle interfere with placing the blade in a vise or clamp for filing, or on a plank in a setting apparatus for setting; whereas, by this plan, the pin being removed, the blade can be wholly detached, or be swung away from the back on the screw to be placed in the vise.

After the wood handle has shrunk, the blades get loose and shift about in the handle so as to interfere considerably with doing work well by them, when connected in the old way; whereas, when arranged according to this improvement, they can be kept tight by the adjusting nut, although the handle shrinks to any extent it is liable to.

The back may be adjusted readily for saws varying considerably in length, for it may extend into the handle more or less within a considerable range of variation.

This invention has recently been patented by Mr. Joseph Holden, of Middletown, N. Y.

Waves of Sound and of Light.

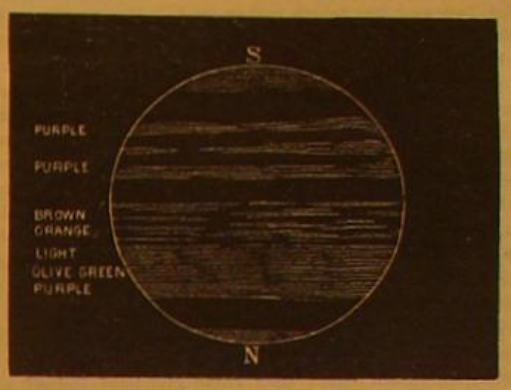
In the case of a sound wave—moving 1,100 feet a second whatever the wave length—if the length be diminished, more vibrations enter the ear in the same time and the pitch rises; if it be increased, less vibrations enter, and the pitch lowers. Light waves are strictly analogous; whenever any one of the colored waves which form white light is lengthened, its color changes toward the red end of the spectrum; when it is shortened, toward the violet. Hence change of pitch in the case of sound, or of color in the case of light, is evidence of motion, either to or from the observer; which it is, depends on whether the wave is lengthened or shortened. Now, while the motion of a star at right angles to the line of sight is easily detected and measured by the telescope, motion in the direction of this line is capable of measurement only by the spectroscope; if the motion be diagonal, then by both of these instruments together. Hence the motion of a fixed star in space, or of a whirlwind on the sun, may be measured by the change, in refrangibility, which certain lines in the spectrum undergo.

To illustrate this point by means of sound waves, Professor Mayer, of the Stevens' Institute, has originated a new and beautiful experiment, which he recently employed in a lecture before the scientific department at Yale College. With the lantern, the image of a tuning fork beating 256 times a second—and giving the note Ut_3—was thrown on the screen. By the side of one of the prongs, and just touching it, was a carefully rounded and varnished cork ball, suspended by a filament of silk. On sounding a second fork placed on its case, and tuned in accurate unison with the first, anywhere in the room, even 30 feet distant, the first fork was thrown into vibration and the image of the cork ball was projected on the screen a foot or two away from the prong. When, however, the second fork was sounded, and the lecturer walked rapidly—at a rate of 8 feet a second—towards or from the first, touching the case only when in motion, no motion of the cork was observed; the wave being in this way shortened or lengthened by an amount sufficient to throw it out of unison with the lantern fork. Again, a third fork, vibrating 254 times a second, produced no effect on the ball; but when sounded and placed on its case, as this was swung rapidly toward the first fork, the wave length was thereby so shortened as to bring it into unison with this, and the ball promptly responded. A fourth fork, vibrating 258 times, showed the same phenomenon, when placed on its case as this was swung away from the first fork, the wave thus being shortened into unison. The demonstration was most complete and satisfactory. Professor Mayer stated that he purposed making some quantitative experiments with the apparatus, which will be of the highest value to science.

THE PLANET JUPITER.

This planet is receiving a good deal of attention from astronomical observers.

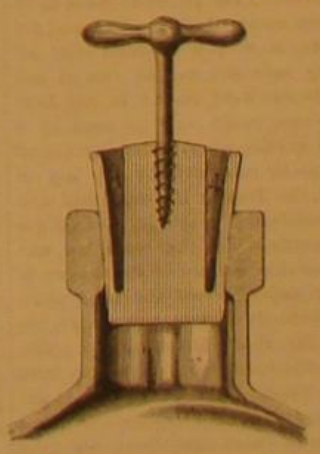
W. Lassell, Esq., ex-President of the Royal Astronomical Society, has just published, in the Transactions of that learned body, some remarks upon this subject, with a sketch of the planet as seen by him in his 2-feet Newtonian reflector with powers of 260, 430, and 579. These observations were taken on the interesting occasion of a transit of the fourth of the satellite across the planets disk, when the satellite appeared almost as black as if it were a shadow transit—a striking proof of the exceeding brilliancy of the planet's surface. But this was not the phenomenon that appeared most striking in the rare and exquisite view of Jupiter, but rather the distinct presence of color on the disk, sufficiently marked to overcome previous skepticism. Mr. Lassell deems it an advantage of a Newtonian reflecting telescope, when the alloy of the specula is well compounded, that colors of the planets are more faithfully represented than is possible in refracting telescopes, which, not being perfectly corrected for chromatic aberration, generally introduce a modifying tinge.



In the same number of the proceedings of the Royal Astronomical Society, the Astronomer Royal makes a suggestion that one observatory shoud be permanently devoted to observations of the phenomena of Jupiter's satellites. In advocating this proposal, Professor Airy points out that the theory of the movements of Jupiter's satellites is perhaps the most interesting among the planetary applications of the theory of gravitation, especially in the remarkable enchainment exhibited in the movements of the three interior satellites.

WRIGHT'S BOTTLE STOPPER.

The object of this invention is to provide a bottle stopper which may be inserted and withdrawn an indefinite number of times without injury, and which shall be homogeneous in texture and uniform in its elasticity.



The stopper is made of a block of wood, in which is turned a deep annular groove, A, by which the outer bearing of the stopper forms a more or less elastic and flexible ring, according to the nature and thickness of the wood. The stopper is preferably made of soft pine, poplar, or other soft elastic wood. The lower end may be saturated or covered with varnish or other suitable substance to close its pores and prevent the evaporation or escape of volatile liquids.

A hole, B, is formed in the center for the insertion of a screw, by means of which the stopper is withdrawn. This device was patented, through the Scientific American Patent Agency, Nov. 14, 1871, by Wendell Wright, of Phœnicia, N.Y.

MALLEABLE IRON CASTINGS.—A correspondent wanting a few hundred pounds of malleable iron castings informs us that he has written to every foundery that he knows of, and is frequently informed that they have on hand orders to last them for the next three or four months. He states his belief that if he could find a maker of malleable iron castings who is too poor or too stingy to advertise, and who consequently is in want of customers, he could get his orders filled promptly. This seems to be a good business for enterprising people to engage in.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Saws and Files, and their Manufacture.

To the Editor of the Scientific American:

A short sojourn at Johnstown, Fulton County, N. Y., has given me the desired opportunity of visiting the Cayadutta Works, a large saw and file manufacturing establishment in this place, and to inspect some machines and processes, a brief description of which may interest some who daily use those useful articles, but who have never witnessed the making of them.

In the saw department, almost all kinds of saws are made, circular, cross cut, hand, wood butcher's and kitchen, the last three being the specialty.

As a type of all, let us trace the steps by which sheets of steel, 18 by 30 inches, and two inch birch, maple, or ash plank are converted into the well known red jacket buck saw, which bears on the bright blade the company stamp, The Livingston and Cheritree M'f'g Co., and on the frame, the device of a bow and arrow.

By a strong power shears, the sheets of steel are cut into strips two and one fourth inches wide. For toothing, the blade is then fixed upon the bed, or table, of the toothing machine, on which one edge is made to pass steadily beneath a V shaped punch, by which the teeth are cut more rapidly than one can count. The toother used was made here, has toothed as many as sixty dozen saws in a day, and is valued at $350. The punch leaves a burr on one side of the teeth, which is "knocked down" by passing the blade under a small trip hammer. The saws are next taken to the hardening shop, where they are first heated in an oven until the color indicates sufficient heat, the best steel requiring to be brought to a light blue color, the poorest to nearly a straw color, intermediate qualities of steel requiring different shades; so that great skill is necessary in the operator. From the oven, the saws are plunged into a vat containing a mixture of oil, beeswax, etc., from which they come out hard indeed, and almost as brittle as glass. They are then heated again to a certain extent and allowed to cool slowly, which gives a spring temper, so that they can be bent double without breaking. The smithing process follows, in which the saws are straightened with hammers on steel faced anvils, after which the whole blade is ground and then smoothed on emery wheels. After another heating to perfect the temper, and the removal of the blue color which this heating gives with acid, they are set and filed in the ordinary way, by hand, when they are ready for the frames, to the making of which we will now attend.

In the company's mill the logs are cut into plank. These are cut with a circular saw into pieces of the proper length for the several parts of the frame, namely, the handle, head and cross bar. The pieces are then marked by patterns and sawn with gig saws. Each piece is next split with a small circular saw. After drying for several months, they are run through an ordinary planer, which brings them to one thickness. The next process is the most interesting of all. It is called burring, which means the rounding of the edges and ends of the pieces which form the frame. It is done by a wonderful little machine, not much larger than an ordinary sewing machine, the invention of Mr. John W. Millet, the machinist of the establishment. It consists of four wheels, about eight inches in diameter, three of them having a V shaped edge, which runs in a groove in the edge of the fourth. Two of the V edged wheels are on shafts which are made to revolve by belts running to the main shaft. The third is above these, and the fourth, or groove edged one, is supported by the other three in the center of the triangle formed by them. It is turned by the friction of the two wheels, below it, on which it rests. This wheel in the center has a hole in its center, some two and one half inches across. On the inner edge of the wheel, knives are set. The pieces of wood to be burred are shoved through the center of this wheel and are thus rounded. The advantages of this machine over all others are that it is perfectly safe and can be run at one third of the expense. The double head burrer, in use here before the invention of this one, could only be used by a strong and skillful man, and is charged with having cut off eight or ten fingers. This can be run safely by any boy of fifteen. After being burred, the frames are smoothed and polished by Whitney's smoothing machine, the edges smoothed on a sand wheel, mortised for the cross bar, and grooved for the saw. The peculiar feature of these saws is the brace which connects the upper end of the head piece with the center of the cross bar. It is the invention of the President of the company, Mr. Wm. H. Livingston. The strainer and brace are one continuous rod, extending from the swivel at the top of the handle, through an eye at the top of the head piece, to the center of the cross bar. Of these brace saws, which are made nowhere else, there are four grades, distinguished by the color of the fastenings, and named respectively red jacket, blue jacket, green jacket and black jacket.

The peculiar features of the butcher saw made here are the stiffener, the mode of fastening to the handle, and the buckle by which all the parts are held in place. The complete saw consists of the blade, back, stiffener, buckle, and handle. To form the back, a groove is cut with a small circular saw lengthwise in an iron rod, into which groove is fitted the stiffener, a strip of steel the length of the saw, an inch or more in width, and about one eighth inch thick. The rod, which projects some six inches at each end of the stiffener, is bent without heating over the ends of it, to a curve at one end and a right angle at the other. Through a hole in the handle, the right angled end of the rod passes flatwise, and is secured by the buckle, a small triangular prism which serves as a nut at the end of the rod, no rivets being used in the handle. One end of the blade is fastened by a rivet to the outer end of the rod which forms the back. A short rod fastened to the other end passes through a hole in the buckle, and is secured by a nut, by which the saw is tight ened. A vertical slit in the buckle receives the end of the blade.

The kitchen saw consists of three parts only, the blade, back, and handle, the back passing through the handle, and the blade being riveted at both ends, the spring of the back giving sufficient strain to the saw.

Various other saws are made, but in the ordinary manner.

Besides the burrer, described above, there are several curious machines in use here, also the invention of Mr. Millet, by each of which hundreds, if not thousands, of dollars are annually saved. Among them are two eight inch circular saws, run by one shaft and so placed as to cut off at once and at the proper bevel both ends of the cross bar of the buck saw. A little toothed and grooved wheel cuts the tenons at the end of the cross bar, leaving the shoulder to fit the rounded edge of the frame. With a little machine, which can be made for $25, a small boy bends the rod which forms the brace and strainer and forms around it, at the angle, the eye by which it is fastened to the head piece. With a pair of long handled gouges set in a frame, the round at the upper end of the handle is cut.

Seventy-five kinds of machines are used in this factory, and the full force of men is about 250. 20,000 dozen saws can be made in a year, and the company intend to make 10,000 buck saws in 1872.

Files are first forged from bars of steel by smiths, on anvils, then annealed by heating and straightened, after which they are cut by hand with chisels. They are then covered with a kind of paste, the exact composition of which is a secret of the trade, which protects the teeth during the hardening process. They are hardened by dipping in hot lead and, when brought to a cherry red heat, plunging in salt water.

This factory has six forges and twenty-nine blocks for cutting, and is thought to be one of the best arranged establishments in the world.

The celebrated McCarthey cotton gin for the long sea island cotton is manufactured here.

The Cayadutta Works are named from the stream which furnishes the power by which they are carried on, about 108 horse power. They were founded, in 1863, by Wm. H. Livingston, the President of the company, to whose kindness I am indebted for so favorable an opportunity to visit the establishment and learn the details of the business.

I forgot to state that a new plan is about to be tried for sawing out the frames without the tedious process of marking by a pattern.

Johnstown, N. Y. CHAS. H. DANN.

Coating Cast Iron with Other Metals.

To the Editor of the Scientific American:

In response to your article, page 165, current volume, I will submit the following:

In plating iron with tin and other metals, the first thing to be done is to prepare the iron for plating; any fault or neglect in this will cause a total failure. First, then, cleanse the articles to be plated from sand, dirt, smoke pitch, grease, etc., by immersing them in dilute sulphuric acid for about fifteen or twenty minutes; then scrape, file, scour, or grind the parts to be plated until bright and smooth; then, if the articles are small, take a camel's hair pencil, if large, a flat camel's hair brush, and apply dilute muriatic acid to the parts to be plated, taking care not to get any on other parts. Next take an iron pot, and put into it a sufficient quantity of tin, or whatever metal is to be used; place the pot over a steady fire, and, when the contents are quite melted, dip the articles into the melted tin, taking care to scrape to one side any scum or dirt which may collect upon the surface of the melted tin, so that nothing but pure melted tin can come in contact with the articles dipped. If the articles are of any considerable size, it will be well to plunge them into cold water when taken from the pot of tin. The work having been well done, the articles will now be thoroughly coated where they were scoured and washed with acid, while no tin will adhere to the other portions. All that now remains to be done is to rub down any lumps and ridges, which may have collected here and there, with a soldering iron, and then polish with a burnisher, and the work is done.

Other metals besides tin, such as zinc, lead, etc., may be used; or a compound of metals, such as pewter, etc., can be applied by melting the hardest first, and adding the others, one at a time, until all are in and well mixed; but the zinc must be added last, if any is used, because it is most easily injured or burned.

The practice of covering the melted mass with a thin layer of tallow, when a lengthy process is to be performed, is to keep the tin from hardening or scumming over, and not to affect the process of tinning in any way; and care must be taken that no grease comes in contact with the articles when dipped; the sweat from the hands of the workmen is sufficient to prevent the tin from adhering to the iron.

St. Albans, Vt. CHARLES THOMPSON.

Shaving with Pumice Stone.

To the Editor of the Scientific American:

I am of a very inquiring mind and derive a great deal of comfort from reading your valuable paper. Anything novel or strange in science or the arts is sure to attract my attention.

I was more than usually interested in the communication on shaving with pumice stone. Visions of bankrupt barbers and a total revolution in the tonsorial system arose before my fervid imagination. I could not rest until I had tried this wonderful means of keeping down the human stubble; accordingly I procured two nice pieces of pumice stone and prepared them as directed; and, after a half hour's work on a week old stubble, I have—a chapped face. To say I am disappointed but feebly expresses my feelings. I have heard of very young men shaving with a towel, but I am convinced this sand paper arrangement is a fraud. The joke would have had more point if your correspondent had deferred publishing it until the 1st of April. A VICTIM.

Macon, Ga.

["Victim" must be thin skinned, or the result of his shaving with pumice stone, if skillfully used, would have been more satisfactory. It is a favorite mode of shaving in Havana, and we know of persons in this city who employ it. A celebrated physician told us the other day that he was in the habit of polishing off his face with pumice stone before going out in the evening, having used the razor in the morning. On persons of thick skin, and stiff beard before it has grown to much length, the result of the pumice stone shave, we have his authority for saying, is most satisfactory.—EDS.

City Disinfection.

To the Editor of the Scientific American:

In an article in your paper of March 9 on "City Disinfection," you quote the remark of Professor Liebig that "the coming generation will consider those men as the greatest benefactors of mankind who devote all their efforts to utilise and save the night soil of the cities," and mention a patented method of Mr. Dotch for disinfecting night soil, consisting of the application of a prepared earth, containing clay and sulphuric and nitric acids, which is spread in thin layers over the fresh feces. Without questioning the value of this patented method, it occurs to me that Nature has provided in illimitable quantities a substance, which is very accessible and cheaper than any prepared or invented, which will accomplish the desired object instantaneously and add its own valuable properties to those of the disinfected feces. This substance is dried peat, to be reduced to an impalpable powder by the action of frost or by passing it through a threshing apparatus. By spreading this substance in thin layers over the fresh feces, all offensive odor is seized as quickly as thought and held; and the decomposed vegetable matter of the peat, added to the feces, makes a manure of the greatest value which can be handled without the least possible offence. It is adapted to the utilizing of both solid and liquid excrements. The city of New York, by adopting a system of earth closets and the use of this unpatented method, cannot only convert what is now a nuisance and the source of malaria and consequent sickness into a substance of incalculable value to the agricultural interests of the country, but also make it a source of revenue to the city. Besides, the adopting of this system will dispel all fears of a failure of the supply of Croton water to the present or increased population of the city. R.

GEOLOGICAL REPORT FOR NEW JERSEY.

We are indebted to Professor George H. Cook, State Geologist, for his 1871 report. From it, we learn a great deal of information concerning the mineral products of this State. In some portions of the State, mines rich in magnetic ore are being constantly discovered and are extensively worked. The product last year, according to Professor Cook, amounted to 450,000 tuns, more than four fifths, about 370,000 tuns, coming from Morris county alone. The mining of hematite ore in New Jersey is limited to a few localities, and the total product is estimated on good authority to be only 15,000 tuns for last year. The zinc mines of New Jersey have yielded about 22 000 tuns of ore during the year. Of arsenical ore, Professor Cook says:

"During the past season, specimens of so called silver ore have been extensively circulated at Hackettstown, and in the neighboring villages of Warren and Sussex counties, the localities whence they came being kept secret. A single lump of what was said to be the same as the 'silver ore' was obtained from the ridges on the east side of the Jenny Jump Mountain, and was analyzed and found to be an ore of arsenic. The specimen yielded 15·60 per cent of sulphur, and 29·80 per cent of arsenic. Mineralogically, it is arsenopyrite or mispickel, with probably some löllingite, but the specimen was too small to determine the latter with certainty. In the report on the mineralogy of New York, Dr. L. C. Beck mentions this arsenical ore as occurring in crystalline limestone near Edenville, Orange county. The geological character of the latter locality is very similar to that of these subordinate ridges of Jenny Jump Mountain range. The analysis of the New Jersey specimen indicated traces of cobalt and nickel, but no silver could be detected. It is probable that the traditions of silver ore on this mountain are based upon these arsenical pyrites. This ore, associated with other combinations of arsenic, nickel, cobalt, iron and sulphur, is worked in Saxony, and extensively at Reichenstein, in Silesia, as a source of metallic arsenic, arsenious acid, or white arsenic, the pigments realgar and orpiment, and for other arsenical compounds used in the arts. The extent of the occurrence and the character of this ore are matters to be more fully studied, before deciding upon its probable value."

On road making, the Professor states that, in the city of Orange, N. J., trap rock has come into use, for making roads, with the most satisfactory results. The material is hard and tough, and the roads made of it are solid, smooth and durable, and, for their excellence, of moderate expense. They are so

well liked that their use is extending rapidly. Several miles are already built. It is known as the Telford pavement, and is described as follows :

"The roadway to be excavated, graded and properly leveled to a depth of sixteen inches below the top of the gutter stone; the form of the cross section to be in every respect the same as that to be given to the surface of the pavement. The road bed is then to be rolled with the steam roller until approved by the Street Commissioner. On the road bed thus formed, a bottom course or layer of stones, of an average depth of eight inches, is to be set by hand in the form of a close firm pavement, the stones to be placed on their broadest edges, lengthwise across the street, and so as to break joints as much as possible; the breadth of the upper edges not to exceed eight inches. The interstices are then to be filled with stone chips, firmly wedged by hand with hammers, and projecting points broken off. The whole surface of this pavement to be subjected to a thorough setting or ramming with heavy sledge hammers. The intermediate layer of broken stone is then put on to the depth of six inches, the stones to be broken, to a size not exceeding three inches diameter, and thoroughly rolled down with the steam roller; after which the surface layer of broken stone, of a size not exceeding two inches in diameter, is to be put on and evenly spread to such depth as may be required to bring the surface, when thoroughly compacted with the steam roller, to the proper grade and cross section; making the total depth of broken stone eight inches, and the entire thickness of the pavement, when completed, sixteen inches. Any irregularities appearing during the rolling are to be carefully filled with additional material, so as to produce an even surface. When the surface is thoroughly rolled, a binding, composed of the screening and *detritus* of the broken stones with sand, is to be spread thereon, sprinkled, and thoroughly and repeatedly rolled with the steam roller until the surface becomes firm, compact and smooth. Any binding material remaining on the surface is then to be swept off and removed. For the foundation, any stone not liable to be affected by the action of the frost may be used after having been approved by the Street Commissioner. The broken stone in the intermediate and surface layers to be exclusively of trap rocks.

"When the traffic is lighter over the road, the broken stone may be thinner—down to twelve or even ten inches, and the breadth may be less—sixteen or twenty-four feet. The cost of these roads varies with the distance to which the broken stone has to be hauled. That in Main street, Orange, which is sixteen inches deep, cost $1.90 a square yard. Center street, which is paved thirty feet wide and a foot deep, cost $2.50 a running foot. The road going up the mountain is twenty feet width of pavement, and from eight to twelve inches depth of stone, and was built for one dollar a square yard. The road from the stone breakers, on the Northfield road, for a mile down, was graded and paved for a dollar per running foot. The contract for paving High street, Newark, was let for $1.90 per square yard, which was probably too low. Other contracts for like work have been taken at $2.25 to $2.50 a square yard. The stone is broken in a Blake's rock crusher; and, when driven by a ten or twelve horse engine, ninety tuns or sixty cubic yards can be broken in a day. Daniel Brennan, jr., of Orange, has done a large part of the work there, and his arrangements for doing it are very complete. He quarries the stone near the top of the First Mountain, and the breakers are so located that the carts dump the stone close to them, and the broken stones are elevated, sorted and deposited in proper shoots by machinery, and wagons are driven directly under the shoots and the stone falls into them, thus needing no handling. The excellence and economy of these roads is such that I am sure that it will be a great public benefit to have them more thoroughly known. I do not think that better stone roads can be found anywhere in the world than these in Orange; and it will be worth while for any who are considering the subject to go and see them.

"Trap rock is abundant in all the middle portion of the State. Bergen Hill, and its extension to the Palisades, is of this rock, so are the First, Second and Third Mountains west of Newark extending from Pluckemin and Somerville to Paterson and almost to the State line. Rocky Hill, Mount Rose, Sourland Mountain, Goat Hill, Pickle's Mountain, and many smaller outcrops in the red sandstone region are of this same rock. The gneiss and gray rocks of the Highlands furnish a good material for stone roads, but not equal to the trap. The stone is not so tough, and it wears into dust much faster. Limestone is still a softer rock, and, of course, is not so well adapted for this purpose."

SCIENTIFIC AND PRACTICAL INFORMATION.

THE COMET HYPOTHESES.

M. Faye recently read to the French Academy two papers, in which he summarized all the theories which have as yet been given to the world on the nature of the comets. He attacked, with some satire, Sir William Thomson's view, given to the British Association at its meeting for 1871, that the comet's tail still remains an insoluble mystery. M. Faye asserts that the tails of comets are the effect of the repulsion of the sun; and he has supported this view by argument and experiment, stating that all white hot bodies exert a repulsive force on extremely rarefied matter, and exhibiting the repulsion of rarefied air by a white hot metal plate. The experiment, considered by M. Faye to be a conclusive demonstration of the correctness of his view, was differently interpreted by the spectators, who were some of the most eminent scientists in France; and various opinions as to the cause of the repulsion were given. We may reasonably expect that the spectroscope will enlighten us on this matter, as it has done already on many other phenomena, scarcely believed to be within man's powers of explanation and analysis.

THE LAND OF OPHIR.

Herr Karl Mauch, now travelling in southeastern Africa, has recently forwarded to Dr. Petermann, of Gotha, editor of the *Mittheilungen*, a remarkable account of the gold mines, of great wealth and antiquity, of Sofala, a maritime province lying between Mozambique and the territory of the Transvaal republic. Dr. Petermann publishes a most interesting circular, from which we extract the following :

"For many centuries, authorities have inquired into the true locality of the land Ophir of the Bible, whence King Solomon, 3,000 years ago, obtained immense masses of gold, ivory, and precious stones. Some have placed it in Eastern Africa or Southern Arabia; others thought it to be in the East Indies or in Sumatra; still others even in the West Indies or Peru. It is certain that they must have been very rich mines from which the gold came.

When, in the fourteenth century, the Portuguese came to Sofala, they found there rich gold mines, worked from time immemorial, and near them ruins of structures which, according to native traditions, were built by Queen Saba. Lopez, the historian, records that the natives pride themselves on possessing books which testified to the Ophir cruises of Solomon. From Arabic writers (Mabudi, Edrisi, etc.), we know that this trade was continued throughout the middle ages by the Arabs, who, frequently, from the Persian Gulf came as far south as Sofala.

"The German traveller, Karl Mauch, undertook last fall an excursion to Sofala for the purpose of exploring the mines and the monuments of antiquity. His discoveries consist of ruins, walls, some of which are thirty feet high, fifteen feet thick, and 480 feet in circumference, a tower, etc. The fact of all of them, without exception, being of hewn granite, put together without mortar, testifies to a high antiquity; and the drawings of the ornaments prove that they do not originate from the Portuguese or from the Arabs, but from Phœnicians, the Solomonic Ophir cruisers.

"The present population has been there but for about forty years. The ruins are sacred to them, and they all believe that whites have once lived in this region. Such would appear to be true from the ruins of houses and the iron vessels found there, which cannot have been the works of the blacks.

"Whether or not this land may finally prove to be the biblical Ophir, it is at least sure that what has been found thus far establishes the probability of its connection with the Solomonic Ophir cruisers. Voyages from ports in the Red Sea along the coast of Eastern Africa were within the means of the navigation of that age, and the time of three years, said to be used for the voyage both ways, would also correspond.

"In short, to the quartz gold fields, the alluvial gold discovered by Burton and Mauch, and the steadily increasing yield of the diamond fields, there seems now to be added, in Southern Africa, also the Ophir land of Solomon. An archæological expedition directly to Sofala harbor, and hence about one hundred and sixty miles west into the interior, would soon throw light on this question. In the meantime we may expect, with each mail, new reports from Mauch."

DIVING IN MINES.

In the coal mines of Westphalia, it has been resolved, after much experimenting, to organize an instructed corps of divers for operating in mines of which the levels or shafts are flooded. In conjunction with some one of the several subaqueous lamps which have been described in our columns, the diving bell or dress will enable many mines to be cleared of obstructions, pumps to be repaired, and lost tools and other property to be recovered. In the mines in question, a descent was made into a shaft containing 80 feet of water, and the bottom was cleared of *débris*. An abandoned shaft of the same mine was examined; the pumps were discovered to be in good condition, and, new valves being supplied, they were set to work and mining was at once resumed.

THE FORMATION OF FIBRIN.

Among the many marvels of organic existence, the origin of the fibrous form of animal matter has long been a question widely discussed and a puzzle, the solution of which has evaded the most penetrating observation. Dr. John Goodman, who last year read a communication on this subject before the British Association for the Advancement of Science, has now published the following results of his investigations into the conversion of albumen into fibrin, a process which has met with some acceptance as a credible answer to the question of the nature and genesis of the fibers of flesh:

1. Albumen, from the egg, suspended in ropes in cold and pure water, and exposed for some little time to its influence, loses its character of albumen, and assumes the nature, appearances, and constitution of fibrin spontaneously. Thus, it coagulates, independently of the application of heat, and becomes solid and insoluble—characteristics which distinguish fibrin from all other analogous substances.

2. Under the microscope, when thus transformed by water, it exactly resembles blood fibrin, with the reactions, etc., of which it was constantly compared. So great was the resemblance that a medical gentleman selected this substance under the microscope for the real genuine blood fibrin, in preference to a specimen of the fibrin substance itself.

3. Blood fibrin and especially this substance, differs from albumen in possessing intense attractive powers and affinities, which appear to be the secret cause of the formative qualities of fibrin; causing it to form, in definite lines, into rods and substances, etc., which evince the presence of a controlling constructive power, and enabling it to assume forms and grotesque figures, of which it might be said that nothing but vitality was wanting to endow them with the character of living beings. In several instances, the fibrin from albumen manifested decided electrical attraction, for it was drawn aside and out of its perpendicular, in several instances, some ¼ inch or so, by attractive influence toward a copper wire when raised from the water. On the other hand, albumen presents itself as a homogeneous, motionless, and shapeless mass, and entirely destitute of these powers and characteristics.

4. Like blood fibrin, it was found to decompose peroxide of hydrogen with effervescence, while albumen produces no such effect. Again, Dr. Miller tells us that neutral salts, mixed with blood, on abstraction, prevent its coagulation. This we found to be the case with regard to this substance—even sea water prevented, in a great measure, the transformation.

ELISÉE RECLUS.

In our number of March 16, we called attention to the case of this eminent geographer, and we are glad to hear that the French government has commuted his sentence to one of exile from his native country. The administration of M. Thiers is thus spared the shame of sacrificing one of France's worthiest sons to a political idea; and M. Reclus will be enabled to pursue his labors, and perhaps to learn that no political success or distinction can confer a glory comparable to that which surrounds the smallest discovery of scientific truth.

THE COMING DESTRUCTION.

While we have endeavored to calm the fears of some of our impressible contemporaries, whose alarm at the impending collision has lately been so widely exhibited, *Nature* regrets that the rumor of an approaching comet is without foundation. "In the present state of science, nothing would be more acceptable than the appearance of a good large comet, and the nearer it comes the better, for the spectroscope has a long account to settle with the whole genus, which up to this present time has fairly eluded our grasp. But it is not too much to suppose that the laymen in these matters might imagine that discovery would be too dearly bought by the ruin of our planet. Doubtless, if such ruin were possible, or indeed probable—but let us discuss this point. Kepler, who was wont to say that there are as many comets in the sky as fishes in the ocean, has had his opinion endorsed in later times by Arago, who has estimated the number of these bodies which traverse the solar system as 17,500,000. But what follows from this? Surely that comets are very harmless bodies, or the planetary system, the earth included, would have suffered from them long before this, even if we do not admit that the earth is as old as geologists would make it."

Decline in Prices of Farm Stock.

According to a recent report of the Department of Agriculture, a very extensive decline in the prices of domestic animals has taken place within the past year. The following are the current rates, as compared with last spring:

HORSES, OVER THREE YEARS.	1872.	1871.
New Jersey	$148·57	$163·21
Georgia	113·29	129·45
Ohio	102·28	102·92
Kentucky	89·67	96·35
Illinois	88·26	93·93
Texas	46·23	45·52
MULES, THREE YEARS AND OVER.	1872.	1871.
Georgia	$130·00	$139·86
Tennessee	119·12	128·00
Kentucky	112·89	115·14
Illinois	107·95	114·44
Texas	67·60	73·60
cows.	1872.	1871.
Massachusetts	$39·87	$59·16
New York	39·53	48·51
Pennsylvania	39·16	46·67
Ohio	37·36	45·09
Michigan	36·86	41·15
Illinois	33·77	37·68
Iowa	28·49	34·31
Missouri	25·85	31·92
Kansas	30·77	38·46
Tennessee	22·83	23·57
Georgia	20·81	21·61
Texas	14·12	12·83

The prices of oxen and other cattle have heavily declined in the Eastern States during the year, owing to scarcity of fodder. In the Middle States the decline is less, and at the South still less.

Hogs have also greatly declined. The prices this spring in the Western States are from thirty to fifty per cent less than last year. Hogs over one year old sell now in Ohio for $9·07 against $12·07 last year at this time. In Illinois, at $7·48, last year, $12·71.

Sheep are the only farm animals that have advanced. In Vermont, the price of a sheep not less than one year old has advanced since last spring from $2·75 to $4·56; New York, $3·37 to $4·32; Ohio, from $2·49 to $3·37; Texas, $1·59 to $1·73.

THE Russians seem to resume our abandoned experiments in the use of liquid fuels for steamboats and locomotives. An engineer, Proviecki, is reported as having made successful experiments in that line. Should the plan succeed, it will doubtless lead to considerable saving in money, as a case of naphtha—the liquid employed—weighing 40 lbs. only costs one copeck—equal to one cent—at the Caucasus, while coal is of course much more expensive.

Earth Boring Auger.

The old method of digging wells, post holes, etc., required the excavation of from two to three times the amount of earth absolutely necessary for the desired opening. The method of boring, on the contrary, leaves the excavation nearly or quite the exact size wanted, and is, therefore, much more economical of labor, besides that it makes a much neater job.

Our engraving illustrates an earth auger, which may be applied to opening post holes, or on a larger scale, as shown in the engraving, to boring wells, for which latter purpose it is claimed to possess superior advantages. Its construction is extremely simple, and will be readily understood.

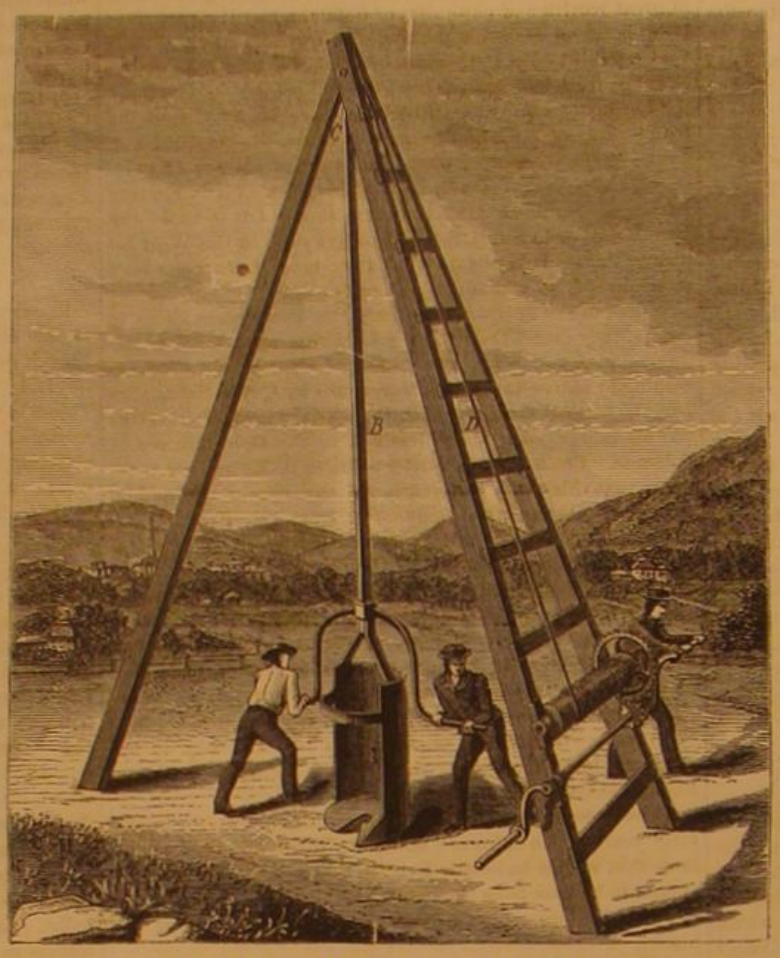
A is the auger, having a suitable lip at the bottom, made of cast steel by a peculiar process which enables it to be hardened on the edge, or not, as desired for special kinds of work. It is in form a section of a cylinder, slightly flattened on one side so as to allow air to pass by it when it is withdrawn with its charge of earth. It also has near the top a band of iron, extending over the open side, which serves as a support for plastic soils when the charge is taken out. A section which completes the cylinder may be hinged to the one shown, which is necessary sometimes in certain kinds of boring.

From the auger proper rises the shank, B. This shank is swiveled at the top, C, to the rope, D, of a derrick, by which the auger is raised or lowered: upon the shank, B, is placed a bent lever, so attached at the middle that it may be adjusted up or down on the shank, and through the action of which the auger is turned in boring.

When the auger is filled by the excavated earth it is raised, turned into a horizontal position, and its contents discharged. Water in suitable quantity is poured into the excavation to lubricate the auger, and to aid in compacting the charge, the flattened side of A preventing a vacuum from forming below the auger when it is being withdrawn.

When large flat stones are met with, they are broken by a suitable drop, when the auger seizes the fragments, and brings them up with the excavated soil. It is further claimed that, with this auger, and by tubing as the work proceeds, a well can be successfully sunk in quicksand.

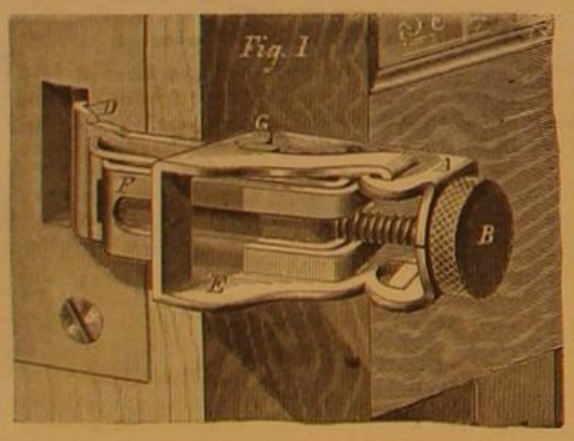
The invention was patented, August 1, 1871, through the Scientific American Patent Agency, by William Wheeten Jilz, of Saint Joseph, Mo., who may be addressed for further information.



JILZ'S EARTH BORING AUGER.

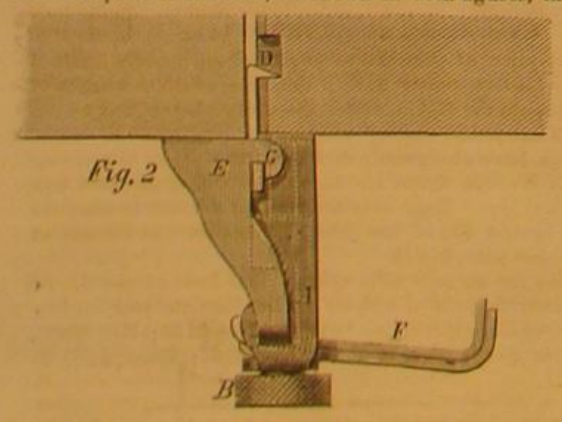
MELENDY'S DOOR FASTENER.

This little device seems to us to meet the requirements of a good door fastener more fully than anything of the kind we have met with. It is very cheaply made, and holds the doors to which it is applied very securely, without marring



the casement. It consists of a body, A, Figs. 1 and 2, of strong sheet metal, which carries a strong adjusting screw, B. The screw plays in a nut, C, shown in dotted outlines in Fig. 2, and formed on the end of the strong claw, D, Figs. 1 and 2. To the body, A, is loosely pivoted the bracket, E, Figs. 1 and 2. The parts lettered F are called compensators, and their use will be subsequently described.

Now to fasten the door, the claw is placed in the mortise of the bolt plate of the lock, as shown in both figures, the



pivoted bracket being turned back, so that the door will pass it in closing. Then the door being closed, as shown in section in Fig. 2, the bracket is turned down into the position shown, slipped back on its pivots so that the hook, G, engages lugs formed on the body, A, and the screw is then turned until the bracket abuts firmly against the door, as shown in Fig. 2.

The compensators, F, when not needed, are slipped back, as shown in Fig. 2; but when the crack between the edge of the door and the casing is too wide to hold the claw firmly, one or both of them are placed in position, as shown in Fig. 1, so as to fill up the space and press and hold the claw firmly into the mortise of the bolt plate when the door is closed.

When a door is unprovided with a lock, the claw may be made to engage the wood or a crack in the joining of the casement, in which last case the casement will not be defaced.

It is small, and convenient for travelers to carry in the pocket.

Patented March 12, 1872, through the Scientific American Patent Agency, by B. H. Melendy, whom address, for further information, box 125, Amherst, N. H.

Prizes for Chemical Inventions.

The following is a list of prizes offered by the Prussian Society for Industrial Advancement, at Berlin, for discoveries to be realized in practical science:

1. The gold medal of the Society, or its value in specie, and the sum of 3,750 francs to the inventor of an exact and rapid method of separating the several ingredients of the anilin of commerce, both as to quantity and quality. The same would also have to show the influence of the several compositions of anilin upon their manufacture and their transformation into fuchsin, and to examine and clearly indicate the conditions under which anilin will furnish the greatest proportion of coloring material.

2. The silver medal, or its value, and the sum of 1,125 francs for an opaque red enamel, applicable to gold, silver, copper, or bronze.

3. The sum of 925 francs to the author of the best criticism on the deficiencies in the present methods of composing cement.

4. The silver medal, or its value, and the sum of 560 francs to the author of a profound essay on industrial fabrication, the mode of forming and the chemical constitution of coralin (aurin, rosolic acid, peonin) and on the blue color of azulin prepared therefrom.

5. The silver medal, or its value, and the sum of 1,875 francs to the inventor of a yellow solder, possessing the properties and quality of ordinary tin solder, and to be used for soldering brass or similar alloys so that the seams will not be visible.

BEACH'S SPIRAL SPRING SCROLL SAWING MACHINE.

Our engraving illustrates the construction of a spiral spring scroll sawing machine, which, at the Fair of the American Institute last season, elicited general praise on account of the high speed at which it can be run without jar, its general convenience, and the facility with which it can be operated. The saw can be run at from 800 to 1,000 per minute without jar. The two springs employed give from 10 to 75 lbs. strain on the saw, while the average movement of the coils is but one sixteenth of an inch. The motion of the springs being so slight, the variation in the tension on the saw is less than one eighth of a pound, thus enabling the lightest saw to be run without breaking. The raising and lowering of the springs, with all their connections, bring the lifting power of the springs directly to the top of the saw no matter what its length. The simple and complete mode of changing the tension of the saw allows it to be done in a moment of time, without stopping the machine. The construction of the springs and their connections with the saw, is so arranged as to bring the strain of the saw in a direct line with the bolt, fastening the machine to the joist overhead, so that, if the three braces shown in the cut are removed to leave it suspended upon one single bolt, it does not shake enough to jar the machine when running 1,000 motion.

In the engraving, A represents two spiral springs, made from Jessup's best imported English steel. Each spring contains ten coils of one half or five eighths round steel rod, one being a right hand, the other a left hand coil. One end of each of these springs is firmly fastened to the ratchets, B the opposite ends to the front end of the lever, F, which is supported upon the shaft passing through the center of the springs, and so constructed that there is no friction whatever upon any part of the springs when in motion. The link, H, which is of iron, connects the upper lever, F, with the lower lever, G. These levers are so connected that, when the saw is moving a five inch stroke, the first coils of the springs, A A, move but one eighth of an inch, the second coils but one ninth of an inch, and so on down to nothing, making the average movement of the coils but one sixteenth of an inch. The upper crosshead, which carries the top of the saw, is firmly connected to the lever, G, thus making a positive connection between the saw and springs. This insures a perfectly rigid strain on the saw. By means of the ratchets, B, and lever, C, any amount of strain can be given, from ten to seventy-five lbs., according as it is a small or large saw. This is done by taking hold of the lever, C, which is inserted into the side of the ratchets, B, and thus winding or unwinding the springs, A. Each spring and ratchet is independent of the other, so that one or both springs can be used. The tension on the saw by this means can be changed in a moment, while the machine is in motion. A plunger pump is attached to the inside of the iron plate, D, with a rubber pipe running to the saw, and is worked by the motion of the lever, G. The two springs, with all their connections, are permanently fastened to the iron plate, D, which is raised or lowered to suit any length of saw by means of the crank, E, and held in position by the thumb screw, O.

This construction enables the saw to run with a peculiar freedom, lightness, and steadiness that is delightful to the mechanical eye, while it insures the accurate performance of the most delicate work. This sawing machine has been introduced into many of the best shops in New York and vicinity, and is, so far as we can learn, giving general satisfaction.

It has also been introduced into nearly every State in the Union, more than two hundred having been sold since last July. The judges at the American Institute Fair reported that, in their opinion, the machine possessed the highest de



gree of merit, being unsurpassed for convenience in operation and adjustability.

For further particulars address Henry L. Beach, the inventor and manufacturer, office at 90 Fulton street, New York, factory at Montrose, Pa.

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Contents:

(Illustrated articles are marked with an asterisk.)

Another Big Patent Job before Congress 216
Answers to Correspondents 217
*Beach's Spiral Spring Scroll Sawing Machine 214
Business and Personal 216
City Disinfection 212
Coating Cast Iron with Other Metals 212
Decline in Prices of Farm Stock 213
Delprino's Mode of Treating Silk Worms 207
*Earth Boring Anger 214
Galvanic Batteries 209
Geological Report for New Jersey 213
Gunmaking by Machinery 208
Hydrogen the Vapor of the Metal Hydrium 215
Improvement in Saws 211
Inventions Patented in England by Americans 219
*Johnson's Renewable Tooth Comb 210
Junction of the Black and Caspian Seas 207
Leaden Water Pipes 209
*Machine for Bending Printers' Leads and Rules 207
*Machine for Testing the Strength of Metals, etc 207
Making Organic Substances from their Inorganic Elements 215
Malleable Iron Castings 211
Mechanical Impossibilities 215
*Melendy's Door Fastener 214
*Moustache Guard 210
New Books and Publications 216
Notes and Queries 217
Official List of Patents, Extensions, Designs, etc 219
Poisonous Hair Dyes 210
Prizes for Chemical Inventions 214
Recent American and Foreign Patents 218
Saws and Files, and their Manufacture 212
Scientific and Practical Information 213
Shaving with Pumice Stone 212
Sleep and Dreams 210
State Reports 208
Terra Cotta 209
*The Planet Jupiter 211
*The Quantitative Determination of Arsenic 211
The Relations of Art to Industry —Museums of the Arts of Design 215
The Uses of Ammonia 210
To Cover Metallic Utensils with Black Coating 208
Tungsten Compounds 210
Waves of Sound and Light 211
*Wright's Bottle Stopper 211
Yaupon 209

THE RELATIONS OF ART TO INDUSTRY--MUSEUMS OF THE ARTS OF DESIGN.

We are, so far as the mere sheltering and feeding of our bodies are concerned, surrounded by superfluities. We do our utmost to gain more or less of these, according to our personal tastes and desires, and a large portion, indeed the larger portion, of the work of the world consists in producing them. Did we not find in them the reward for our labor in striving after them, we should cease our efforts. These things minister to cravings just as natural as hunger or thirst, if not as potent. The desire for beautiful and ornamental objects exists for a wise purpose, and has chiefly been instrumental in raising a portion of the human race from savage barbarity to refined civilization.

This being true, art is essentially inseparable from industry. Among the workers of the world must be found the artists of the world. Not necessarily painters of pictures or sculptors of marble, but still painters and sculptors as worthy in their way as the devotees of the so called "fine arts." Why *fine* arts? All art is fine, and refining in its tendency, both on its producer and him into whose hands it passes.

There has arisen, in the present age, a revival of the school of stoic philosophers, who decry all sentiment, who say that the romances of the past are of no value to the present, that reason should not only stand pre-eminent to feeling, but that the emotions should be absolutely subjected to reason, and as far as possible crushed out from the human breast. Generous impulse, buoyant hope, noble affection—all these emotions and sentiments are considered by them as weaknesses, obstructive to progress and unworthy the man who wishes to soar above his fellows, either in the pursuit of wealth or fame.

While according pre-eminence to reason over the emotional nature of man, we have not the slightest sympathy with this cold and unhealthy doctrine. A man who is all mind is as abnormally developed as one who is all emotion or all muscle. Sensibilities may be crushed out, but they leave a morbid state behind them.

It is the province of art to develop and discipline the emotional nature of man, to refine it of its grossness, and lead it to expend its force upon high aspirations and things intrinsically worthy. It is not, however, necessary that this refining influence should emanate alone from canvas, from marble, from the poet's pen, from the musician's studio, and the stage. The commonest things of daily use may do their part in this kind of education. Common things may be beautiful, and the tendency of beautiful things is to lead the mind insensibly away from that which is base and unworthy. So much is this the case that it requires an effort of mind to believe that what is beautiful is not also good.

Seeing, then, how art can be made the handmaid of industry, it should be our aim to make every artisan an artist in his avocation. By so doing, we shall not only elevate him but elevate society with him. At present we are doing scarcely anything to promote this desirable end, and it is the principal object of this article to suggest a way in which to secure it.

Much has been said about the desirability of a metropolitan art museum, yet the collection intended to form such a museum will, though admirable and valuable as an educational influence, fall short of what we think should be established for the benefit of mechanics.

The latter should be a museum of the arts of design, and should contain specimens of the finest workmanship in all industrial departments. Dress, furniture, household adornments; in short, all sorts of handiwork approved by refined taste, should be seen there. Prizes should be offered for designs, combining highest grace and beauty with widest utility, and exhibitions should be held that would serve to mark progress.

From this would spring up a noble emulation among mechanics, who, finding that honor attached to the skillful in their calling, would earnestly seek to reflect that honor upon themselves. It would add a new attraction to handiwork, and would greatly advance the character of our manufactures. Many things that we are now compelled to import would be produced in equal beauty at home. Every department of industry would feel the manifold benefits of such an institution.

We would not, however, have such an institution only in New York. Every large commercial center should have a similar one, each striving to take the foremost rank, and thus add the stimulus of competition to the interest otherwise attaching to them. So far as we know, no such institution exists, even in embryo, on this continent. Where shall the first one be started?

MAKING ORGANIC SUBSTANCES FROM THEIR INORGANIC ELEMENTS.

We referred, some time ago, to a discovery by Professor Schulze, who succeeded in making a series of organic compounds, hitherto obtained only from the vegetable kingdom or from coal (which is also a product of vegetation in one of the geological eras), directly from the inorganic elements. We will now proceed to describe the details of his discovery and the different steps by which different organic compounds have thus been produced.

He took some form of carbon, say charcoal, plumbago, or graphite, and produced the oxidation of the same without heat (in which case he simply would have had combustion and the formation of carbonic acid). He took permanganate of potash, or the so called mineral chameleon, which is a substance very rich in oxygen and which gives it very easily to other substances with which it readily combines while in the nascent state, that is, while at the moment of being set free it meets another substance with which it can combine. This takes place when one molecule of the permanganate is, under proper circumstances, brought into contact with four atoms of carbon; the reaction is best expressed by the formula $KO+Mn_2O_7+C_4=KO+Mn_2O_4+C_4O_3$. It is seen that the mixture of the two is changed into potash, deutoxide of manganese, and a compound C_4O_3, which Professor Schulze found to be an acid, and called anthraconic acid. After investigation, he found that it was identical with mellitic acid, an acid obtained from the so called honey stone or mellite, which is also, as well as coal and asphaltum, a product of geological vegetation, and, chemically speaking, a mellitate of alumina. This mellitic acid had long since attracted the attention of chemists for reason of being one of the rare organic acids which contain no hydrogen. However, when separated from its base, it takes, like all acids, one atom of HO or water; and its complete formula therefore is C_4O_3HO or HC_4O_4. Succinic acid, obtained from amber, another product of geological vegetation, has the formula $H_3C_4O_4$, and differs from mellitic acid by containing two hydrogen atoms more, but attempts to change one into the other by the addition or withdrawal of these two hydrogen atoms have constantly failed.

The most remarkable property of this mellitic acid is that it withstands the action of the strongest mineral acids; even fuming nitric acid, which destroys almost every other organic acid, is powerless on it, and boiling sulphuric acid dissolves it only without changing it, as it may be again separated by distillation. When treated with caustic soda, however, it produces benzole; by the affinity of caustic soda for carbonic acid, it compels all the oxygen of the mellitic acid to combine with some of its carbon, and to give us carbonic acid according to the formula

$$12NaO+6(HC_4O_4)=12NaOCO_2+C_{12}H_6.$$

The latter $C_{12}H_6$ is the formula for benzole, which being first produced from the resin *benzoes*, was called thus; later, as is well known, it was made from coal tar, and the further operations have been known for some time. The first is to make nitro-benzole by the gradual addition of hot fuming nitric acid; this reaction is explained by the formula

$$C_{12}H_6+NO_5=HO+C_{12}H_5NO_4.$$

The nitro-benzole $C_{12}H_5NO_4$ is then changed into anilin by iron filings and acetic acid, which develop hydrogen which, being in nascent condition, is combined with the nitro-benzole in exchange for four atoms of water driven out:

$$C_{12}H_5NO_4+6H=C_{12}H_7N+4HO.$$

The anilin is $C_{12}H_7N$, and is a colorless oily fluid of pleasant smell, but very poisonous. It is one of the most important compounds in the whole field of organic chemistry, and has taught us many details in regard to the nature of organic bases. As is well known, it gives rise to a large series of beautiful and very intense colors; for instance, the least addition of chloride of lime forms the beautiful aniline violet.

We have thus traced how, in the laboratory of the chemist, without help from any contemporaneous or vegetable growth, a series of products, thus far only obtained by such help, can be made from inorganic plumbago, permanganate of potash, soda, nitric acid, iron, chloride of lime, etc. It is a new contribution to the many triumphs of the chemical laboratory; but we must not forget that they are only the products of organic life which we are thus able to imitate, but not life itself, nor the organic cell, nor even the organic structure which results from cell action. We may make dextrin or starch; but we shall never be able to produce a single starch granule. Who doubts this, let him examine the elaborate structure of the latter under the polarizing microscope.

MECHANICAL IMPOSSIBILITIES.

Much has been said and written upon a certain class of devices, aiming at results rightly deemed impossibilities. These devices, variously styled perpetual motions, self-moving machines, etc., are, however, no more *mechanical* impossibilities than chemical. It is simply impossible for human agency to create a force, by any means whatever, or to increase a force, which would be equivalent to an act of creation. We bipeds that rule over the beasts of the field may, like the inferior animals, act as directors of force, but we create nothing. By our superior intelligence and constructive powers, we may do what animals cannot do, that is place and link together a chain of causes that lead to a remote and premeditated result. Every machine is such a train of causes, logically connected.

When we speak of mechanical impossibilities, we should limit the term to such results as from their nature must be reached by mechanical agencies, if ever attained at all. Are there any such impossibilities? Is there a result which is accomplished by natural mechanical agencies that cannot be compassed by artificial means? Of course we refer not to any special result, like the revolution of the earth about the sun or the flight of a comet, but to classes of results. Man will never cause a globe like the earth to revolve about the sun, but he can in a smaller way cause a body to imitate this motion. He cannot cause oceans to ebb and flow, but he can mimic the tides. From this point of view, we declare our belief that there are no mechanical impossibilities to mankind. Whatever kind of result is brought about by natural mechanical means may also be done by artificial, at least on a small scale.

We have been gradually led up to this belief through our long observation of the ingenious artificial agencies by which are reached the results of the most complicated manipulations of, that most wonderful of all machines, the human hand, guided by human intelligence. Should any one ask us whether we consider it possible that a landscape should be artistically painted by machinery, we would answer: Behold the Gobelin tapestry, behold the chromo-lithograph; there is your answer. Machinery can fill our halls with music, can do all that is mechanical in the adornment of our houses, can carve our sculpture, can, in short, do everything but think. It is the agent of thought, sometimes of many thoughts, ideas, and conceptions which it works out in all their subtle refinements. Through it, the artist finds the means for the repeated expression and reproduction of form, which his own hand can only work out slowly and with painstaking. Through it, feeble forces are made to assume the direction of large ones, and an apparently slight cause to influence other causes until the resultant effect becomes out of all proportion to the directing effort.

Let it be set down, then, as a maxim established by the mechanical triumphs already achieved, that whatever is accomplished by the action of physical forces in nature, or by the animal mechanism intelligently directed, can be performed by machinery of man's devising. In some cases the work will not be performed as well, but in a large majority of cases it will be done better.

Accepting this maxim as true, what a rich field for inventive talent and constructive skill remains to be worked! What a vast number of operations in daily demand are still performed by slow, laborious, and expensive methods! Take the operation of type setting as a familiar example. Machinery must ultimately do this work and a thousand other things yet chiefly performed by manual labor. We feel assured that the end of mechanical progress is very remote from the present age.

HYDROGEN THE VAPOR OF THE METAL HYDRIUM

It is now just 30 years ago that the great French chemist Dumas announced, at the termination of one of his lectures on hydrogen, at the Sorbonne, Paris, the following views, then startlingly new and laughed at by many, but now commencing to be appreciated and adopted: "Whatever it may cost me, gentlemen, in the estimation of my colleagues, in giving a new opinion, I ought to express it fully. We ought no longer to consider hydrogen as a metalloid, or as merely approaching to a metal in any form; it ought to be classed by the side of metals or among metals. *It is a gaseous metal, even as mercury is a liquid metal.* If we suppose that it were impossible to liquefy the vapor of mercury, and consider that it is colorless, inodorous, and transparent as hydrogen, we shall have a correct idea of the views I wish to establish By degrees, you will learn to appreciate the correctness of this new theory; when, for instance, you study the different compound bodies of which hydrogen is a counterpart. The *ensemble* of the properties approaches, in fact, to mercury and potassium."

Some German authors have now adopted these views, and Hiller calls, therefore, the element H "hydrium," in order to be consistent with the rule accepted in regard to the metals which have no common names, as cadmium, aluminum, etc. and, according to Dumas' views, hydrogen gas is considered as the vapor of this metal, which, for its condensation into a liquid metal, requires a temperature far below any cold we have thus far been able to produce; and then, for the solidification into the ordinary metallic state, a further degree of cold, perhaps as far below the freezing point of mercury as this is below the melting point of potassium. In order to come to an approximate estimate of such a low temperature, we may consider that hydrogen when cooled contracts like other gases, for every degree $\frac{1}{180}$ of the volume which it possesses at 32° Fah.; and, inversely, increases as much in volume by heating. It has been surmised by many physicists—among them Clerk Maxwell and Clausius—that as heat thus

increases the elasticity of gases, it is the absolute cause of that elasticity, or, in other words, that the cause of that elasticity is the molecular motion, which we call heat, associated with the molecules of the gas; and which, by their increase, cause more powerful impact on one another and on the walls of the vessels containing them, and so increase the pressure. Therefore, the absolute zero of temperature would be the absolute zero of gaseous tension, that is, the temperature, at which the gas would cease to have any elastic force, would exert no pressure, or have no molecular motion whatsoever. It would then cease to be a gas, as steam ceases to be a vapor when a sufficient amount of latent heat, that is, molecular motion, of the kind described on page 37 of the current volume, is withdrawn. As 1° Fah. added increases the elasticity of hydrogen by $\frac{1}{491}$ of its volume, and each degree withdrawn diminishes the volume by $\frac{1}{491}$, it is evident that, if this law holds at all temperatures, there is no further reduction possible at 490° below 32°, and hence no more heat could be extracted; therefore, the volume of the gas would cease to exist. Hence, if we withdraw heat until we reach —458° Fah., we should arrive at the absolute zero, at which all hydrogen would become lifeless and inert, and incapable of responding to or assimilating any form of motion, which, under other circumstances, would influence its molecules. Other gases would probably liquefy or solidify before that point was reached; but hydrogen, being evidently the most volatile of all, would be the last to lose its gaseous condition, and be compelled to liquefy or solidify; it would then be chemically as inert as two pieces of solid metal, which are mutually inert in regard to one another. In short, chemically speaking, hydrogen would have the property of a solid metal; and, physically speaking, as there is no motion called latent heat of fusion or evaporation, there could be no cause for its liquidity of gaseous condition, and it could be in no other condition than that of a solid. These are the legitimate consequences of the modern theory in regard to heat being a mode of motion.

ANOTHER BIG PATENT JOB BEFORE CONGRESS.

The patent of A. B. Wilson, for the device popularly known as the Wheeler and Wilson sewing machine, was originally granted in 1852, and covers the so-called four motion feed, an important and valuable improvement. The original term of the patent expired in 1856, the owners having, up to that time, realized from it several millions of dollars. The Commissioner of Patents then extended the grant for seven years, for the especial benefit of the inventor; and this last term will expire in 1873, making 21 years in all that the patent has run. But it appears that neither inventor nor manufacturers have yet made from it as much as they think they ought, and so they have applied to Congress for a further extension of the monopoly by special act. All testimony for or against the grant, must be filed, with the Clerk of the Senate Committee on Patents, on or before April 4th, 1872.

We are in general opposed to the grant of special monopolies by Congress, and we think that the industrial interests of the country should no longer be burdened with this particular patent. But it may be said of the owners of the Wheeler and Wilson machine that they have supplied the people with first rate machines, and that although, by their immense profits, they have been raised, individually, from the condition of poor laboring men to be millionaires, they have used their wealth judiciously, to the advantage of the communities where they dwell. It may be further said that it is to the invention of A. B. Wilson and the persevering efforts of the Wheeler and Wilson Company, in developing and introducing the improvement, that we owe much of the present perfection and extended usefulnes , of the modern sewing machine.

THE Baltimore and Ohio Railroad Company has been experimenting with iron freight cars, and finds them to possess advantages, but have also discovered some disadvantages. They are rendered useless for some kinds of freight on account of the sweating process to which they are subject, and, when ventilation was resorted to to obviate this, it was found that the goods were covered with dust, or were in danger of fire from sparks that found their way in.

NEW BOOKS AND PUBLICATIONS.

POTTERY: Observations on the Materials and Manufacture of Terra Cotta Stone Ware, Fire Brick, Porcelain Earthen Ware, Brick, Majolica and Encaustic Tiles, with Remarks on the Products Exhibited at the International Exhibition, London, 1871. By Arthur Beckwith, C. E. New York: D. Van Nostrand, Publisher, 23 Murray Street, and 27 Warren Street. 1872.

This work will be found of great value to any who are engaged in the manufacture of pottery ties, or anything which is made of clay as a basis. In it the different kinds of ceramic wares are described, together with the processes employed in their manufacture. The employment of clay in the manufacture of building materials also is treated in detail, particular attention being paid to terra cotta, a material not used in this country nearly as much as its merits warrant.

THE PRACTICAL METAL WORKER'S ASSISTANT: Comprising Metallurgic Chemistry, the Arts of Working All Metals and Alloys, Forging of Iron and Steel, Hardening and Tempering, Melting and Mixing, Casting and Founding, Works in Sheet Metal, the Processes Dependent on the Ductility of the Metals, Soldering, and the Most Improved Processes and Tools Employed by Metal Workers. With the Application of the Art of Electro-Metallurgy to Manufacturing Processes, Collected from Original Sources, and from the works of Holtzapffel, Bergeron, Leupold, Plumier, Napier, Scoffern, Clay, Fairbairn, and others. By Oliver Byrne. A New, Revised, and Improved Edition. To which is added an Appendix, containing the Manufacture of Russian Sheet Iron, by John Percy, M.D., F.R.S.; the Manufacture of Malleable Castings and Improvements in Bessemer Steel. By A. A. Fesquet, Chemist and Engineer. With Six Hundred and Nine Engravings, Illustrating Every Branch of the Subject. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street. Price, by Mail, Free of Postage, $7.00.

As will be seen by this very comprehensive title, the original work of Mr. Byrne has received important additions, whereby the treatise is considerably enlarged, and its value much enhanced. The advance made recently in metallurgic science required the revision and additions thus made, which now bring the work fully up to the present state of the iron and steel manufacture, and the arts which employ metals as the whole or part of their materials. The public will receive, with especial satisfaction, the portion of the work devoted to Malleable Casting, Russian Sheet Iron, and American Sheet Iron. The work should not only be in the hands of mechanics generally, but it would be found a most valuable addition to school libraries, for which its comprehensive character specially fits it.

SOPHISMS OF FREE TRADE, and Popular Political Economy Examined. By a Barrister (Sir John Byles, Judge of Common Pleas). First American, from the Ninth English Edition, as published by the Manchester Reciprocity Association. Manchester: John Heywood, 141 and 143 Deansgate. London: Simpkin, Marshall & Co. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street. Price, by mail, free of postage, $0.75.

This is a collection of essays on the fallacy of free trade sophisms, which are commonly expressed in the form of aphorisms. "Buy in the cheapest market;" "Protected manufactures are sickly;" "All commodities should be rendered as cheap as possible," are examples of some of these accepted maxims of free trade, which are here attacked by a legal and logical mind in trenchant, yet thoroughly candid way. The book will be found good reading, both by the advocates and opponents of protection. Its style is elegant, and its arguments are powerful. In short, it is produced by a man who can think, and whose power of expression clothes his thoughts in a most attractive garb.

The DENTAL COSMOS for March maintains its character as a first class professional journal. The subject of replanting teeth, which has interested the profession a good deal of late, receives new light from the experience of G. V. N. Relyea, of Belleville, who states that, in seven cases, four have proved unqualified successes, the three others failing from causes not fully inherent in the operation. Other papers are of interest and importance.

The WORKSHOP, published by E. Steiger, Nos. 22 and 24 Frankfort Street New York, price $4.50 per year, is a monthly publication we have frequently noticed, and which is always worthy of high commendation. Its last issue contains a number of admirable designs for various kinds of ornamentation, furniture, stone carving, silver ware, jewelry, etc.

SCRIBNER'S MONTHLY for April is, we think, the best number yet issued of this justly popular and well conducted magazine. It has a long table of contents, all of which are excellent. The publishers are to be congratulated on the character of the feast they have placed before the general reader in this issue.

The GALAXY for April is a good number. It leads off with a characteristic sketch of Justin McCarthy's, which gives us an insight into the often amusing eccentricities of that brilliant story writer. The French at Home, is another interesting paper, by Albert Rhodes. The Nether Side of New York, by Edward Cropsey, gives us an account of the lottery gamblers. There is, beside, the usual collection of tales, poetry, scientific miscellany, etc.

The AMERICAN WATCHMAKER'S, JEWELER'S AND SILVERSMITH'S JOURNAL is the title of a new monthly publication, issued by Shaw & Co., No. 41 Park Row, New York, price $2.50 per annum, in advance; single copies twenty-five cents. The first number—March—is a good specimen of technical journalism, is neatly printed, and has the appearance of a publication destined to a successful career.

The ATLANTIC MONTHLY for April contains a poem of Longfellow's, entitled the "Ballad of Carmilhan;" another of Parton's sketches, "Jefferson in the House of Burgesses;" the continuation of Hawthorne's "Septimius Felton," and the "Poet at the Breakfast Table," by Holmes, enrich the number. A paper on Immigration, by Edward Jarvis, of heavier and more instructive reading. The "Brewing of Soma" is a short poem by Whittier. There is, beside, the usual complement of tales, notices of current literature, etc. Altogether, the number is an excellent one.

Examples for the Ladies.

Mrs. J. R. Bowen, Wellsboro, Pa., has used her Wheeler & Wilson Machine almost constantly since 1859 on all kinds of material, without any repairs or personal instruction.

Mrs. Mary Hacher, Muscatine, Iowa, has used her Wheeler & Wilson Machine since September, 1857, and earned from $10 to $20 a week, making dresses and cloaks, from the finest to the heaviest, and her machine is now in as good order as when she bought it.

"To Perfume and Dress the Hair, use Burnett's Cocoaine."—*Philadelphia Bulletin.*

Watch No. 2291, Stem Winder—bearing Trade Mark "Fayette Stratton, Marion, N. J."—manufactured by United States Watch Co. (Giles, Wales & Co.), has been carried by me eighteen months; its total variation from mean time, five seconds per month. E. O. WHIPPLE, Con. U. & B. R. R.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Dry Steam, dries green lumber in 2 days; tobacco, in 3 hours; and is the best House Furnace. H. G. Bulkley, Patentee, Cleveland, Ohio.

Diamonds and Carbon turned and shaped for Philosophical and Mechanical purposes, also Glazier's Diamonds, manufactured and reset by J. Dickinson, 64 Nassau st., New York.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin. $4 00 a year. Advertisements 10c. a line.

Right, for Sale, of a valuable improvement in Sad Irons. Address, H. W. Seaman, Millport, N. Y.

Williamson's Road Steamer and Steam Plow, with Rubber Tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1809.

Something New. Shaping Machine Attachment for Lathes. Wm. E. Cass, 61 & 63 Hamilton Street, Newark, N. J.

For a well auger, with which a man can earn $50.00 per day, see illustrations on another page.

Lord's improved Screen or Separator for Ores, or any other material. We will send a cut with full explanation. Geo. W. Lord, 232 Arch Street, Philadelphia, Pa.

Wanted—The latest approved Artificial Drier, for fertilizers. Manufacturers, send Circulars. Address Frank Treat, Eastport, Maine.

Dealers in Patents, and Manufacturers of Patented Articles in Iron, address H. W. Thomson, North Williston, Vt.

Where can I get lap welded iron tubes, 4 in. diameter, ⅛ in. thick? Address J. Milton Ferguson, St. Louis, Missouri.

Improved Foot Lathes, Hand Planers, etc. Many a reader of this paper has one of them. Selling in all parts of the country, Canada, Europe, etc. Catalogue free. N. H. Baldwin, Laconia, N. H.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms $4.00 a year.

Wanted—A good second hand Steam Engine Cut-off of 75 to 100 Horse Power. Lafayette Paper Mill Co., Lafayette, Ind.

Wanted—A good carriage ironer, with one to $2,000 capital. Business established. Address T. P. Yates, Waverly, N. Y.

Drawings and tracings made of Machinery, Models, etc. C. Delafield, C. E., 26 Broad Street, New York.

Grindstones for Edge Tool Manufacturers. Worthington & Sons, North Amherst, Ohio.

The Baxter Steam Engine is safe, and pays no extra Insurance.

"How to hang and use Grindstones"—a pamphlet sent free by J. E. Mitchell, 810 York Avenue, Philadelphia, Pa.

The most simple and best Pump in use. Hersey's Patent Rotary Pump, for Soap, Oil, Tallow, Beer, Water, etc. We guarantee it the best in use, and allow one month for trial before payment. Send for circular. Hawes & Hersey, South Boston, Mass.

50 Hand Drilling Machines, the best in the market, for sale at half price, $20. Hoffman & Finney, 215 Water Street, Brooklyn, N. Y.

Nickel Plating.—For the best Apparatus and Solutions, apply to George W. Beardslee, 92 Fulton Street, Brooklyn, N. Y.

Wanted—One first class Engine with all modern improvements, either new or second hand, from 150 to 200 Horse Power. Address Box 237, Buffalo, N. Y.

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For the best and cheapest Water Wheel Regulator "in all creation," address Sullivan Machine Co., Claremont, N. H.

Manufacturers and Mill Supplies of all kinds. Greene, Tweed & Co., 18 Park Place, New York.

Standard Twist Drills, every size, in lots from one drill to 10,000, at ⅓ manufacturer's price. Sample and circular mailed for 25c. Hamilton E. Towle, 176 Broadway, New York.

Steel Measuring Tapes, manufactured by W. H. Paine, 116 Freeman St., Greenpoint, opposite New York City. Send for circular.

The most economical Engine, from 2 to 10 H.P., is the Baxter.

Our Home Physician. By Dr. Beard and other eminent Physicians. Is the latest and best Family Guide. 1067 pages. $3. E. B. Treat, Pub., 805 Broadway, New York. Agents wanted.

$3.00 Microscope sent for $3.00. No toy, but a useful instrument. F. Blockley, 552 Lafayette Ave., Brooklyn, N. Y.

Dealers in Machinery, Metals, and Engineer's Supplies, who have not sent business cards and price-lists to Richard H. Buel, 7 Warren Street, New York, should do so at once.

If you want to know all about the Baxter Engine, address Wm. D. Russell, office of the Baxter Steam Engine Co., 18 Park Row, N. Y.

Magnificent Stereopticon, Phantasmagory, and Mechanical Working Views for sale at a great bargain. 765 Br'dway, 3 flights from 11th St.

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Shive's Patent Watchman's Clock and Time Detector—the best ever made. Price $15. Shive Governor Company, Philadelphia, Pa.

Building Felt (no tar) for outside work and inside, instead of plaster. Felt Carpeting, &c. C. J. Fay, Camden, N. J.

For best Hay and Cotton Press, address C. J. Fay, Camden, N. J.

Save your Boilers and Save Fuel—Use Thomas's Scale Dissolver, pr. 5c. per lb., in bbls. and ½ bbls. N. Spencer Thomas, Elmira, N. Y.

Derricks built by R. H. Allen & Co., New York and Brooklyn.

Farm Implements & Machines. R. H. Allen & Co., New York.

Seeds and Fertilizers. R. H. Allen & Co., New York.

Walrus Leather for Polishing Steel, Brass, and Plated Ware. Greene, Tweed & Co., 18 Park Place, New York.

An Engineer, experienced in designing and constructing Engines, Boilers, and general Machinery, desires a permanent position as superintendent or head draftsman. A practical machinist, familiar with Indicator. Refers to leading concerns. Address M. R., P. O. Box 5,632 N. Y.,

The Greenleaf Grate Bar saves fuel, and lasts much longer than the ordinary bar. Address Greenleaf Machine Works, Indianapolis, Ind.

Peck's Patent Drop Press. Milo Peck & Co., New Haven, Ct.

Enameled and Tinned Hollow-Ware and job work of all kinds. Warranted to give satisfaction, by A. G. Patton, Troy, N. Y.

Best and Cheapest—The Jones Scale Works, Binghamton N. Y.

Grist Mills, New Patents. Edward Harrison, New Haven, Conn.

Taft's Portable Hot Air Vapor and Shower Bathing Apparatus. Address Portable Bath Co., Sag Harbor, N. Y. Send for Circular.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

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

Belting as is Belting—Best Philadelphia Oak Tanned. C. W. Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

Boynton's Lightning Saws. The genuine $500 challenge. Will cut five times as fast as an ax. A 6 foot cross cut and buck saw, $6. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

Presses, Dies & all can tools. Ferracute Mch Wks, Bridgeton, N. J.

For 2 & 4 Horse Engines, address Twiss Bros., New Haven, Ct.

Hydraulic Jacks and Presses, New or Second Hand, Bought and sold, send for circular to E. Lyon, 470 Grand Street, New York.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro., 414 Water st., N. Y.

Presses, Dies, and Tinners' Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N. Y.

Over 1,000 Tanners, Paper-makers, Contractors, &c., use the Pumps of Heald, Sisco & Co. See advertisement.

In the Wakefield Earth Closet are combined Health, Cleanliness and Comfort. Send to 36 Dey St., New York, for descriptive pamphlet.

For Diamond Turning Tools for Truing Emery Wheels and Grindstones, address Sullivan Machine Co., Claremont, N. Hamp.

Notes & Queries.

[We present herewith a number of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—FUSIBLE METAL PLUGS.—Can any one inform me what is the mixture of metals for fusible plugs for boilers?—W. H. W.

2.—TESTING HYDRAULIC GAGE.—Please inform me how to construct a hydraulic pump, to test a hydraulic gage.—G. M.

3.—WET COAL DUST.—Will some of your readers tell me whether coal dust burns any better for moistening with water; and if so, give the reason?—G. W. F.

4.—TESTING BARK FOR TANNIN.—Will some expert please inform me how to ascertain the amount of tannin contained in bark and wood? I wish to test certain kinds of timber, both bark and wood, which are said to contain remarkable tanning properties.—J. F. A.

5.—CUPOLA PROCESS FOR IRON.—I have heard that there is a cupola process of melting large bodies of iron; if so, will some one please inform me who the inventor is?—G. S. C.

6.—SEASONING HICKORY.—Is there any way by which one and a half inch square hickory pieces of green wood, in which there is a heart, can be seasoned without checking?—L. W.

7.—FUSIBLE GLASS.—Is there any preparation of glass that will melt at a low temperature and adhere firmly to iron, and what is that preparation? How may the difficulties in enamelling iron be overcome by one unskilled in the working of glass?—J. N. S.

8.—BELTING FOR USE IN LIME WATER.—Can any of your readers inform us of a belting that will stand the continued action of hot lime water?—We wish to use it for elevating purposes.—P. & Co.

9.—SCALES ON IRON AND STEEL.—Can any of your readers inform me how to remove scales from iron or steel that has passed through fire?—J. P. S.

10.—POWER OF WINDMILL.—I am about to build a wind mill of about two or three horse power. I do not know how to calculate or ascertain the power. Can some one give me the number of square feet, of wing surface to wind, per horse power?—J. E.

11.—MERCURIAL COLUMN.—Please inform me the manner in which the mechanical part of a mercurial column is constructed. What I wish to find out is how it is read off, after the pump is applied. I also wish to know if a mercurial gage or column in Boston will agree with one in New York, Utica, Buffalo or Cincinnati.—G. M.

12.—SWOLLEN FEET.—Will some of your many readers tell me how I can prevent my feet from swelling? I have suffered for over two years, and cannot prevent it. It is worst in the morning, for then I cannot put my boots on, and have to wear slippers until noon. My boots are large and well made.—B. S.

13.—NOISE OF STEAM ENGINE.—Can any one inform me of a means of lessening the jar and noise, caused by running a small steam engine, in the other parts of the building in which it is? What would be the effect of putting it upon some elastic foundation? The engine is supposed to be in good working order, and causes no pounding by any lost motion. It is a three horse power, vertical, side attachment to boiler, with which it occupies about three by four feet of floor space.—C. W. W.

14.—A CHEAP POLISH.—I am making brush handles of walnut and cherry wood, and I have to polish them. I have been doing it with alcohol and gum shellac in the lathe, but the price does not justify me in so doing it. Common varnish looks too smeary. Can any one inform me of some kind of a varnish or coating that will not be so costly as polishing, and will have a good gloss? What are saw and chisel handles coated with? They have a nice gloss when first bought.—E. H.

15.—CLEANSING STOVE PIPES.—I have a stove pipe extended from a stove through a large room, say 24 feet long; during the winter, the pipe has become filled up with a thick soft mortar of soot, stopping the passage for smoke, compelling me (with the thermometer at zero) to take down the pipe and dig out the soot. Can any of your scientific readers explain the cause of this and give me a remedy? There is no obstruction in pipes running straight up through the roof. So long as the stove pipe is clear, it gives sufficient heat, thereby dispensing with the use of an additional stove.—N. C.

16.—WORCESTERSHIRE SAUCE.—Can any one furnish me with a good recipe for Worcestershire sauce, or for a good substitute for that condiment?—A.

17.—SUPPLYING STEAM THROUGH LONG PIPES.—Can a four horse power engine be supplied with steam from a boiler, 300 feet distant, and work as well as if the boiler were in the usual proximity to the engine?—J. E.

18.—POWER OF SCREW.—Can any one give me a simple rule to calculate the effective power of a screw of a given diameter and pitch —J. M. T.

19.—STEEL AND IRON.—Will some one tell me a quick and easy way to tell steel from iron? Is there any acid that, if put on a piece of bright steel and a piece of bright iron, will show the difference?—J. H.

20.—INK IN ANCIENT TIMES.—What caused the fading of the old Uncial manuscripts of the Bible? I have been told that they were written with lamp black, and it seems to me that, if lamp black or any compound containing a large per cent of it was used, they would not have faded. In other words, will carbon in this form fade, and what is the true composition of the ink with which these manuscripts were written?—H. P. K.

21.—CHLORO-ACETIC ACID.—Will some of the many readers of your valuable paper furnish a formula for making chloro-acetic acid? —A.

22.—SAW MILLS.—What does E. B. T., of Va., mean by cutting with the grain, and how does he do it? Is anything to be gained by reducing the *number* of teeth?—F. M. E.

23.—PACKING FOR HIGH TEMPERATURES.—What packing can be used, or how can packing be prepared, so as to be air tight and indestructible, although exposed to a heat of several hundred degrees?—W. C. K.

24.—PURIFYING RANCID BUTTER.—Does any one know where I can get any information in regard to purifying rancid butter? I have examined recipe books and works on chemistry, but can find nothing that is satisfactory.—J. B. B.

25.—QUICK DRYING BLACK PAINT.—How can I make a cheap quick drying black paint, that will preserve a box when buried under ground? Will it add to the durability if painted inside? Will chestnut be best to make the box of?—D. B.

26.—PAINT TO RESIST ACID VAPORS.—Can any one give me a practical recipe for a paint or whitewash that will resist acid vapors? I have tried silicate of soda, but have not succeeded with it.—A. M. P.

27.—IMPERFECT BRASS CASTINGS.—My molders are experiencing considerable trouble in making brass castings. The alloy is composed of nine parts of copper and one part of tin; and the castings come out of the sand apparently all right, but when the scale is removed, they are a perfect honeycomb. Please tell me the cause of and remedy for this.—G. G.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

LIGHT ENGINES OR POWER FOR SAW MILLS.—NEMO, No. 16, January 20th, inquires on this subject, calling for various opinions *pro* and con. I propose giving the result of my experience with a circular saw mill of very light power. In 1855, I constructed and put into operation a mill of the following dimensions: Two boilers, each 16 feet long x 30 inches in diameter, with twelve 2½ inch tubes in each, with a small steam drum say 3½ feet long by 18 inches in diameter; engine cylinder 6 inches in diameter x 12 inch stroke; steam pressure 100 to 125 pounds to the square inch. All of the machinery was built by Messrs. Benham & Booth, then of the city of Marysville, Yuba county, Cal. With this power, I ran a 60 inch lower and a 46 inch upper saw, with five inserted teeth in each saw. I erected the mill at Eureka, in Sierra county, about seven miles from the city of Downeville. The average amount of lumber sawed per day (ten hours) was a little more than 4,000 feet, board measure, and that with three men including the fireman. The fuel used was slabs and sawdust exclusively. The timber was mountain hard pine and spruce, with some sugar pine, the mountain spruce being very hard and tough. Much of this timber was from 3 to 4½ feet in diameter. We carried from three eighths to five eighths feed to each revolution of the saw. The mill was a direct attachment, the connecting rod being attached to the end of the saw mandril, which I have claimed as being the first direct attachment circular saw mill ever put into operation in this country. By a series of practical tests that I have made, I find that the average cutting that each tooth in a large circular board saw of ordinary thickness—say 6 or 7 gage—will stand is about one eighth of an inch in soft and one sixteenth in hard timber, varying, between one eighth and one sixteenth, in timber from white pine, poplar, hemlock, etc., to white oak and maple. If, then, a saw of 32 in oak will stand 2 inches of feed to each revolution, 4 teeth will cut one fourth of an inch and with exactly one eighth of the power required to drive it with the 32 teeth, always calculating that the same power is required to keep up the velocity of the saw pulleys, fly wheel (if any), and the belts, and nearly the same friction in a light as in a strong power mill; and this is the same in either a circular or reciprocating saw. Four teeth, cutting the same amount to each tooth, will saw just as smoothly as if 32 teeth were cutting; this I have tested practically. It is not to be presumed that any mill of ten horse power will do one half of the work of twenty horse, on account of the amount of power required to overcome friction and velocity being so nearly the same in each. I am of the opinion and am prepared to show that a continuous motion saw, either circular or band, can be made to perform more work with a given power than can be performed with any reciprocating motion saw. And I question whether any man can produce a reciprocating mill that will equal the performance of my Eureka mill with the same power.—J. E. E., of Pa.

POUNDING OF PISTON.—Answer to query 12, in SCIENTIFIC AMERICAN of February 3d.: Let W. M. T. remove the cylinder head and the piston, and see if his cylinder is counterbored at each end far enough in, so that the piston rings at each end of the stroke will pass out in the counter bore at least one eighth of an inch. More would do no harm if it did not exceed half of the width of first ring. The space at each end of the cylinder on which the piston does not run becomes rough, and the grease gets burned on by the heat of the steam; this, with the wear of the rings on the cylinder, will leave a little shoulder at each end of the stroke, unless the rings pass out in the counterbore. If the keys are driven in the connecting rod, it will either shorten or lengthen the rod so that the piston rings will move a little further at one end of the stroke than they did before; and if so, they will hit this shoulder and make it pound. I have known engines pound in which the rings did not come within three fourths of an inch of the counterbore. I was running one, and when I keyed the box on either end of rod it would pound the rod keyed shorter at each end. I chipped the counterbore in about one inch, and the trouble ceased. If the rings are set out too tight, the engine will pound, and also if the packing around the rod is too hard and tight. The slides may also have a little shoulder worn at the end of the stroke of the cross head, unless the latter should run over at each end. Sometimes the valve will make the engine pound by having too much or too little lead. Let W. M. T. commence with about one sixty-fourth inch lead, and run a day or two, and change to one thirty-second and so on up to a sixteenth or three thirty-seconds inch lead; and where his engine runs the stillest and best keep his lead there. I for one do not believe in too much lead on the valve; but all depends on the speed of piston.—L. B.

SHRINKING OF WOOLENS.—Query No. 17. March 2, 1872.—Good old Saint Clement had tender feet; at one time, he put some wool between the soles of his feet and his sandals, and in a short time he noticed the wool, by the action of the warmth and perspiration of his feet and the act of walking, had grown together, forming a firm pad. That was the first record we have of the shrinking of wool, and Father Clement became the patron saint of the woolen manufacturer. The microscope reveals to us that the fibers of wool are covered with a beard, like some kinds of grass, and heads of grain, which on close contact, and being kept in motion, have a tendency to insinuate themselves into their immediate neighbors, and never recede. When cashmere is taken from the loom, it is a yard and four inches wide; it is then put into a fulling mill, when an insinuating process goes on till the fabric has shrunk to three quarters of a yard in width, not quite that proportion in length, and thus gaining in strength and thickness. All other things being equal, coarse wool, slack twisted yarn, and loosely woven cloth shrink the fastest; consequently, flannels made of fine wool, hard twisted and firmly woven, should be selected; but even those, on being rubbed or agitated in warm soap suds, will shrink.—H. S. B., of —.

TENSILE STRENGTH OF SWEDISH IRON.—I revert to this, not for the last word, but in justice to American manufacturers, to whom you have ever proved a fast friend. On page 107 of your Journal, you state: "The breaking weight per square inch of Swedish iron ranges from about 70,000 lbs. to 112,000 lbs., but 85,000 lbs. may be taken as an average." When this was questioned, you give (page 155) Knut Styffe as authority, and refer to pages 124 and 125 of the English edition of his work as giving the tensile strength of puddled steel and puddled iron from Surahammar as averaging 85,000. This is correct, but the strength of Swedish steel was not in consideration, but that of Swedish iron; and, on pages 128 and 129, same edition, Styffe gives the result of these very experiments as showing an average strength of Swedish puddled iron as reaching only 49,229 lbs.; and, on pages 140 and 141, the very highest result reached was of one bar Aryd iron, breaking at 79,667 lbs., while the average of his experiments of iron from puddling furnace and refinery is less than 60,000 lbs. I am sure you will at once see the bearing this claim for Swedish bars has upon the American manufacturer, and upon examination will give corrected statements giving steel and iron separately.—O. W.—O. W.'s references to Knut Styffe's work are correct.

BRONZING GUN BARRELS.—Query 16, March 2, 1872.—First make the barrels smooth and bright with emery; after which clean carefully with lime to remove all grease; then apply the following mixture with a clean sponge or rag: To a quart of soft water, add one ounce and a half of spirits of wine, one ounce and a half tincture of steel, half an ounce of corrosive sublimate, one ounce and a half of sweet spirits of niter, one ounce of blue vitriol, and three quarters of an ounce of nitric acid. The barrels are then to be exposed to the air for twenty-four hours, after which rub with a steel scratch brush until the rust is entirely removed; then again apply the mixture, and in a few hours repeat the scratch brushing. Continue the operation for four or five days; then wash the barrels with plenty of hot water, and while hot, finish with a leather and a little beeswax and turpentine. This will give a fine and glossy finish. Let W. H. R. use the above mixture, or even his own, with these instructions, and he will succeed.—K., of Conn.

PURITY OF WATER.—Query 21, March 2, 1872.—The only water fit for domestic purposes in confined village lots is that saved from showers, in cisterns. These may be very cheaply made in clay soils by digging a hole the shape of an egg, the bottom rounding, about nine feet deep by eight feet across. Four feet from the top, cut a shoulder in the clay wide enough to hold a brick, and lay an arch all round in common mortar, leaning each tier forward, till at twenty inches from the top the hole is not more than two feet in diameter. Fill over the arch with earth as you proceed. Plaster well all over the clay surface with a mortar made of one part hydraulic cement to three parts of sand. Mix a small quantity at a time and apply two or three coats. The last is best. Finish with a wash of pure cement put on with a brush. This cistern may be made by a common laborer for about $30. One I had made in 1854 is in perfect order yet, and has never given any trouble. Heaven's water is the best, purest, and healthiest in the world. Keep the roof clean and no filter is ever needed. A chain pump is best as it agitates and aerates the water. Here in the West we use no other sort.—B. T., of —.

THE SLIDE VALVE STEAM ENGINE.—Your correspondent is correct in saying that most of the western engineers persist in maintaining that the pressure of steam only covers the area of the ports, not the whole of the valve. A large majority take this position, though it is certainly an erroneous one. The slide valve engine is necessarily very imperfect, not only on this account, but from the fact that, while the crank is on its center and the engine is thus in its weakest position, the pressure of steam is greatest, there being very little counteracting pressure in the cylinder. Yet, imperfect as it is, it is the only engine now used by all the railways of the world. Theoretically, I believe it only utilizes about four per cent or one twenty-fifth part of the steam power which ought to be produced by the combustion of the coal. Actually and practically, in his pamphlet published in 1870, on the awards made by the American Institute of New York, Mr. Harris, of Providence, R. I., represents it as being fully fifty per cent behind the performance of a Corliss engine, the cylinders of each being of exactly the same size, and careful notes being made of the coal consumed and work done.—B. T., of —.

B. T., of —.—The coefficient of friction between two surfaces is the constant pressure or force it takes to move one upon the other, usually expressed as a percentage of the pressure in pounds. This in estimating friction is multiplied by the pressure, and not by the extent of surface. Thus, should two plates of cast iron of equal weights, but with widely different areas of bearing surface, be compared, resting upon bearing surfaces of the same material, they would be found to have the same coefficient of friction, the pressures being their weights only. If a pressure equal to their weight be added, the coefficient of friction should be multiplied by twice the original pressure, and so on; and to find the power expended in overcoming it, the product is multiplied by the distance the friction is overcome per minute, and the resulting product divided by 33,000, which gives the total in horse power. From this and suitable tables of coefficients of friction, to be found in almost any handbook of engineering, you may solve the problem stated for yourself.

TANNING RABBIT SKINS, ETC.—Query 4, March 9, 1872.—Let L. H. S. stretch the skin tightly upon a board, and scrape with a dull knife until all the flesh is removed. Mix two quarts of milk, one teacupful of salt, and half an ounce of oil of vitriol. Warm this mixture to somewhat more than blood heat, but not to the scalding point, and soak the skin in it forty minutes, stirring and squeezing it in the warm liquid. Press out the liquid and let the skin dry a short time, then commence rubbing the flesh side with all your strength across the smooth edge of a board until the desired softness is obtained.—B. F. F., of Pa.

SOLDERING STEAM PIPES.—Query 4, March 2, 1872.—E. W. K. can use soft solder to stop cracks or splits in wrought iron steam pipe, by first chipping the split out, lengthwise and nearly through the pipe, with a diamond pointed chisel, then cleaning the surface of the pipe on both sides of the split with a file, and then burring the edges with a light hammer, taking care not to get any dirt or grease in it while hammering. It can then be soldered by first wetting the clean part with chloride of zinc to which is added a little water and sal ammoniac. Burring the edges of the split prevents the solder from being thrown out at a high pressure, if the pressure of steam does not exceed 140 pounds, the temperature of which would be sufficient to melt the solder. I have tried this and know it to be effectual.—W. S. B., of Ill.

TRANSFERRING PRINTS.—No. 17, page 169.—K. W. is hereby informed that my workmen have tried everything recommended for this purpose, and find good No. 1 furniture varnish, reduced with an equal quantity of turpentine, to give the best satisfaction for all purposes of transferring. But on glass, where total absence of color is required, I would use fir balsam, dammar varnish, two parts each, and Venice turpentine, one part, reduced with turpentine two to one.—C. T., of Vt.

TRUEING GRINDSTONES.—To A. J. P. S., query 2, March 2, 1872. A piece of half inch gas pipe, about two or three feet long, with a screw cut on half its length, is used for trueing grindstones by turning the pipe around. The threads of the screw form cutting edges as the pipe wears away, and the thinness of the metal prevents it from heating.—J. E. M., of Pa.

TANNING RABBIT SKINS.—To L. H. S., query 4, page 169. If newly taken off, all right; if dry, soften in water. Equal quantities of fine salt and pulverized alum strewn upon the flesh side of the skin; double it together, flesh and flesh; roll it up tight; let it lay three or four days, turning it over twice every day; shake remaining salt and alum off; when nearly dry, in the shade, rub the skin briskly, on the flesh side, over the edge of a hoe, spade, or shovel. Do this thoroughly, and when the skin is dry, stretch it with the hands until soft, which will be in a few minutes. The salt and alum should be put on as thickly as if it were salt only, intended to save the skin. Sheep skins may be done in the same way.—N. D., of —.

SPLITTING OF HORSE'S HOOFS.—If E. E. S., query 18, Feb. 24, will rasp his horse's hoofs perfectly smooth all around up to the soft part next the hair, sandpaper the rasp with coarse sandpaper, then beat up a hard lump of charcoal, and mix up with train oil to the consistency of paste, and run into the hoof well with a woolen cloth once a day, he will very soon find a change in the hoofs. For cracks, rasp, with the corners of the rasp, across at the top of the crack, as deep as it will bear, put on thin broad shoes, and all will work right.—J. L. B., of Tenn.

PRESSURE GAGE QUESTION.—A. H. G., of Mo.—According to Mariotte's law of gases and vapors, steam pressure is "inversely as the space occupied." Then why is it that, in blowing off in boilers, the steam gage does not fall as the water lowers in the boiler, but remains at the same point until the water is all out?—A. H. G., of Mo.—Answer: It is because the accumulated heat in the boiler and contained water generate steam as fast as the water escapes, thus keeping up the pressure.

COINS.—No. 3, page 169.—L. B. will find that oxalic acid, dissolved in water, is the best article to cleanse old coins. It is also the best for cleaning old brass, either household utensils or the tarnished brass work of locomotives. And oxide of tin is the best article to finish or polish brass, etc., with, after it has been well cleaned.—C. T., of Vt.

WATER FOR AQUARIA.—No. 13, page 169.—I would inform C. D. that the only effectual way to keep pure water in an aquarium is to keep a small stream running in at the bottom and another running out at the top. But he can fit a bent tube to his aquarium, and let the top end of the tube be higher than the water in the aquarium, and fit a funnel to the top end of the tube to receive the water from a pump or dipper, as may be most convenient.—C. T., of Vt.

TEST FOR NITRIC ACID.—To P. C. H., No. 19, page 169.—Add to your suspected liquid a drop more of sulphate of indigo, and boil; the nitric acid should decolorize the solution. At other times, a crystal of protosulphate of iron, on being added, should present a reddish color. Litmus paper is of no use, as any acid would have the same effect.—E. H. H., of Mass.

TEST FOR LEAD IN WATER.—To F. C., No. 24, page 169.—Acidulate the gill of concentrated water with nitric acid, and add a drop or more of a solution of bichromate or iodide of potassium; either will produce a yellow precipitate; sulphuretted hydrogen will produce a black cloudiness. The last two are very delicate tests.—E. H. H., of Mass.

RENEWING THE COLOR OF FADED BLACK WALNUT DOORS.—If F. C. (No. 23, page 169), will go to any color shop and get one pound of burnt umber, ground in oil, and add a little of it to his oil when he oils over his doors, he can lighten the color to any point required. But, to do a good job, he must first scrape off all oil, varnish, and shellac, and apply the color to the bare wood, rubbing it into the grain, and then shellac and varnish anew.—C. T., of Vt.

DYEING FURS.—No. 1, page 169.—L. K. is informed that a solution of nitrate of silver is the best dye for furs. It may be applied and rubbed in with a sponge or brush, and the furs should then be exposed to the light.—C. T., of Vt.

CEMENT FOR ALABASTER.—Query No. 7, page 90.—With white of egg, beaten to a froth, mix dry white lead to about the thickness of ordinary paint and apply quickly, as it dries very fast.—H. H. C.

CEMENT FOR IRON PIPES.—E. W. K. can stop leaks in steam or water pipes, if the cracks are lengthwise, by a clamp or clamps made of thin strips of iron, bent to fit the pipe two thirds around it, with the ends turned out to admit a bolt through them which can be screwed up until neither steam nor water will escape.—J. H. G., of Tenn.

SPEED OF CIRCULAR SAW.—On page 138, current volume, N. B., of Pa., states that it will be safe to run a 52 inch circular saw 1,500 revolutions per minute. Now I and many others have supposed it was excee ingly dangerous to run at so high a rate, owing to the liability of the saw to burst when going at such a speed. I think it highly important for the public to know if N. B. is correct, differing as he does so widely from the commonly received opinion.—C. B., of Minn.

FREAK OF PRESSURE GAGE.—In reply to Mc., query 21, page 138, "Freak of a pressure gage," I will say that my pressure gage always was this. Most pressure gages are filled with water, and water will expand in freezing. It will sometimes make a gage go up to 150. This has always been my solution of the question.—H. B., of Pa.

DYEING FURS BLACK.—To K., query 1, page 169.—Steep furs for half an hour in a bath, of one part bichromate of potash in eighty parts of water, as hot as the skins will allow. Take out, drain, and rinse in clean water; then steep and work, in a bath of logwood, one half the weight of the furs, in a sufficiency of water (hot as before) for another half hour. Take out and expose to the air, and afterwards wash well in clean water. Of course the furs must be free from grease.—E. H. H., of Mass.

NON-INFLAMMABLE SAWDUST.—To L. M., No. 9, page 169.—Steep sawdust in a saturated solution of alum, and dry.—E. H. H., o Mass.

PREVENTION OF FREEZING OF VINEGAR.—To J. R. D., No. 15, page 169. The addition of one eighth part of glycerin will prevent trouble; but may not be applicable, on account of its sweetness.—E. H. H., of Mass.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

PANELING MACHINE.—Silas Heyser, of Jackson, Mich., assignor to James Harding and James B. Wesley, of same place.—A suitable rectangular frame is used with an ordinary table on the top, on which is arranged a broad vertical guide, made adjustable laterally by means of the slotted bars and clamping screws. Said guide, also, has a notch in the lower edge near the center, through which the rotary planing tool works against the board to be acted on, which is fed along the side of the guide in any suitable way, and held up snugly against it by a spring. A short adjustable guide is placed in front of the first named guide, behind the cutting point, between which and the first the board passes as it is dressed. This cutter is mounted on the upper end of a vertical mandrel running in fixed bearings, and acts upon one side of the board, while another similar cutter mounted on a similar mandrel, adjustable toward or from the mandrel works on the other side. The said cutters are suitably shaped for making the wide rabbets at the edges of the boards, such as is common in paneled boards. Sheet metal or other hoods are placed over the cutters and provided with extensions leading to one end of the frame parallel with the guide and arranged to conduct the chips off the table, the said chips being forced by the blast nduced by the rotation of the cutters. These hoods have openings at the sides suited for the cutters to work through to reach the boards to be dressed. These hoods constructed as described, when combined with paneling tools placed in one end thereof, and operating to cut out the shavings and to produce a current of air which forces them through the hoods, constitute the invention.

LAMP.—William Brown, of Newburyport, Mass.—The peculiarity of this lamp is that by a series of gauze screens, and a filtering stratum of sand or other equivalent material in connection with a self acting spring valve, all danger of flame entering the oil reservoir is obviated under any and all circumstances. In case of a fall of a lamp, no oil can escape, and all that could possibly burn is that held by the wick and the small supply tube that leads to it. Thus it is claimed all danger of explosion, or extensive conflagration is obviated. The reservoir may be placed at any required distance from the lamp, in railway cars, etc., and the device is equally applicable to chandeliers, brackets and lamps with standards.

CHIGNON.—Edward Ulmann, of New York city.—This invention has for its object to reduce the expense of imitation braids, waterfalls, or chignons, by doing away with the necessity of braiding the same. It consists in a chignon, as a new article of manufacture, produced by subjecting it to pressure and heat in such manner that the desired form and appearance is pro_uced without braiding or twisting the hair or imitation hair by hand. At present such articles, whether produced from hair or other fiber, are braided to imitate natural braids. The process of so doing is tedious and costly, and requires a considerable additional quantity of material that cannot be exposed to view on account of the peculiar formation of the braids. This imitation chignon is provided with imitation braids, produced by pressure between appropriate shaped dies, which are heated to impart gloss, and to cause the fibers to retain the shape imparted to them. In this manner, it is claimed, an article equally as valuable as, but far less expensive than, the braided chignons is obtained.

CAR COUPLING.—Aaron K. Kline, of Readington, N. J.—A double headed coupling rod is employed. The draw heads have wide large mouthed openings for the coupling bolt, the sides and bottom of which converge toward the rear to a point behind which are square shoulders for holding the head of the coupling rod which drops behind them, a narrow space being provided between that portion of the side wall rising higher than the bottom wall for the shank of the connecting bolt to fall into. The side walls are brought so close together in advance of this space as to cause the rod head to rise without the aid of the bottom to pass over the shoulders to the space. In this space the shoulders are recessed where the head draws against them so that, when the link is uncoupled at one end and let fall, the other head will be arrested by the upper wall of said recess so as to prevent the coupling link from falling out. There is an overhanging projection on the end wall of the recess, under which a projection on the head of the rod is engaged, when it is adjusted for coupling. A coupling rod, with a head on one end and a link on the other, may be used for coupling a draw head of this kind with one of the other kind.

CONSTRUCTION OF RAFTS.—John T. Moore, of Havre de Grace, and Ravand K. Hawley, of Baltimore, Md.—As ordinarily or heretofore constructed, rafts have not been able to withstand the severe strain incident to transit across the larger lakes or ocean bays during rough weather; and the object of this invention is to so connect the logs of the ordinary length with a skeleton of booms as to enable the raft thus formed to be towed in heavy waves or seas with perfect security. To this end are employed screw eye bolts to secure the logs to the chains which connect the parallel booms, so that they may play thereon or have the free movement necessary to allow the raft, as a whole, to rise and fall or otherwise conform to the motion of the waves. The screw bolts are likewise easily inserted or removed, do not, it is claimed, materially injure the lumber, are strong and durable, and have little friction on the chains or ropes. A new chain hitch or mode of fastening the booms or logs together is used, whereby greater security is obtained without a complicated arrangement or tedious process of manipulating to adjust the same.

STOPPER FOR BOTTLES, BARRELS, ETC.—Alfred Marsh, of Detroit, Mich. assignor to Annie Marsh, of same place.—This is a barrel bung made of wood or other suitable fibrous material, which will expand and contract to keep the bung hole properly closed. A metal plate is placed on the top of the bung and is provided with a shank, which extends through the bung and is, below the same, fastened with a pin or wedge, a metal washer being placed against the under side of the bung, so that the wedge bears against it. The bung is thus confined between the plate and washer, and thereby considerably strengthened. In the center the upper plate is perforated, the aperture extending into the upper part of the shank to form a cavity therein. This cavity is narrow at or near the top, and enlarged below. A key, having projecting lugs or ears, can be fitted through the narrow part of the cavity into the larger portion of the same, and then turned so that its ears will come under the shoulders. By then pulling the key directly, or with the aid of a lever, the bung can be readily extracted. The same invention can be applied to bottle stoppers.

LOG LIFTER.—Green B. Sims, of Elizabeth, Ind.—This invention has for its object to furnish an improved machine for lifting logs and other heavy weights to load them upon wagons, for pulling stumps, and for other similar purposes. It is an arrangement of lever and ratchet, in principle somewhat like a lifting jack for greasing wagons, pivoted at the bottom so that it may be inclined from the perpendicular to accommodate itself to the motion of a log of which one end is raised while the other rests upon the ground. It is provided with an apparatus for grappling the log or other object to be raised, and being portable may be used with convenience for handling various materials in moving them for transportation and in warehouses.

COTTON PRESS.—Robert N. Wyatt, of Tehula, Miss.—The press is revolved upon improved bearings by power applied hrough levers. A right and a left hand threaded screw revolve with the press. They pass through the sill and girder of the press and engage with screw nuts which are bedded in the sill and girder. On the inner end of each of these screws is a follower, which, as the press is revolved, approach each other and press the cotton or other substance between them, or recede from each other by reversing the motion. The end frames are constructed together by rods, and the frames are connected with friction caps by means of the gains in the lugs of those caps. The bed nuts and friction caps are grooved and ribbed, so that, as the press revolves there can be no lateral motion, and so that the screw will always be kept in a central position and not be subjected to undue strain or danger of fracture at these points. By thus improving the frictional points, it is claimed, the revolving press is made strong and durable, and is not liable to break or get out of order; besides the improvements render these parts of the press much more simple and inexpensive than they have heretofore been.

GATE FOR WATER WHEELS.—Edward F. Hunt, of Cornton, Vt.—This invention consists in the application to the stationary wheel case of swivel guides, in which the gates can slide when moved by the turning of the ring to which they are pivoted. By this means water may be admitted from either direction, so that the gates are equally adapted to right and left handed wheels.

CASH FARE BOX.—James W. Prendergast, of New York city.—This box is designed to be supported on the arm or in the hand of the conductor, and to be carried from passenger to passenger throughout the car. It is also intended that each passenger shall deposit his or her own fare, and that the conductor, while he is enabled to make the change, is not allowed to handle the fare. A hood, into which the passengers drop their fares, is placed upon the top or near the top of the box. The fare drops from the hood on to a slide, from which it slides on an inclined surface and thence along an apron to a revolving plate, where it is stopped. A plate of glass forms the upper part of the front of the box. Two sides of this part of the box are also of glass. While the fare rests on the plate, it is exposed to the view of both passengers and conductor. When the conductor sees that the proper or required fare has been deposited by the passenger, he turns the plate and drops the fare into the cash receptacle or bottom portion of the box. This part is closed and locked at the office before the box is given to the conductor, and is kept locked or locked and sealed until the box is returned to the office for making the returns. In one corner or in some other part of this cash receptacle, or in some other part of the box, is placed a small vial or tube filled, or partially filled, with shot. This tube is open at the top, so that if the fare box is inverted the shot will escape from the tube by their own gravity. Now, the box would never be inverted or turned over except in an attempt to tamper with it for gaining access to the cash by allowing the latter to slide from the box. The revolving plate is held in a horizontal position by means of a double spring. The shaft or pivots of this plate project through the sides of the box, with a knob on one end for turning the plate through the use of suitable mechanism. A fare box provided with a shot tube for the purpose set forth, constitutes the claim upon which a patent has been issued.

SELF LOCKING BLIND BUTT.—William R. Goodrich, of Utica, N. Y.—This invention has for its object to furnish an improved reversible locking hinge for blinds and shutters. It consists in making double locking inclines on the male or pintle portion of the hinge. By this construction, when the blind is swung fully open, it is locked. The butt can be used as a right or left butt, as may be desired.

COMB SAWING MACHINE.—William Booth, of College Point, N. Y.—In the ordinary comb sawing machine, the shift screw thread is cut upon a cam so that, when the descent of the platform is limited by the stop rod, the platform will be held up from the cam for a part of its revolution, leaving a portion of its attachments free to slip. This difficulty is, it is claimed, wholly removed by the present invention, which, by connecting the shift with the frame, always holds the frame and its attachments securely against slipping or lateral movement, except when moved by the shifting device. A circular shift wheel, constructed in a peculiar manner, in combination with the driving shaft and stationary screw, attached to the frame that carries the pivoted platform, clamp holder, and comb clamp, and a combination of the clamp holder, clamp, clamping screw, and swivelled adjusting screw with each other, said parts being constructed and operating together in a peculiar manner, constitute the claims upon which a patent has been obtained.

PEG CUTTER.—Jacob G. Klock, Mansfield, O.—The invention relates to a new mode of cutting or rasping out the pegs that project from the inside of boots or shoes. The means consist of an arc shaped float, which is worked by a treadle, and is moved in arc slots of a hollow upright. It seems to be not only theoretically correct in its construction, but to work with such accuracy and efficiency that no shoemaker should be without the device.

CAR COUPLING.—Henry Hawley, of Lynchburg, Va.—The coupler is connected with the draw head in any convenient manner. The coupling link may be formed in any manner with spear heads at the ends. Springs are attached to the opening plates, and an opening button is attached to an upright shaft. This shaft passes through the coupling and is supported by the the bottom plates thereof and by the top plate. A cord pulley on the top of the coupling is fast on the shaft. To a pulley on another vertical shaft a cord or chain is attached. Its other end passes around the firstnamed pulley on the top of the coupling and is attached thereto. When the latter pulley is turned, the ends of the button are turned in contact with the opening plates, which throws the springs with the catch plates from the shoulders of the spear heads, and thus uncouples the cars. The cars are self coupling as they come together, as the link requires no hand manipulation. A cord may extend from cranks under the coupling to the locomotive, so that the engineer may at any time release the locomotive from the cars.

CORPSE PRESERVER.—John F. Waters and Edward G. Waters, of Philadelphia, Pa.—The object of this invention is to provide suitable, convenient, and effective means for preserving the corpses of deceased persons during the time which elapses between the first stages of decomposition and burial. It consists in a wood case with a perforated lining and with a space between the outer case and the lining, and otherwise so constructed that the corpse may be exposed to any disinfecting agent that may be employed. A false bottom is perforated beneath the lining, thus making the middle portion of the bottom double, and having a discharge aperture. This portion is fitted to a bottom or base, having one or more drawers therein, arranged at the ends or any portion thereof for containing any disinfecting material or substance, either such as are now known or may hereafter be discovered. The gases evolved from such disinfecting material will pass into and fill the interior from the space at the sides and ends, and through the space beneath. Any fluids which may escape from the corpse will pass into the space beneath the double bottom, and may be drawn from the base by a spigot. There are test holes through the top of the case by means of which the first indications of decomposition may be detected, and which is immediately arrested by the application of the disinfectant agents. These holes are closed by slides. A glass is set in the top, through which the face of the corpse is visible. The top closes air tight on to the case, and the case is designed to close air tight on to the bottom. The case is held tightly down to the bottom by clutches and keys, four in number, more or less.

LIFTING JACK.—Beers B. Tomlinson, of Mt. Carrol, Ill.—This is a new wagon jack of very simple and convenient make, applicable to axles of suitable hight. The invention consists in a new arrangement of standard shifting lever and locking link, by which the lever can be shifted for the front or hind axle without requiring the displacement of the pivot, while yet the latter is also adjustable in the standard, to provide for still greater differences of hight than the lever alone can regulate. The entire jack can be made of cheap and light material, but with great strength, all parts being used to advantage.

SEWING MACHINE FOR LEATHER.—George V. Sheffield, of New York city, assignor to himself and Godfrey K. Mellor, of Woonsocket, R. I.—This invention is an improvement in the class of sewing machines designed especially for sewing leather or other thick and tough material. It consists mainly in the employment of a "whirl" or thread carrying plate and a reciprocating rotating needle, whose conjoint operation produces the desired loops and twists in the thread. The mechanism is very ingenious and seemingly well adapted to secure a good result. In order to secure a still firmer hold, the inventor proposes to use thread of successive double conical sections, or swells, they being so spaced that the needle will always take hold at the thin portions, and thereby draw two conical pieces alongside of each other up, such pieces entering the leather like wedges, and holding it very securely. This last is a novel and striking feature. Patents have also been secured abroad.

SAFETY GUARD FOR HATCHWAYS.—Zebedee S. B. Weeks and Charles L. Kohler, New York city.—This excellent invention consists of a safety guard for hatchways so arranged and connected with the hatch door or doors that it will be automatically closed when the door opens, to guard against falling through, and to be similarly opened when the door closes, the said guard being hinged to its support and connected to the door by a guard or chain which works over guide rollers in such manner as to allow of the automatic opening and closing. The guard may consist of a framing of bars, jointed together in any suitable or approved way, and pivoted to the post placed in front of the hatchway, so as to swing up and down, the joints allowing the guards to be pivoted to the posts in two or more places; or it may consist of a parallel or rigidly constructed door or gate, and be hinged to the post at one point only. Each section of the guard is connected to its corresponding section of the hatch door by a cord, which works over guide rollers in such manner that when one rises the other will fall, and *vice versa*, so that, whenever the hatch door is opened, the guard will fall in front of the open hatch and guard it while open. The guard may, however, be opened while the door is opened, if required, by lifting it up. This simple contrivance will insure the closing of the guard at all times, when necessary, and thus save lives and injuries to persons liable to accidentally fall through when the guards, which have to be worked by hand, are neglected.

BROILER.—Richard Penn Smith, New York city.—This invention consists of a broiler constructed wholly or in part of fine wire gauze, or finely perforated metal or other substance, to allow the heat to act upon the meat and yet prevent the actual contact of the flame with the meat, whereby the inventor claims to utilize all the advantages of the heat for broiling without any of the destructive effects of flame and smoke, the instrument being so constructed as not to partake of the nature of a frying pan. In order to prevent the actual contact of fire and smoke with the meat, which are injurious to it in respect to taste and smell, he proposes to interpose between the fire and the meat, in some form or other, fine wire gauze or finely perforated sheet or cast metal, adapted to arrest the passage of flame, on the principle of the Davy lamp, while allowing the heat to pass; and for this purpose he may take an ordinary broiler and attach a sheet of wire gauze below the bars, or may use a wire gauze or perforated sheet only, the same being provided with suitable legs and a handle and strengthening bars or strips of any kind at the edges; but he prefers to arrange the said gauze or perforated sheet in corrugated form, with end and side pieces of any kind for making strong and rigid broilers. And for preserving the gravy, he proposes not to perforate the plate at the bottom of the grooves or corrugations, or, in the case of wire gauze being used, to fit a little angle plate of sheet metal in the bottom of each groove, arranging the surface flush with the surface of the gauze; and at one end, preferably the front, he arranges a trough or reservoir for these troughs to empty into. A handle and legs, attached to the rear end to elevate it a little, and arranged so they will fold up with the body of the broiler, for convenience in packing, complete the device.

GRAIN SEPARATOR.—James C. Bowden, Farmington, Cal.—This grain cleaner and separator is claimed to be thorough in operation, easy to keep the motion, and always under full control of the operator, who can regulate the quantity to be fed with great exactness. Zinc screens combined with sieves, plates, and rotary screens, arranged in a peculiar way, and an arrangement, in a grain separator, of a shaft carrying wheels, belt, and pistons, with respect to the several screens and sieves, for the purpose specified, are the claims upon which a patent has issued.

INDICATOR PADLOCK.—Frederick J. Hoyt, New York city.—This invention consists of an ingenious combination, with a lock, of a rolled and numbered paper strip, and apparatus for causing said strip to be forced out of the case the distance of one number by the key each time it is turned, in order that the person locking the lock may tear off the number thrust out to be kept for comparison with the numbers torn off by others, to show whether the lock has been unlocked by any unauthorized person. The essential object of the improvement is to provide a lock for freight cars, by which to ascertain, with unerring certainty, on what section of a long line of road missing goods have been stolen, in order to render the particular section whereon the goods were lost accountable, instead of charging the loss *pro rata* upon all the sections, as is now the practice, owing to the want of any reliable means to fix with certainty upon the section encountering the loss. The inventor does not limit himself to any particular arrangement of the apparatus for actuating the paper strip, nor to actuating the apparatus through the medium of the key post, for it may be done by the tumblers, or by the bolt, or any moving part, the same being provided with a pawl to actuate the rollers, or other equivalent means. This numbered paper strip will, it is claimed, not only indicate with unerring certainty between what stations—where the lock is opened and locked by duly authorized agents—it has been opened unauthorizedly, but it will be a check upon the station agents, whose duty it is to open and relock them, by requiring each station agent to forward the number torn off by him to the general agent for comparison; for, if one agent neglects his duty, the number torn off by the next one, which the first should have taken, being compared with the first number torn off at starting, will show the neglect of the delinquent agent.

BEATER PRESS.—Franklin Frey, Liberty, Ill.—This invention consists of a beater press, wherein the beater is raised by a capstan pulley, and a loose arm carried by said pulley and held so as to be let free by a tripping apparatus at the proper time to let the beater fall. The beater is forced down to press the bale, after it has been beaten in this way as much as required, by levers worked by another drum on the capstan, which is disconnected from the shaft, so as not to turn when the beater is to be worked.

DISH DRAINER.—Henry R. Richmond, of New Plymouth, New Zealand.—This invention consists in a dish drainer consisting of a rack, inclined board, sloping gutters, and shelf, designed to be attached to the wall of the kitchen or other washroom, and preferably above the table upon which the crockery is to be washed, so that it may be conveniently accessible.

CLASP FOR LOOPING SKIRTS.—Marion R. Zerbe, New York city.—This invention consists of a skirt clasp for looping up dress skirts and the like, which is formed of a small plate of metal with a spring, button, and points on each side, so arranged that it will be buttoned to a slight loop or fold of the skirt by one end, and suspended to receive the other fold in the other end, the said folds being secured by turning the buttons over the fold, which is placed on the plate and the points. The instrument is to be made quite small and light, and may be made of any fine metal and in any ornamental style.

COTTON PRESS.—Malkiah W. Bradford, Greenwood, La.—This invention has for its object to furnish an improved press for pressing and baling cotton and other materials, which shall act with increased power as the bale becomes more and more compressed. An arrangement of hinged sides, detachable ends, lock bars, and forked or slotted bars with respect to each other, and the box, frame, and top frame to which the head is attached, and also an arrangement of the top frame with its hinges and hasps, in connection with a head block, frame and receiving box, composed of sides and ends in a peculiar manner, are the claims on which a patent was granted. The press is of the class in which the power is applied through the agency of ropes or chains, and a windlass or drum in connection with toggle jointed levers.

BREECH LOADING FIRE ARM.—Ruth Goshen, New York city.—This invention has for its object to improve the construction of breech loading fire-arms, so that ordinary muzzle loaders may be easily and cheaply converted into breech loaders, and which improvement may be applied to new arms with facility and advantage. The improvement is covered by four claims on which a patent has issued. Our readers have been introduced to this inventor before. On page 103, Vol. XXIV, we published an article entitled "THE LARGEST INVENTOR YET," giving his birth and parentage, and a brief sketch of his personal history and appearance. He is decidedly the largest client we have ever had or ever expect to have.

[OFFICIAL.]

Index of Inventions

For which Letters Patent of the United States were granted

FOR THE WEEK ENDING MARCH 19, 1872, AND EACH BEARING THAT DATE.

Alarm, fire, F. F. Herman 124,680
Alkalies, acids, etc., package for, J. H. Selbert 124,859
Amalgamating precious metals, apparatus for, D. D. Wyckoff 124,873
Auger, earth, I. Yeasel 124,711
Auger bits, machine for forming, W. A. Ives 124,683
Axles, process of making hollow metallic, W. A. Lewis 124,833
Axles, manufacture of ribbed plates for hollow car, W. A. Lewis 124,834
Baby walking apparatus, C. D. and J. A. Westlake 124,706
Bark breaking and rossing machine, Burdwin and Tillinghast 124,688
Barrel, paper, W. H. Bailey 124,714
Basket, hanging, C. C. Hibbert 124,818
Bed bottom, M. M. Murray 124,847
Bedstead fastening, E. G. Gory 124,735
Bedstead, sofa, J. Schafer 124,765
Bell hanging, M. R. Jones 124,685
Bevel, carpenter's, Bailey and Sargent 124,779
Boats, paddle mechanism for, C. Howard 124,746
Bobbin winder, Day and Shook 124,667
Boilers, base burning steam, Z. S. Durfee 124,672
Boot and shoe heel, J. M. Hunter 124,682
Boot and shoe edges, machine for trimming and setting, S. H. Hodges 124,744
Boots and shoes, rotary heel for, A. O. Crane 124,723
Bottle, spice, J. L. Likins 124,836
Bracelet fastening, R. S. Hamilton 124,815
Brick machine, Rich and Hubbard 124,761
Bridle bit, G. W. Barnes 124,789
Brush holder, A. H. Trego 124,865
Bureau, washstand, and commode combined, L. Aling 124,653
Burial case, S. Stein 124,769
Burial case, R. J. Howdon 124,747
Burner, gas, T. Ward 124,866
Burner, oxyhydrogen gas, A. W. Wilkinson 124,869
Butteris, D. I. Foust 124,804
Camera box, photographic, M. Flammang 124,674
Can, fruit, A. A. Wilcox 124,710
Car coupling, Kuhnle and Row 124,750
Car coupling, J. W. Jones 124,684
Car coupling, J. Bassler 124,780
Car starter, C. B. Broadwell 124,662
Car, railway, E. D. Gird 124,734
Car wheels, mounting and securing, W. A. Lewis 124,835
Carriage step, J. Pendergast 124,697
Carriage wheel hub, J. F. Fowler 124,731
Carriage tops, etc., waterproof cloth for, A. M. Whipple 124,708
Caster, pickle, H. C. Wilcox, (reissue) 4,820
Chains, construction of ornamental, I. Lindsley 124,837
Chair, barber's, A. Abel 124,715
Churn, J. A. Marine 124,841
Clamp, G. F. Almy 124,776
Clothes line reel, Prouty and Thompson 124,698
Coal, coking fossil, G. Lander 124,698, 124,699
Cock, compression, J. Maclaren 124,840
Coffins, fastening key for, J. Homrighous 124,745
Composition, plastic, T. B. Gunning 124,736
Composition for blacking and polishing boots and shoes, H. A. Reams 124,760
Compound for skin diseases, F. W. A. Bergengren 124,660
Cooperage, dowel hoop for, A. W. Ballou 124,656
Cultivator, J. Harris, (reissue) 4,812, 4,813
Cultivator, J. T. W. Larrabee 124,831
Cultivator, S. Crossly 124,724
Cultivator, hand hoe, W. Goodwin 124,810
Cutting thin material, A. Delkescamp 124,669
Digger, potato, J. J. Naylor 124,695
Digger, potato, R. G. Dayton 124,726
Dryer, fruit, S. C. Barth 124,658
Drill, grain, Wensthoff and Troup 124,707
Drill, hand, L. Hillebrand 124,681
Drill, portable hand rock, I. B. Milliner 124,845
Earth closet, A. W. Davis 124,725
Electricity, apparatus for lighting and extinguishing gas by, J. Vansant 124,778
Electro magnetic engine, W. Wickersham 124,868
Elevator, hay, A. S. Brown 124,787
Elevator, pneumatic wool, J. Penman 124,851
Elevators, safety catch for platform, Tatham and Brittin 124,864
Engine steam, C. M. Farrar 124,801
Engine, air and gas, A. H. de Villeneuve 124,671
Engine, oscillating steam, G. F. Lowry 124,754
Engine, rotary steam, J. B. Bennett, (reissue) 4,808
Engine valve, steam, A. W. Harris 124,817
Engine, direct acting steam, J. B. Smith 124,863
Engines, wheel for traction, A. G. Barrett 124,778
Equalizer, three horse, A. March 124,692
Felting machine, C. P. Ladd 124,828
Fence post, J. F. Keeler 124,686
Filter, water, F. Henshaw 124,741
Fire escape, Bearns and Olsson 124,715
Fire kindler, S. F. Watson 124,705
Fire arms, projectile for, C. Maduell, (reissue) 4,814
Flask, pocket, R. George 124,733
Food for the table, device for forming, J. Bisettier 124,792
Fruit gatherer, N. E. Hinds 124,743
Furnace, hot air, J. H. Mearns 124,842
Furnaces, dome for hot air, B. Gommeninger 124,807
Furnaces with hydrocarbon liquids, heating, J. K. Caldwell 124,791
Game, E. J. Brooks 124,786
Gas apparatus, C. Seeger 124,766
Gas, manufacture of illuminating, A. W. Wilkinson 4,821
Gases from blast furnaces, using, J. E. A. B. De Langlade 124,796
Gate, P. Schwebel 124,858
Gauge, registering steam, T. C. Hargrave 124,816
Governor, D. J. Wolfe 124,871
Grate, fire place, R. P. Sause 124,699
Harrow, O. J. Leabo 124,752
Harvester, J. Beach 124,781
Harvester, corn, T. Merrell 124,737
Harvester, corn, Besant and Atkinson 124,661
Heater, base burning fire place, S. B. Sexton 124,860
Horses from carriages, detaching, J. Summers 124,703
Horses from carriages, detaching, T., Jr., and I. Byrd 124,790
Hose, suction, Stetson and Brandon 124,770
Hydrant, G. C. Bailey 124,777
Hydraulic motor, M. Millard 124,843
Jack, lifting, J. T. Hamilton 124,814
Jack, lifting, H. Clement 124,721
Jack, wagon, I. Van Kersen 124,704
Jars, instrument for extracting air from fruit, J. H. Parrish 124,758
Jewelry, and silver ware case, Bodwell and Beck 124,783
Lamp, J. S. Hull 124,823
Lamp, street, M. B. Dyott 124,673
Lantern, street, C. F. Hollis 124,819
Lantern, street, J. Cook 124,665
Lathe, turning, F. G. Sheldon 124,861
Leather, machine for rolling, J. Whitney 124,709
Lifter, tie, J. H. Koontz 124,749
Loading apparatus, stone, H. S. Perkins 124,852
Meat cutter, D. R. Kenyon 124,748
Medical compound, J. M. Cantrell 124,718
Medical compound or salve, N. Lauer 124,751
Milk cooler, O. H. Willard 124,870
Mill, paint, C. Belcher (reissue) 4,807
Mill, feed grinding, M. S. Harshe 124,737
Miter box, T. B. Dooley 124,797
Motion, apparatus for converting, R. M. Fryer 124,805
Motor, S. L. Langdon 124,839
Movement, mechanical, C. Zeltler 124,712
Mowing machine, L. Gordon 124,678
Nails, machine for making horseshoe, J. Stone 124,771
Nitro-glycerin, making and using, A. Nobel (reissue) 4,815, 4,816, 4,817, 4,818, 4,819
Oil tanks, man hole cover for, H. F. Snyder 124,768
Packing for pistons, etc., E. D. Murfey 124,846
Padlock, C. F. Gerlach 124,677
Paint, mineral, W. B. Towers 124,772
Paper box machine, J. Worell 124,872
Paper cutting machine, G. A. Walker 124,774
Paper cutting machine, Leviness and Van Horn 124,690
Paper board for buildings, etc., F. N. Davis 124,795
Pavement, road, M. K. Couzens 124,722
Pavement, wood, G. W. Dyer 124,799
Peg cutter, J. G. Klock 124,826
Pipes, device for the manufacture of drain, J. W. Stockwell 124,702
Pipes, device for cutting off, Barwick and Farre 124,659
Pipes, foul air escape for waste, J. Daniels 124,666
Planing machine, J. Griffen 124,813
Planing machine, iron, A. Gastel 124,676
Planter, corn, S. L. Donnell 124,728
Plow, B. C. Blomsten (reissue) 4,810
Plow, gang, D. M. Fay 124,802
Plow, snow, O. Heggem 124,739
Pot, chamber, F. Imhorst 124,824
Pot, dinner, A. F. Wolf 124,725
Preserving cranberries, L. G. Kniffen 124,827
Press, hay, J. Briggs 124,717
Printing press, E. H. Smith 124,701
Printing press, B. Huber 124,822
Punch and edger, combined, G. E. Heinig 124,740
Pump, rotary, C. P. Holmes 124,820
Pump, steam, L. Griscom 124,679
Railway switch, P. Carrigan 124,719
Railway rails, splice piece for, C. Roosevelt 124,856
Railway rails, sawing and straightening, White and Wostenholm 124,867
Rake, horse hay, S. Rockafellow 124,855
Rake teeth etc., machine for bending, J. and E. J. Sugden 124,863
Register, hot air, Bunce and Salt 124,665
Rice, etc., cleaning, decorticating, and scouring, A. B. Paige 124,848
Roof, fire proof, S. Smith 124,767
Roofing, apparatus for making artificial, D. G. Conger 124,794
Rubber filling for the grooves of transmission wheels, W. A. Roebling 124,764
Safe, M. C. Boyer 124,784
Sash holder, J. Peck 124,696
Sash guide block, A. Bicknell, (reissue) 4,809
Saw, M. Jincks 124,825
Saw mills, machine for turning logs in, A. Rogers 124,763
Screen and other frames, window, P. L. Quinn 124,759
Separator, grain, J. A. Cohoon 124,793
Sewing machine, Price and Billings 124,854
Sewing machine motor, C. F. Greer 124,812
Sewing machines, hemmer for, H. C. Goodrich 124,809
Sewing machines, treadle for, L. W. Sapp 124,857
Sewing machines, ruffling attachment for, R. E. Peterson, Jr. 124,853
Sewing pamphlets, C. H. Palmer 124,694
Shirts, measuring and cutting out, M. Palmer, Jr. 124,849
Signals, operating railway, R. Gidley 124,806
Spark arrester, Hawkes and Paine 124,738
Spark arrester for locomotives, E. Lannay 124,880
Sprinkler, street, L. F. Bancroft 124,657
Stables, releasing apparatus for, A. Dehuff 124,668
Stage for washing windows, J. Robinson 124,762
Stamp, hand, F. L. Bailey 124,655
Stand, wire dish, G. D. Dudley 124,798
Staves, machine for jointing, A. M. Benson 124,716
Steel and refined metals, manufacture of cast, W. Sellers 124,700
Stove, hot blast, B. Ford 124,803
Sulky, M. C. Boyer 124,785
Table, side, E. Green 124,811
Telegraphic recording instrument, T. A. Edison 124,800
Ticket box for railroad conductors, N. B. Lyman 124,839
Toy sewing machine, R. A. Goodes 124,808
Trap, animal, J. W. F. How 124,821
Trap, animal, M. W. Lyman 124,838
Tray holder, O. Fahnestock 124,730
Valve, safety, J. R. Cazier 124,792
Valve, stop, S. J. Peet 124,850
Vehicles, spring for, A. W. McKown 124,756
Vehicles, wheel for, G. R. Duval 124,729
Ventilator, L. Kelley 124,687
Wagon body lifter, E. A. Chatfield 124,720
Wagon spring seat, S. W. Denny 124,670
Washer, feather, J. Weaver 124,782
Washer, clothes, Miller and Irons 124,844
Washing machine, L. Gall 124,675
Washing machine, E. A. Park 124,696
Watch chains, safety hook for, G. Leigh 124,832
Watches, dial for calendar, G. Maranville 124,691
Water wheel, W. G. C. Mastersun 124,735
Water wheel, S. G. Dewey 124,727
Wells, safety guard for tubing of artesian, A. S. Hill 124,742
Whiffletree, N. Campbell 124,664
Wood, machine for bending, C. Leseberg 124,753
Work holder, J. E. Gilman, (reissue) 4,811
Wrench, L. Anderson 124,654

EXTENSIONS GRANTED.

19,572.—MACHINE FOR PACKING FLOUR.—J. Mattison, Oswego, N. Y.
19,637.—GRAIN SEPARATOR AND SCOURER.—S. Howes, Silver Creek, G. E. Throop, Syracuse, N. Y.
19,591.—ENGINE VALVE.—I. Van Doren, Annandale, N. J.
19,555.—SPLICE FOR RAILS.—J. B. Norris, E. W. Scudder, Trenton, N. J.
19,548.—TIGHTENING KEYS OF JOURNAL BOXES, ETC.—L. Dederick, Jersey City, N. J.
19,610.—RAISING DOUGH.—J. Perry, Brooklyn, N. Y., and J. C. Fuller Orange, N. J.

DISCLAIMER.

STRAW CUTTER.—D. T. Willson, D. Fleming, C. H. Willson, executors of T. H. Willson, deceased. Letters Patent No. 19,462, dated February 23, 1858.

DESIGNS PATENTED.

5,653 to 5,660.—CARPETS.—R. R. Campbell, Lowell, Mass.
5,661 to 5,664.—CARPETS.—J. M. Christie, Lowell, Mass.
5,665 to 5,669.—CARPETS.—J. Fisher, Enfield, Conn.
5,670 to 5,676.—CARPETS.—O. Heinigke, New York city.
5,677 to 5,679.—CARPETS.—H. Horan, Newark, N. J.
5,680 to 5,684.—CARPETS.—L. G. Malkin, New York city.
5,685 to 5,693.—CARPETS.—E. J. Ney, New York city.
5,694.—PAPER CLIP.—J. Ottner, New Britain, Conn.
5,695.—PUMP.—W. Burlingham, New York city.
5,696.—SASH FASTENER.—O. E. Fogelstrand, Kensington, Conn.
5,697.—CHEST HANDLE.—O. F. Fogelstrand, Kensington, Conn.
5,698.—CUPBOARD CATCH.—O. F. Fogelstrand, Kensington, Conn.
5,699.—CEILING HOOK.—O. F. Fogelstrand, Kensington, Conn.
5,700 and 5,701.—SODA FOUNTAINS.—G. F. Meacham, Newton, Mass.
5,702.—DRAWER PULL.—J. Ottner, New Britain, Conn.
5,703.—BOLT CASE.—J. Ottner, New Britain, Conn.
5,704.—BRACKET.—J. Ottner, New Britain, Conn.

TRADE MARKS REGISTERED.

703.—WHISKY.—Adams, Blake & Taylor, Boston, Mass.
704.—WHISKY.—D. C. Brady & Company, Louisville, Ky.
705.—LONG CLOTH.—Coffin & Altemus, Philadelphia, Pa.
706.—CARBON OIL AND BURNERS.—M. B. Dyott, Philadelphia, Pa.
707.—MEDICINE.—J. R. Nichols & Co., Boston, Mass.
708.—BURNING FLUID.—W. H. Reed, Indianapolis, Ind.
709.—SHIRTS, ETC.—L. Sternberger, Philadelphia, Pa.
710.—HEATERS, ETC.—Stuart, Peterson & Co., Philadelphia, Pa.
711.—WHISKY.—T. E. Moore, Shawhan, Ky.

SCHEDULE OF PATENT FEES:

On each Caveat $10
On each Trade-Mark $25
On filing each application for a Patent, (seventeen years) $15
On issuing each original Patent $20
On appeal to Examiners-in-Chief $10
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APPLICATIONS FOR EXTENSIONS.

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

20,566.—ADJUSTABLE HANGER.—W. Johnson. May 29, 1872.
20,309.—RAILWAY SWITCH.—G. R. Smith. July 9, 1872.
20,538.—HOUSE BELL.—J. Barton. May 29, 1872.
20,681.—SKIRT HOOP.—R. J. Mann. June 5, 1872.
20,618.—HARVESTER.—T. Berry. June 5, 1872.
20,539.—CUTTING PINS.—J. G. Baker. May 29, 1872.

Inventions Patented in England by Americans

[Compiled from the Commissioners of Patents' Journal.]

From February 23 to February 29, 1872, inclusive.

ALLOYS, ETC.—G. H. Smith (of New York city), London, England.
CAST TIRES, ETC.—N. Washburn, Mass.
CUTTING FILES.—A. Weed, Boston, Mass.
FINISHING NAILS.—J. A. Wills, Vergennes, L. S. Kingsland, Burlington, Vt
KNITTING MACHINE.—D. Bickford, New York city.
LEVER FOR MOVING RAILWAY CARS.—W. H. Chase (N. Y. city), London, Eng.
PNEUMATIC BRAKE.—G. Westinghouse, Jr. (of Pittsburgh, Pa.), London, Eng
RAILWAY RAILS.—T. R. Tinsley, Tarrytown, N. Y.
SAW.—E. M. Boynton, Grand Rapids, Mich.
SEWING MACHINE.—N. A. Baldwin, Milford, Conn.

FOREIGN PATENTS—A HINT TO PATENTEES.

It is generally much better to apply for foreign patents simultaneously with the application in the United States. If this cannot be conveniently done, as little time as possible should be lost after the patent is issued, as the laws in some foreign countries allow patents to any who first makes the application, and in this way many inventors are deprived of valid patents for their own inventions. It should also be borne in mind that a patent is issued in England to the first *introducer*, without regard to the rights of the *real* inventor; therefore, it is important that all applications should be entrusted to responsible agents in this country, who can assure parties that their valuable inventions will not be misappropriated. The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address

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Practical Hints to Inventors.

MUNN & CO., Publishers of the SCIENTIFIC AMERICAN have devoted the past twenty-five years to the procuring of Letters Patent in this and foreign countries. More than 50,000 inventors have availed themselves of their services in procuring patents, and many millions of dollars have accrued to the patentees whose specifications and claims they have prepared. No discrimination against foreigners; subjects of all countries obtain patents on the same terms as citizens.

How Can I Obtain a Patent?

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

How Can I Best Secure My Invention?

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

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

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention, if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake without any fraudulent or deceptive intention.

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Foreign designers and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto-relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

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Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing

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TWENTY-SIXTH
Annual Statement
—OF THE—
Connecticut Mutual
LIFE INSURANCE CO.,
—OF—
HARTFORD, CONN.

Net Assets, January 1, 1871.....$29,747,494 70
Received in 1871:
For premiums.....$1,803,491 91
" interest and rent..... 1,924,308 14
9,727,700 05
$39,475,194 75

Disbursements in 1871:
To POLICY HOLDERS:
For claims by death and matured endowments... $1,795,266 83
Surplus returned to policy-holders.. 4,302,112 80
Surrendered and lapsed policies..... 904,862 16
$7,630,241 79
EXPENSES:
Commissions to agents ... $652,488 96
Salaries of officers, clerks, and all others employed on salary 53,492 92
Medical examiner's fees. 21,541 49
Printing, stationery, rent, advertising, postage, exchange, etc. 63,016 56
790,542 93
TAXES, including arrears of taxes resisted..... 308,732 79
8,729,517 51
Balance, net assets Dec. 31, 1871.....$30,745,677 24

SCHEDULE OF ASSETS, DEC. 31, 1871.

Loans upon real estate (first lien) value $39,512,065 ..... $18,879,554 14
Loans upon stocks and bonds, value $861,497. 626,203 28
Premium notes on policies in force..... 9,295,005 38
Cost of real estate owned by the company.. 800,092 40
Cost of stocks and bonds owned by the company..... 4,870,020 55
Cash in bank, at interest..... 1,302,175 11
Cash in company's office 9,040 00
Balances due from agents, secured..... 94,876 30
$30,745,677 24
ADD, Interest due and accrued....$742,864 41
Rents accrued 3,000 00
Market value stocks and bonds above cost 399,434 45
Net premiums in course of collection..... 60,558 88
Net deferred quarterly and semi-annual premiums.... 26,866 68
1,232,724 42
Gross Assets, Dec. 31, 1871..... $31,978,401 66

LIABILITIES.

Net 4 per cent re-insurance reserve..... $25,009,655 00
All other liabilities..... 697,981 92
$26,307,636 92
Surplus..... $ 5,670,764 74

Ratio of expenses for 1871..... 8 12-100 per cent
Ratio of expenses for 1870..... 8 35-100 per cent
Ratio of expenses for 1869..... 8 45-100 per cent

Whole number of policies issued by the Co.....116,013
Number of policies in force Jan. 1, 1872..... 62,458
Amount at risk Jan. 1, 1872 ..... $102,786,236 86

JAMES GOODWIN, Prest.
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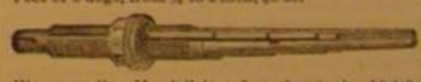
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Portable Spring Grist Mill.

Our illustration this week shows an arrangement of portable mills, with bolt, which is claimed to combine many important improvements.

The mill is complete in itself, with surfaces dressed and ready to make flour, when it leaves the shop. All that is required is to attach the belt. These mills are built under the patents of Messrs. Reed and Buckingham, and are of three sizes, namely 24 inches, 30 inches, and 36 inches diameter. The grinding surfaces are composed of the best French burr stones, set in cast iron cups, and the mill is what millers would call an upper runner, that is, the upper stone revolves while the lower one is stationary.

The spindle, which is attached to the upper or runner stone, is hollow and contains a stationary tube by which the grain is fed directly to the stones. As by this means the grain does not touch the revolving surface until it enters between the stones, it cannot fill up the eye or hang as it does in the common mills; so that any kind of grain, such as oats or crushed cobs, may, it is claimed, be ground without difficulty, when, on other mills, they can only be ground by being mixed with heavy substances. This is a feature of very great importance in all mills where a high motion is required, as, without such an arrangement for feeding, it would be difficult to introduce the grain between the stones.

The runner stone is attached to the spindle in such a manner that, while it is carried around with a true and even motion and held steady on the spindle by springs, it can still rise when necessary by the yielding of the springs, and permit hard substances, such as nails or pieces of iron, to pass through the mill without injury to the stones or their connections. In this important feature, this mill differs from all others. The method of attaching the spindle to the runner stone by means of springs, which operate as above described, was patented by Gen. C. P. Buckingham, and has been used exclusively on these mills.

This method, and the arrangement for feeding, constitute the distinctive features of the above described mills.

The bed stone is hung on a point, and is prevented from rotating by two trunnions on opposite sides of the cup. It is clasped by spring bars at four points on the side which permit it to train itself with certainty, hold it when in train with a firm grasp, and prevent all wobbling of the stones.

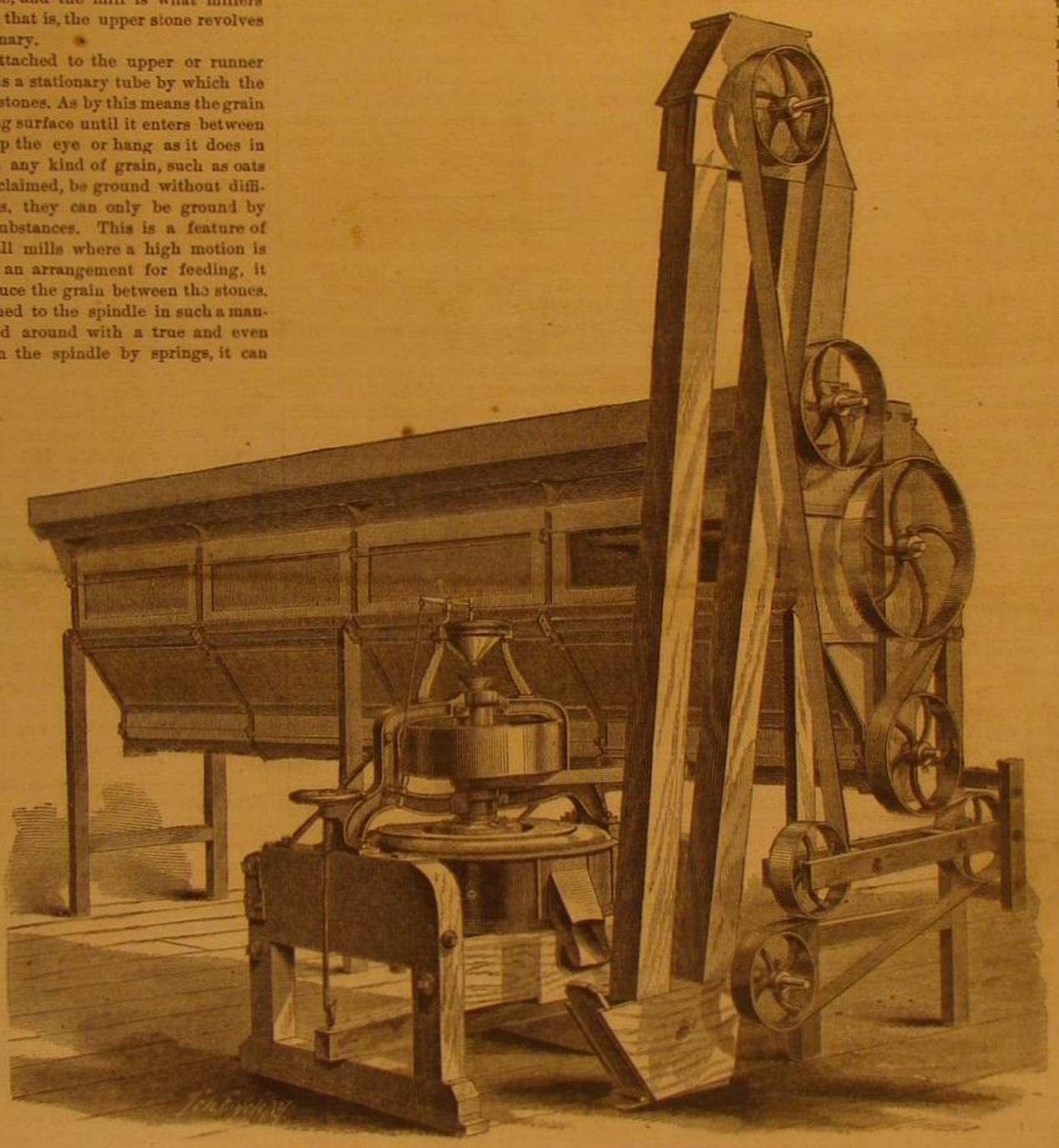
The bearings, two in number, are in the iron frame above, and may be oiled at pleasure without stopping the mill. For the purpose of dressing the stones, the frame opens back on hinges so as to turn the surface of the runner up and bring it on a horizontal line, the stones remaining in their bearings; and in dressing the runner, it can be turned round on the spindle as if chucked in a lathe, so as to make the surface perfectly true without trouble or danger of getting the stones out of line. In putting the surfaces of the stones together for grinding again, it is claimed to be impossible to get them out of position. The operation is as simple as shutting a book.

The bolt chest is composed of iron frames and wood panels, held together by iron rods, arranged to be packed closely in boxes for shipment, and which can be set up ready for work in a few hours. The iron trussed reel—30 inches long by 30 inches diameter—is also in sections, and is furnished with a coat of best quality bolting cloth. The lower part of the chest forms the conveyer trough, which is provided with the proper cut-off and slides for grading the flour, while at the top is the cooler conveyer, to temper the flour before entering the reel.

There is also attached a return conveyer, so that at the option of the miller he can return part of the flour to the head of the reel to be rebolted, thereby producing the maximum yield.

A flour elevator is also furnished complete, as represented, and the arrangement of the various parts to each other is such that the same belt drives them all.

It is claimed that there is nothing about the mills or bolts that can, for a long time, get out of repair. With proper attention, the running parts cannot get out of order (excepting the wear of the stones themselves), and will, it is claimed, last for many years.



PORTABLE SPRING GRIST MILL.

A good mill that, with ordinary care, will make the best of flour, and one that can be furnished for a moderate price, and, at the same time, have such attachments as will guarantee the best results, both as regards quality and quantity, and also one that is so arranged and completed at the shop that any ordinary carpenter can in a few days set it up in place, ready to work in any room or building where there is power, is certainly a great desideratum.

These mills have been in the market for some fifteen years, and, it is claimed, not one has failed to give satisfaction. This mill took the gold medal at the Exhibition of the Mechanics' Institute, Cincinnati, and was especially noticed in the report of the committee. It also received the first premium at the Ohio State Fair, and the highest award (silver medal) over all others at the Cincinnati Industrial Exposition.

The manufacturers make a specialty of building portable machinery, and have, within the past two years, very much improved these mills, which they guarantee to do as much and as good work as any mills of like size in the United States. They state that the 36 inch mill and bolt grinds and bolts from ten to twelve bushels of wheat per hour as an average business, and that the yield and quantity of flour is unsurpassed. For further information address John Cooper & Co., Mount Vernon, Ohio.

Price's Composition Pavement.

Notwithstanding the many failures in constructing improved pavements, and the few successes that have been achieved, inventors seem resolved not to relinquish the problem until they secure a complete triumph. Mr. Thomas Price, of Pittsburgh, Pa., assignor to himself and John D. Burton, of the same place, has recently patented, through the Scientific American Patent Agency, a new method of making asphalt pavements of carbonized rock—that is to say, of broken rock whose pores have been filled with asphalt, tar, or other carboniferous material. It is intended, therefore, to produce a pavement, every particle of which shall be air and water proof, and whose hard ingredients will readily and instantly combine with the binding material.

The invention consists in the use of a compound prepared as follows:

Rock of a suitable kind, preferably lime rock, is broken into pieces of convenient size, and then in a suitable vessel exposed to heat. Its pores are thereby opened, and it is prepared for the reception of the asphaltum, tar, or equivalent matter. The latter, being mixed with the heated rock, penetrates the pores and envelopes the several pieces, so as to make them thoroughly air and waterproof. During the process of heating, the rock is liberated of all gaseous matter and properly prepared for the reception of the asphaltum and tar. The rock, after having cooled, is reheated, and more tar or asphaltum added, which may be mixed with a small quantity of plaster of Paris, some oxide of zinc or iron, and some disinfecting powder for destroying the smell and noxious vapors. This composition should be spread three and a half or four inches thick, upon a bed of gravel or other material, and then pressed by hot and heavy rollers until quite firm. It will, it is claimed, prove a durable pavement, easily put down, and as easily taken up and replaced when necessary, which will become the stronger the more it is compressed by wear. The patent on this invention was issued March 12, 1872.

Transplanting Hair.

The successful transferring of skin and flesh to assist the recovery of wounds, has induced some one to experiment on hair, and the result is a process of removing portions of the scalp, with the hair on, from some luxuriant head, and planting it on the victim of baldness. A cotemporary points out that it may soon become fashionable to wear hair of various hues and shades, thereby producing the most singular and beautiful effects of color; or the hair might be made to appear white, green, blue, or red, at the owner's option, and by various ways of disposing it. "Take, in due proportions, hair of all the prismatic tints, rumple it, and immediately you have white hair; comb it in another way, and there is your purple, your ultramarine, your yellow, or any possible hue." If these directions are followed, the recognition of the original color of the head may require the use of the spectroscope

THE TOBACCO MANUFACTORIES IN BROOKLYN.

The manufacture of tobacco is carried on in the city of New York and its vicinity to a greater extent than in any other part of the United States, although there are factories for this business, of more or less importance, in every large city. In Brooklyn, there are several large factories for the production of plug tobacco for chewing, three of which give employment to about 1,600 hands, producing nearly 7,000,000 pounds per annum, and paying over $2,000,000 tax. The Brooklyn *Daily Union* has recently made an investigation into the processes employed in the preparation, and gives, among much other interesting information on the subject, the following particulars:

The Pioneer Tobacco Company has a factory situated in Hicks street, occupying the space on the west side, between Warren and Baltic streets, connected with the New York office of the firm by a private telegraph. The visitor was permitted to witness the process of manufacturing plug tobacco in all its stages, from taking the tightly pressed leaf from the huge hogsheads in which it was packed after being dried on the Virginia plantation down to the pasting of the gaily colored label and the more important revenue stamp on the box in which the finished plugs are packed for final sale. It would be impracticable to give within the ordinary limits of a newspaper article a detailed description of all the various manipulations which the innocent "weed" is subjected to in this vast establishment, where five hundred and fifty employees, men and women, are busily occupied in preparing the coarse and brittle leaves into preparations designed to tempt the palates of men all over the earth; though everything is done with the utmost care and regularity, and the nicest system is everywhere discernible. The "hands," as the handfuls of tobacco leaves tied together at the stalk when picked are designated, go through innumerable processes of drying, moistening, extraction of stems, dipping in licorice juice—a beastly process, and sufficient to impart a permanent distaste for the article to any but the most hardened devotee—followed by more rolling, squeezing, flavoring, drying, and finally rolling and cutting into its desired shape of plugs. The flavoring process is a secret and mysterious feature of the tobacco transformation—defying even the scrutiny of the Government officials. The bunches of leaves, after a long series of torturings, are laid in a pile upon the floor, and each successive layer is sprinkled from a watering pot with some liquid mixture whose ingredients are one of the trade secrets of which every factory has its own peculiar one, and even to hazard a guess at which would probably be deemed an impertinence. Essences and volatile oils, and the mixer thereof only knows what else, are thus sprinkled upon the leaf already partly saturated with licorice, and are forever after blended with the delicate aromatic flavor of the tobacco. The delicacy referred to may be partially realized when it is stated that the odor in some of the apartments of the factory is almost powerful enough to raise a man's hat off his head unless it fits tightly. One of the pleasantest episodes of the tobacco's journey through the building is its brief visit to the 'drying room," where it is hung upon racks and subjected to a degree of heat that speedily extracts all the moisture from it, and compared with which a Turkish bath is but a cold and chilling institution. It would be a dangerous place for an unpopular revenue officer—if there could be such an individual—to be entrapped into. For there are traditions among the operatives—though they have never yet been publicly recorded—of men who have been unwittingly locked up in the drying room late in the day when the hands were leaving for the night, and how upon opening the doors the next morning there was nothing left of them except the heels of their boots, the unhappy owners of which had been melted away like tallow dips in a hot oven.

When the tobacco has been thoroughly prepared, it is rolled by hand: women working with nimble fingers and extreme skill in this process: into long sausage shaped rolls, known technically as "lumps," and containing either one pound or one half pound, each of which is verified by actual weighing. These rolls are afterwards passed through a large machine, which presses them out into flat slabs nearly as hard as stone, and which squares them off at the edges and corners, and then they are ready to be packed for sale.

The second place visited was P. Lorillard & Company's factory in Sedgwick street, a huge establishment occupying an immense building on each side of the street, connected by a covered bridge at the second story. This factory is larger than that of the Pioneer Company already described, but the processes used are mainly the same, except some variations in the mechanical contrivances. There is also a private telegraph here connecting with the office in New York. The same courtesy, also, was displayed to the reporter, who was shown through all the apartments and permitted to witness the various manipulations.

The factory of Messrs. Buchanan & Lyall, in Degraw street, was next visited, with similar experience, the place giving evidence on all sides of able management, and a thorough and well regulated system, while the large force of operators testified to the immense amount of business done there.

The above mentioned are the three largest plug tobacco factories of this city, but not even a visit to their extensive workshops and laboratories, their "lump," "sorting," "dipping," "casing," and "rolling" rooms would give an adequate notion of the magnitude of the supply they furnish to the country's commerce. This will be best gained from the following statistical summary of the amount of business they have done during the few past years, and which is steadily increasing as each twelve months roll by.

P. Lorillard & Co. employ in their Brooklyn factory from four hundred to six hundred hands, paying them for salaries an average of over $3,000 weekly. Their monthly sales are about 250,000 pounds of plug tobacco, the value of which is about $70,000, and the revenue tax upon which is $75,000. Their total sales in 1871 were 2,500,000 pounds, the net value of which, without adding the tax, was $787,000. This, of course, represents only a portion of the business done by that large firm, it having other factories in other cities in the vicinity of New York.

The Pioneer Company employs about five hundred and fifty operatives, and manufactures about 2,250,000 pounds of plug tobacco per annum, paying the government therefor in taxes about $730,000.

Messrs. Buchanan & Lyall employ about four hundred and fifty laborers, and manufacture about 1,800,000 pounds of tobacco yearly, paying about $600,000 a year tax. Their weekly salary account is upwards of $2,000.

A smaller establishment is Watson's factory, opposite Lorillard's, where from 75 to 125 employees are hired, manufacturing about 200,000 pounds of plug tobacco annually. The business done by this establishment is mostly foreign, its products being chiefly exported to South America—a trade in which it has almost a monopoly.

It will accordingly be seen, by referring to the above figures, that the three large Brooklyn plug tobacco factories employ constantly from fifteen to eighteen hundred operatives, paying them about $350,000 per annum for wages, and that they manufacture seven million pounds of tobacco each year, upon which they pay the Government annually over two millions of dollars taxes. It is said that during the last five years, for the same article, the whole State of Virginia has not paid so much to the United States Treasury as these Brooklyn factories.

THE GOVERNMENT WORKS AT HELL GATE.

The great work of removing the rocks at the dangerous pass in the East river, known as Hell Gate, City of New York, is progressing with great vigor. Engravings of the works were published last year in the SCIENTIFIC AMERICAN. A number of interesting illustrations are also to be found in *Science Record* for 1872. The mining, it will be remembered, is done by running out tunnels, into the rocks under the river, from a vertical shaft located on the shore at the margin of the river. The following recent particulars are from the *Evening Post*:

The work of removing the obstructions at Hell Gate, which was begun about two years ago, has been vigorously carried forward with but trifling interruption, and will, it is now estimated, be completed within a year and a half. One hundred and sixty five thousand cubic yards of rock were to be removed from the river, and of this amount at least forty-two thousand cubic yards have already been taken up. About two hundred and forty men are now employed in the work, nearly all of whom are Cornish miners of long experience. A much larger number were formerly employed, but the introduction of the diamond drill, and the increased use of machinery in all branches of the labor, has permitted a great reduction of the working force. A hundred of the workmen were discharged last week.

The immense bed of rock is now perforated by sixteen tunnels and seven concentric galleries, the floor line of which is thirty two feet below the level of the river at mean low tide. It was originally designed to make the channel but twenty five feet in depth; but subsequently it was determined to render it perfectly safe for vessels of the largest draught. The average hight of the tunnels and galleries is twenty-two feet, and their width sixteen, leaving a roof from seven to ten feet thick, supported by numerous pillars. The length of the extreme gallery is six hundred feet, and of the grand tunnel two hundred and twelve feet and a half. There will ultimately be twenty-eight tunnel headings, some of which will extend three hundred and seventy five feet.

THE DIAMOND DRILL.

The work of boring is done wholly by machinery, the laborers serving only to trim and dress the rock after the rougher work has been executed, and to perform the operations connected with blasting. Of the six drills used, two are the diamond pointed drills and four Burleigh steel percussion drills. The diamond drill is the invention of Rodolphe Leschot, a French engineer, and was first used in the construction of the Mont Cenis tunnel, but is now worked by improved machinery under American patents. The two used at Hell Gate were introduced last October, and have proved so satisfactory that three more will be added in a few weeks. This drill consists of a hollow steel disk an inch and a half in diameter, the rim of which is studded with twelve bits of black carbon. Attached to an iron pipe of the same thickness, it is propelled by compressed air at a pressure of sixty pounds per square inch, and cuts its way through the hardest rock with marvellous rapidity. The motion is rotary, and the number of revolutions seven hundred and fifty per minute. Unlike percussion drills, it receives no wear except from friction, and hence is constantly in working order, and needs no sharpening.

Fifty-four feet and four inches have been tunneled by this drill in eight hours, through a mass of granite and quartz. By screwing on additional pieces of pipe, it can be propelled in one direction to an indefinite extent; but for blasting purposes it is seldom driven further than fifteen feet. Occasionally, however, through the intervention of a new process in blasting, it is expedient to continue a tunnel of this character for a long distance, thereby effecting a great saving of time. Sand or clay is then rammed into the bore until it is nearly full, to act as a recoil block to the charge, and the rock is blasted section by section.

BLASTING WITH NITRO GLYCERIN.

All the blasting at Hell Gate is done by nitro-glycerin, and has been so carefully managed that not an accident has yet occurred. The nitro-glycerin is made into cartridges from eight to fifteen inches in length, about an inch in diameter, and holding from four to eight ounces. They are coated with a glutinous composition which effectually protects them from water. When a blast is made, a little tube of fulminate is attached to the cartridge and a spark transmitted to it through a wire connecting with an electric battery. Though a large number of cartridges are often discharged in succession with great rapidity, they are never fired at once, as the vibration in this case might seriously jar the stone roof, opening seams for the admission of the water.

The explosions are of tremendous force, shattering the rock into fragments of a size convenient for removal. These are piled on cars drawn by mules, running on iron tracks which are laid in all the tunnels, and conveyed to the shaft, where they are hoisted up by a steam derrick. The masses already taken out form two immense embankments on the river front.

A building near the mouth of the shaft contains three large steam boilers and five air compressers, the latter furnishing the motive power for the drills. In working the compressers, lubricating oil is now used instead of water, thereby avoiding the formation of ice in the pipes during severe weather. Near by is a powerful steam pump, which drains all the tunnels comparatively dry through pipes radiating from its base.

Before blasting, it is necessary to use great care in ascertaining the line of resistance and quality of the rock, which is chiefly composed of granite, quartz, and gneiss. The strata embrace a great variety of minerals, however, including, besides various metallic deposits, veins of decomposed felspar that are as soft as clay. The testing is done with the diamond drill, which in two instances struck sand and water after boring twenty-eight and thirty-four feet respectively, rendering it necessary to abandon blasting in that direction and to have the bores tightly plugged up. In opening tunnel heading No. 3, a section of rock was struck so full of seams that the water poured through the roof at the rate of six hundred gallons per minute. This was effectually remedied by constructing a massive schilt of timber, oakum, and Roman cement, fourteen feet in length by twelve in width.

The work is carried forward almost constantly night and day, the men being divided into gangs which relieve each other at regular intervals. It is executed under the supervision of Major General John Newton, of the United States Engineer Corps, who planned it from the beginning. The Superintendent in immediate charge is G. C. Reitheimer, an engineer of wide experience in various countries, who has devoted himself especially to work of this kind.

When the rock is at length completely honeycombed, and nothing remains but the roof, its supporting pillars and the outer walls, it will be mined with seven thousand pounds of nitro-glycerin, which is equal in explosive power to seventy thousand pounds of gunpowder. All the charges will be connected by wires with an electric battery in the office of the superintendent, when, at the given signal, it is confidently expected that the whole vast mass will be blown into atoms, which will be entirely removed from the bed of the river.

BROWN TINT FOR IRON AND STEEL.—Dissolve, in four parts of water, two parts of crystallized chloride of iron, two parts of chloride of antimony and one part of gallic acid, and apply the solution with a sponge or cloth to the article, and dry it in the air. Repeat this any number of times, according to the depth of color which it is desired to produce. Wash with water and dry, and finally rub the articles over with boiled linseed oil. The metal thus receives a brown tint and resists moisture. The chloride of antimony should be as little acid as possible.

A WORD TO BOYS.—Boys, did you ever think that this world, with all its wealth and woe, with all its mines and mountains, oceans, seas and rivers; with all its steamboats, railroads and telegraphs; with all its millions of grouping men, and all the science and progress of ages, will soon be given over to the boys of the present age—boys like you? Believe it, and look abroad upon your inheritance, and get ready to enter upon its possession. The presidents, emperors, kings, governors, statesmen, philosophers, ministers, teachers, men of the future—all are boys now.

ROUGH WEATHER.—The captain of the steamship *Dorian* reports that he sailed on February 19th from Gibraltar and six days afterwards encountered a continuation of gales from W. S. W. to W. N. W. veering every few hours, and accompanied with squalls of terrific force. During 25 years' experience afloat, he never saw such weather." In the squalls the water was actually torn up in sheets and hove in the air, rain pouring in torrents, the mastheads enveloped in clouds, lightning fairly blinding, and the thunder cracking as it were among the masts, deafening all on board. Never in the tropics or near the line, have I seen such close proximity to the lightning This weather continued more or less up to the 15th inst., when it gradually toned down, enabling us to make some headway."

THE New York Mutual Gas Company, a new corporation is now laying pipes in this city. It will have new and improved appliances, use naphtha to enrich its products and supply its customers with gas of superior brilliancy—so they say. The present price of gas here is $3.50 per thousand cubic feet; in Pittsburgh, Pa., $1.80.

Beware of Green Colors.

The third report of the Massachusetts State Board of Health contains a valuable article on the evil effects of the use of arsenic in certain shades of green. The subject is not new; more than one hundred years ago the use of arsenic as a pigment in certain manufactures was forbidden by law in France. But the beauty and healthfulness to the eye of the color, and the thoughtlessness or cupidity of makers of wall paper, artificial flowers, toys, lamp shades, confectionery and other articles, render it necessary to warn the public again and again of the injury—sometimes a fatal one—inflicted by its use.

It appears that arsenic, aside from its uses in medicine and in destroying men or vermin, is employed in the arts, mainly as a large ingredient of *green coloring pigments*. Into one of these it enters as the arsenite of copper, known popularly as Scheele's green, and into another as the aceto-arsenite of copper, which is called Schweinfurt green. The generic name of emerald or mineral green is applied indifferently to either. Of these two colors, the first contains fifty-five per cent, more than one half, of white arsenic; the other in every one hundred grains, contains fifty eight grains of arsenic. Both pigments furnish the prettiest and most durable shades of green, each costs comparatively little, and the process of manufacture does not require great skill. Hence, it spite of their deleterious effects, both are used. At one time, in Paris, when it was proposed to make the use of arsenic illegal in the manufacture of wall paper and artificial flowers certain of the makers said such a law would force them to close their shops; and in 1860 a paper maker in England said that in his shops alone two tuns of arsenic were used weekly.

GREEN COLORS IN PAPER HANGINGS ARE DANGEROUS.

The most frequent instances of poisoning by these colors have followed the use of green paper hangings. Makers of the paper, dealers in it, paper hangers and even people who live in the rooms papered with it have often suffered under every sympton of poisoning by arsenic, and in some cases have received lasting or fatal injury. In 1862, in London, four children died in succession, and a *post mortem* chemical examination in the case of the last one showed traces of arsenic. The walls of the room in which they lived were covered with green paper, in which chemical tests showed the presence of arsenic—three grains in every square foot. In 1859, a middle aged woman in Boston was attacked with the well known symptoms of arsenic poisoning; and although her life was saved by removing the paper, yet her health was permanently injured. Such cases might be multiplied almost indefinitely from the reports of physicians.

Some years ago this subject excited considerable discussion, and arsenical paper hangings became unfashionable. The fashion appears to have changed again, however. Dr. Frank W. Draper, author of the article on this subject in the report, says that, in every store he visited while making his investigations, he found paper for sale which, on being tested showed signs of the presence of arsenic. Under these circumstances, it would be well if every one who wishes to buy any green wall paper would subject it to the following simple chemical tests:

EASY TESTS FOR ARSENIC.

Take a fragment of the paper and put it into a solution of ammonia. If arsenic be present, the liquid will assume a bluish color. In case a further test is required, pour a little of the ammoniacal solution on crystals of nitrate of silver; and arsenic, if present, will show itself by leaving a yellow deposit on the crystals. As arsenic is used in coloring all qualities of paper, from the cheapest to the costliest, a knowledge of this test will be of service to every one, whether dealer or customer.

It is of some interest to know how the poisoning by wall paper is effected. Formerly it was held that the poison was set free by some kind of decomposition, and vitiated the air as a gas. The modern theory is, however, that "the poison escapes from the paper into the atmosphere in the form of dust, mechanically disengaged," as by dusting or wiping the walls, or jarring them in any way. The dust of a room whose walls were covered with paper containing arsenic, on being submitted to a delicate chemical test, is said to have exhibited unmistakable traces of the poison.

GREEN COLORED DRESSES, TOYS, CONFECTIONERY, ETC., ARE POISONOUS.

But it is not alone in coloring wall paper that these poisonous pigments are used. Confectionery, pastry, ornaments and toys are colored with them, articles that soon find their way to children's mouths. Toy boxes of water colors furnish an illustration. One of the green blocks of paint, weighing 38·26 grains, on analysis was found to contain 8·89 grains of arsenic. The shelves in closets and pantries are sometimes covered with arsenic paint, from which the poison is easily absorbed by any warm or moist substance. The brilliant green paper so common for covering paste board boxes, for tickets, for *bonbon* wrappers, for lamp shades, is colored with arsenic. The green of artificial grass and leaves is generally produced by arsenic. In one case, in a single twig of twelve leaves, ten grains of pure arsenic were found. Arsenic is used to color cloth for women's dresses. Dr. Draper procured a sample of the stuff called tarlatan, resembling muslin, at one of the retail stores in Boston, which was found to hold feebly 8·21 grains of white arsenic to every square foot. To handle or to wear such goods is dangerous to life.

MESSRS. T. L. VON DORM and E. L. EATON, photographers, of Omaha, will please accept our acknowledgments for an excellent photograph of the U. P. R. R. bridge at that point.

The Administration of Chloroform, Nitrous Oxide, etc.

The recent death from fright in a dentist's chair in this city of a woman to whom nitrous oxide or laughing gas, had been partially administered, has called renewed attention to the dangers that attend the inhalation of anæsthetics generally. It seems to be the opinion of the most experienced medical men that no danger attends the operation if it is properly conducted.

Dr. Curtis of Cincinnati holds that many surgeons are too hasty in putting persons under the anæsthetic influence. He himself determined to give chloroform very slowly, and to urge large inhalations of atmospheric air. As patients seem inclined to refuse full inspirations to avoid inhaling the chloroform, he gave it loosely through a silk handkerchief, and so slowly that from 15 to 30 minutes were required to prepare the patient for operation, never giving it fast enough to diminish sensibly the force or volume of the pulse or to darken the color of the surface. He never gave more than was necessary to prevent sensation, pinching the surface to learn when this was accomplished, and renewing the inhalation during operation only when he found sensation returning. Soon after the introduction of chloroform into surgery, a Boston surgeon, while operating on a patient under its influence, discovered that the blood flowed very freely; but, as it was dark blood, he concluded it was venous, and would not seriously affect the subject. Soon he was alarmed by the sinking of the patient, who was only restored by strong stimulants and friction. The operator had given chloroform without the admixture of a quantity of atmospheric air sufficient to purify the blood of carbon; and hence, though he had wounded an artery, as he discovered by the irregular discharge, the blood was purple, instead of vermilion, as it should have been. The chloroform had been given too fast, excluding the oxygen of the atmosphere, as was evident by the dark color of the blood, the reduction of the force of the circulation, and the purple hue of the surface generally. This is a point to which great attention should be paid in the use of the anæsthetic agent.

The inhalation of chloroform is only a speedy method of making a person "dead drunk," and Dr. Curtis soon saw that if the anæsthetic state were brought on gradually, as intoxication generally is, and stopped as soon as sense and muscular motion are by taking alcoholic liquors, it produced no worse effect upon the system. In both cases the patient often vomits, both when taking the narcotic and when getting rid of it; and in both, insensibility to the severest operations may be produced. By taking proper care in regard to these things, Dr. Curtis says that operations may safely be performed on very small children and very old persons, on those whose lungs or hearts are diseased, or who are much reduced by chronic ailments *of* various kinds.

A singular effect which chloroform has upon some persons is its dulling the brain and destroying the intellectual faculties for months after it has been taken, and after physical health has been restored. One gentleman of active mind, a ready thinker and fluent writer, might be named who has been under the influence of chloroform three or four times for surgical purposes, and after each time his intellect has been torpid for months, though his surgical recovery was rapid.

Electric Probe for Wounds.

In the last general assembly of the Scientific Association of France, M. Trouvé exhibited and described his probe for the search and extraction of foreign bodies remaining in wounds. Surgeons have at all times been occupied with the discovery of a simple and practical means, capable of revealing to them to a certainty the presence of any foreign body in the tissues. Since Garibaldi's wound, two plans have been proposed, the one frictional and the other electrical. That by friction (Dr. Nélaton's plan) was preferred to the employment of electricity, proposed by M. Favre, of Marseilles, which was the subject of a communication to the Academy of Sciences. The style or probe which Dr. Nélaton uses to discover the presence of a ball has at its extremity a small "rugous" or wrinkled porcelain ball, which becomes blackened in contact with a leaden bullet. This plan is, without doubt, ingenious, and in this special case of great utility; but the services which it can render are very limited. In fact the body, the presence of which it is sought to verify, must be of lead, and the wound should not be closed, very straight, nor even very curved. This verification becomes even impossible when, as frequently happens, the bullet is encysted or covered with a portion of muscle or cartilage, or even with a fragment of the clothing of the wounded person.

The apparatus of M. Trouvé consists of three distinct parts: a battery, a probe, and an indicator (*révélateur*). In principle, it is founded on the difference in conductibility between metals and other bodies. The battery is formed of a zinc and carbon element, enclosed in a case of hardened india rubber hermetically sealed, the exciting liquid being bisulphide of mercury. The probe is a pipe, flexible or rigid, constructed so that the preliminary probing may be effected, and then the stylets of the indicating apparatus may be introduced. The indicator contains in its interior a very small electromaguet with a vibrator and two small rods of steel, very sharp and insulated from each other; and as soon as these points, which are in connection with the battery, touch any metallic substance, the vibrator begins to move.

With this apparatus, it is possible to distinguish the different metals from one another. If the metal is lead, the rembler vibrates regularly; if however, it is iron or copper, the trembler has a jerky movement. Iron may be distinguished from copper by its action upon the needle of a galvanometer.

Recent Decision by the Commissioner of Patents.

Harriet L. Low, Administratrix. Application for the extension of Letters Patent granted to Henry H. Low, March 6, 1858, for an Improvement in Sawing Machines. Decided March 2, 1872.

Practice where the original patent has been reissued.—Where a patentee assigns his entire interest in his patent for the original term, and the assignee without the concurrence of the patentee surrenders the original patent and secures a reissue, the patentee may have certificate of extension attached to the original patent.

Leggett, Commissioner:

The invention to which this application relates is an improvement on sawing machines. The claim is very narrow, disclaiming all the parts of the machine, and claiming only the combination in the definite form stated. The examiner reports that this combination was new and patentable at the time the patent was issued, and that the proof shows the same to be of considerable value to the public. The statement of accounts is not very full or definite; but this is explained partly by the death of the patentee, and his books not showing minutely the expenditures on account of the patent; but enough is shown to satisfy the Office that the net receipts have been very small, and much less than the value of the invention.

An argument has been filed in opposition to the extension, based chiefly upon the fact that the application is for the extension of the original patent, while the original patent was surrendered and reissued March 6, 1866, and again reissued April 2, 1867. In the application for extension, no allusion whatever is made to these reissues. They are ignored as completely as if they had never been in existence.

The remonstrant holds that, when the original patent was surrendered and reissued, it ceased to exist, and cannot now be revived by extension. This doctrine would be just and applicable provided the patentee had joined in either application for reissue; but the records of the Office show that he assigned his entire interest in the original term of the patent to one C. S. Burt, and that said Burt as assignee secured the reissues without joining with him, the patentee; and there is no evidence in the Office that the patentee or administratrix had any knowledge whatever of the reissue. Under such circumstances, it would be a manifest and unnecessary hardship to require the patentee to apply for the extension of the reissue, and then compel him to incur the expenses and risk of another reissue in case he preferred the original form of the patent. In this case, the patentee assigned only the the original term of the patent, reserving to himself, under the law, the exclusive right to the extended term; and it would be an anomaly in law if the assignee could render the extended term worthless to the inventor by obtaining a worthless reissue just before the expiration of the original term; yet such might be the case if the remonstrant's doctrine is law.

But it is not necessary to further discuss this matter, as the question has been adjudicated by the courts. In the case of Potter *vs.* Braunsdorf, 7 Blatch., 110, Justice Blatchford says: "Where a patentee, having secured his invention by a patent with a specification in such form as he regards to be most proper, assigns the entire patent for the original term only, reserving his right under the eighteenth section of the act of 1836 to apply for and obtain an extension, it ought not to be and it is not in the power of the assignee, by surrendering the patent and obtaining a reissue of it on a specification not signed, assented to, or adopted by the patentee, and which perhaps the patentee may regard as rendering the reissued patent invalid, or as securing, by new and different claims, rights of little value, to effect, without his consent, the statutory right conferred on the patentee to apply for and obtain an extension of the only patent which he has ever adopted or assented to."

The extension is granted, and the certificate will be attached to the original patent; or, if the original patent is lost, to a certified copy of the same.

The Imitation of Gems.

Nowhere has chemistry—the science most essential for this purpose—been brought to greater perfection than in France. Accordingly, none have attained more skill in the art of imitating gems than the French. If the revenue that Paris has derived from this source alone for the last quarter of a century were stated in plain figures, it would seem more fabulous than any story in the "Arabian Nights." But it would seem worse than fabulous to say than three fourths of those gems which were worn daily, or at least nightly, in New York, Philadelphia, and Boston, including those that sparkle on the bosoms of some of our great men, have contributed to that revenue in proportion to their size and characteristics. Yet it would really be no exaggeration of the fact. Let those who think we want to trespass on their credulity turn to the works of Kunkel, Neri, and Fontainieu, That of M. Fontainieu alone would be sufficient. That learned member of the Royal Academy of Sciences has been enabled, by a long series of experiments, to produce a perfectly colorless crystal. This he calls *fondant*, or base; he has formed one by each of the five different processes; he has also shown how the various colors are produced, according as a given piece of crystal is intended to be a diamond, an amethyst, an emerald, a ruby, etc. Several German chemists have given the world the benefit of their researches on the same subject, and some have enriched themselves and others by them. This is true, for example, of Professor Lippert, of Dresden, who prepared 3,000 casts; of these one jeweller bought 1,000 and rapidly made his fortune; the remainder were purchased by different jewellers, each of whom obtained the prices of real gems. Since the celebrated experiments of Lavoisier, every person of ordinary intelligence is aware that the diamond is simply pure carbon crystallized, and that it can be burned in oxygen, the sole result of the combustion being carbonic acid. M. Despretz, another French chemist, has actually made real diamonds, having melted and crystallized carbon by means *of* a galvanic battery; but Nature has so carefully kept the secret to herself thus far, that the learned Frenchman's diamonds are so small as to be visible only with a microscope.—*British Trade Journal.*

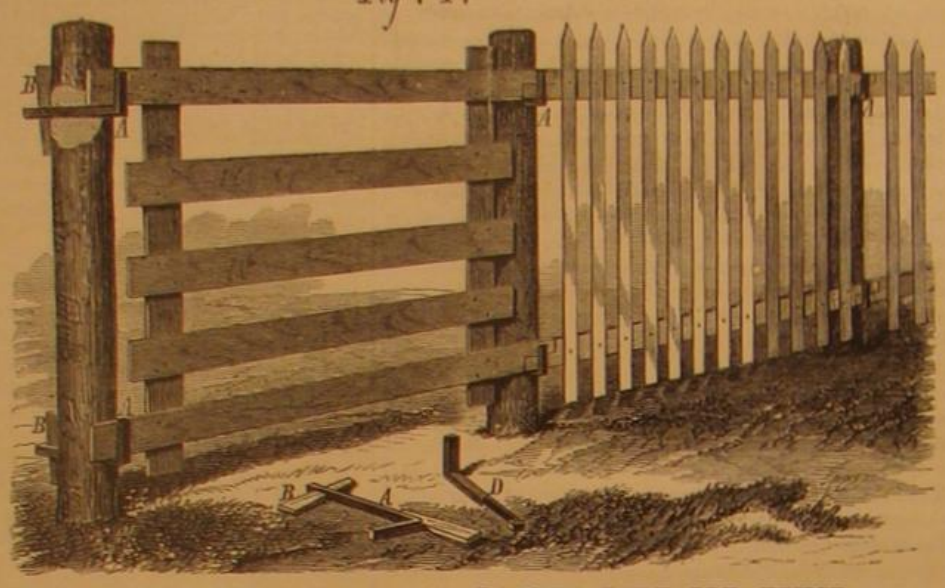
LET him who regrets the loss of time make the proper use of that which is to come.

Improved Portable Fence.

Although there have been many inventions intended to supply a good, cheap, and convenient portable fence, yet, so far as we are aware, very few if any have proved entirely satisfactory. The inventor of the present device has himself been the author of several improvements of this kind, which, upon trial, have proved not to be wholly free from some of the defects usually attending this class of devices, namely, their liability to being blown over by wind storms, the room they occupy, their inefficiency in restraining animals, and their liability to get out of repair.

In the present invention, he claims to have so far profited by previous failures that he has produced a fence free from the defects named. That others are convinced, as well as himself, is evident from his statement that, at a recent exhibition of the fence, the inventor sold in a single afternoon twenty-seven local rights to make and use it.

Fig. 1.



LANDIS' PORTABLE FENCE.

It is claimed to be as strong as any post fence, requiring only small posts, having the sides slightly hewn, and it has two holes bored for the insertion of hooks for fastening, which finish the same without weakening them.

Two metal hooks or clamps, A, Figs. 1 and 2, with slots for wedges, B and C, are used, as shown, for fastening panels to the posts. Another style of hook is shown at D, Fig. 1. The panels consist of two strips nailed at right angles across the slots or rails, say ten or twelve inches from each end. The slots should be six inches apart, and number four or five to each panel, two extending six inches beyond the rest, for fastening on the clamps or hooks. The rails are left unimpaired and not weakened. In picket fences, the rails may meet as shown. In rail fences, the rails need not meet within six inches, as also shown, the post, of course, closing up that space.

Cross lines of posts may be set on farms, and fences removed with great facility from one line of posts and fastened on to another when and where wanted. Any panel may be detached anywhere, and an easy way of access from one field to another obtained, to pass with teams or stock without, as is often the case, going from one end of a field to another; this is especially a great desideratum for lawns, gardens, lots, etc., as means of access where gates are not always just where wanted.

Whitewashing preserves fences. It is believed that by having a large enough trough, made of boards, into which to lay panels, and filling the same with whitewash, two men, by immersing the panels, may whitewash more in one day than they could in a week in the usual way, doing it more thoroughly, dispensing with brushes. This fence is exceedingly simple, and may be made indoors at seasons when farmers have most leisure.

Two patents were obtained on this fence through the Scientific American Patent Agency, Feb. 6, 1872, by Israel L. Landis, of Lancaster, Pa., who may be addressed for further information.

Wood Ashes.

Ashes from the wood of the hickory, sugar maple, elm, etc., contain about 50 per cent of potash compounds, consisting chiefly of combinations with carbonic acid and silica, while the ashes of pine wood will rarely yield more than 20 per cent. Ashes saved from clearings often contain earth, mixed with them in gathering the remains from fires. When wood is used for burning lime, the ashes are often put into the market largely mixed with that substance. Sifted coal ashes are sometimes used to adulterate wood ashes, and the fraud can hardly be detected by the eye.

Leached ashes always retain a portion of potash, usually in combination with silica or phosphoric acid. These compounds are slowly soluble in water, and, therefore, are not removed in leaching, but they are valuable, especially to grain crops and grasses. Ashes, whether leached or unleached, should never be suffered to go to waste. Even coal ashes may be used to good advantage on stiff clay soils. Their effect, however, is more mechanical than chemical.

Cut your Hay and Clover before they Ripen.

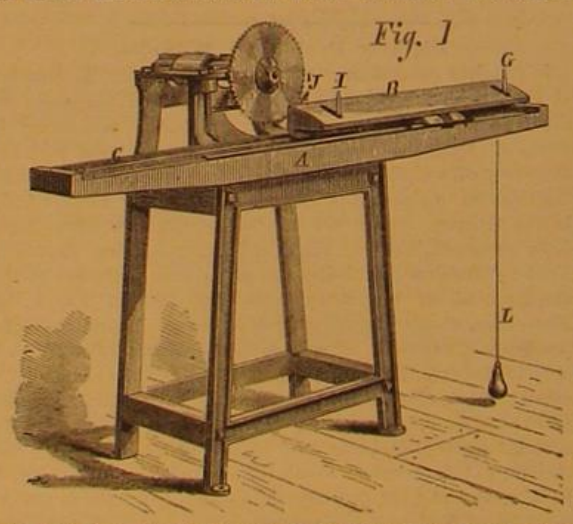
An interesting discussion is in progress, among the chemists of continental Europe, on the true character of that substance which forms the frame work of plants, generally known as *woody fiber*. Chemists have heretofore considered this as a single proximate element, but the researches of Dietrich and König have pretty clearly established the complex character of this substance. There is first the true frame work, or vegetable fiber, consisting, substantially, of organized starch. To this substance, the term *cellulose* has been appropriated. Covering this true skeleton is found a second substance, much denser than the cellulose, and containing the chief part of the mineral matter remaining as ash after the plant is burned. This is called *lignin*. These terms have been heretofore applied indiscriminately to woody fiber.

The point of interest in the discussion lies in the fact that cellulose is largely digestible, while lignin is almost indigestible. Dr. Marcker, at Weende, has conducted a series of instructive experiments on the digestion of hay by sheep. Of the crude fiber of meadow hay, he found that about 60 per cent was digested, and the 40 per cent which remained in the excrement consisted chiefly of the lignin, containing a large proportion of the mineral elements of the food. Of the albuminous portion of the hay, but 55 per cent was digested, while the non-nitrogenized substance, such as sugar, gum, etc., proved more digestible, 68 per cent having disappeared. When the experiment was repeated with hay of the second cutting, in which the woody fiber had not fully matured, it was found that 68 per cent of the crude fiber was digested Professor E. Wolff has made similar experiments with red clover hay, with results almost identical. He ascertained, however, in another experiment, that clover which was cut before it had blossomed was about one sixth more digestible than that which had passed the bloom before it was cut, From these experiments, it is fairly to be inferred that the increased weight which grass acquires in ripening is from the increase of indigestible lignin, and not from digestible cellulose. Meadow grass or clover cut at or before blooming is worth 16 per cent more than an equal weight cut after it has matured. The nutriment in the seed of timothy hay is an unknown quantity in these experiments, and will change the results somewhat.—*R. T. Brown.*

PALMER'S STAVE JOINTING MACHINE.

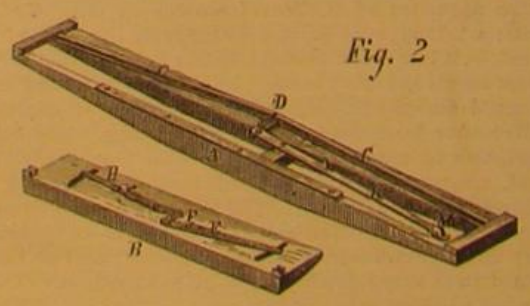
The simple invention illustrated herewith is, in our opinion, calculated to effect a great saving in the jointing of staves, and in the manufacture of all kinds of casks. The object

Fig. 1



which the inventor has accomplished is to joint every stave to the proper curve corresponding to its width, so that out of a lot of jointed staves, those required for a cask may be taken indiscriminately, and no matter whether there may be a third more staves in one than in another, the same ellipsoid

Fig. 2



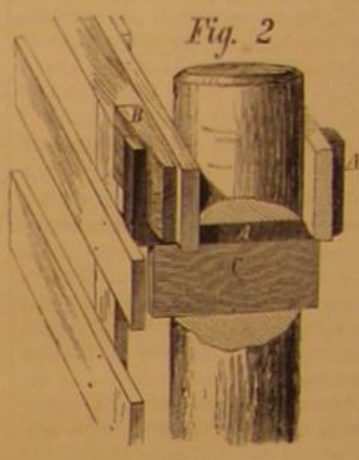
form will be produced in both, and a perfectly tight symmetrical cask will result. We are told that barrels made in this way, without the use of flags, prove perfectly tight. The jointing proceeds with the same rapidity with which the slitting of a stave might be done with a circular saw. The parts are few, and all may be made as strong and substantial as need be. The entire absence of delicate complications, and the ease by which the machine may be manipulated, are points that will attract the attention of practical men, and we have no doubt that this machine will take its place permanently among standard appliances in the manufacture of all sizes and descriptions of casks.

The general principle which underlies the machine is that of making the stave move on a carriage which moves on two guide ways, inclined to each other at an obtuse angle in such a way as to make the carriage describe a curve, the angle of the guides, and consequently the curve cut, varying to suit the width of the stave.

Fig. 1 represents the device as placed on a saw table ready for work. Fig. 2 represents the details of the same. A, in both figures, represents the frame of the carriage ways, and B the carriage. The latter may be rounded on the top to suit the curve of staves cut with barrel saws, or flat, for flat staves. C, Figs. 1 and 2, indicates horizontally inclined guide ways meeting at D. E is a lever pivoted at F. G, Fig. 1, is a pin rising from the end of the long arm of the lever, E, up through a slot in the carriage.

Now, as the lever, E, is also joined to a lever, H, Fig. 2 (where the carriage is shown bottom side upward), the arms of which lever are of the same length as those of E, it is obvious that any movement of the pin, G will also produce an equal movement, in the same direction, of the pin, I, Fig. 1, which rises from the end of the long arm of the lever, H, through a slot in the carriage, the same as the pin, G.

Fig. 2



Thus the two pins move laterally in the same direction and to the same extent, when a stave is placed against them. At the same time the carriage guide ways, C, Fig. 2, are adjusted to give the proper curvature to the edge of that particular stave.

The stave, therefore, has only to be laid upon the carriage in the proper position to be jointed. In doing this, the pins are moved by the edge opposite that presented to the saw, and the guideways are correspondingly adjusted.

A spur, J, Fig. 1, holds the end of the stave which is remote from the operator.

The adjustment of the carriage ways remains to be described.

When the carriage is brought into the position shown in Fig. 1, the lever guide pins, G and I, being left free to move, the end of the long arm of the lever, E, Fig. 2, enters a recess in the end of the lever, K, Fig. 2, being guided thereto by a weighted cord, L, attached to it, which cord runs over a pulley, M, in the recessed end of the lever, K. The lever, E, thus engages the lever, K, and causes it to shift the guideways, a ratchet and pawl (not shown) holding the guideways in place till the cut is made, when the pawl is automatically disengaged on the return of the carriage.

The device is capable of adaptation to any saw table, by slight modifications.

Many testimonials certifying to the value of this machine have been shown us, as coming from practical men who have them in use.

Any desirable bilge may be given to casks or barrels by its use, and it can be applied to the jointing of any kind of staves, large or small, curved or straight. The machine is cheap, and will, we believe, meet a long felt want on the part of stave manufacturers.

Patented August 8, 1871, by Lemuel R. Palmer, whom address, for further information, Belfast, Me.

New Stuffing for Cushions.

A material which has come quite extensively into use in Germany, as a substitute for hair in the stuffing of saddles, etc., consists of a mixture of flax seed and tallow. The advantage of this substitute consists primarily in the fact that the mobility of the seeds, one upon the other, prevents the packing or settling in any particular place, as often happens in saddles stuffed with hair, thus causing any given pressure to be readily and uniformly distributed over any given surface. The tallow serves the purpose, too, of keeping the leather flexible, and of preventing the absorption of perspiration, protects the article itself, and prevents the back of the animal from becoming galled. Animals with sores or galled spots on the back can be ridden with saddles stuffed with this material without any great inconvenience. The tallow also has the effect of preventing the rotting of the flax seed, and is to be added in sufficient quantity to give the requisite softness to the entire mass. An aromatic odor can be imparted by introducing oil of turpentine or camphor powder, and the durability considerably increased thereby. One part of tallow to from six to ten parts of flax seed may be used, according to the temperature.

CARPETED FLOORS.—When a carpet is taken up to be cleansed, the floor beneath is generally much covered with dust. This dust is very fine and dry, and poisonous to the lungs. Before removing it, sprinkle the floor with very dilute carbolic acid, to kill any poisonous germs that may be present and to thoroughly disinfect the floor and render it sweet.

[For the Scientific American.]

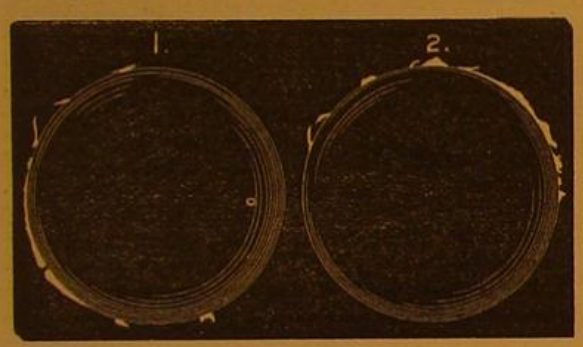
THE DISCOVERY AND HISTORY OF THE CHROMOSPHERE.

BY J. H. LEACH, OF DARTMOUTH COLLEGE.

The discovery of an atmosphere beyond the photosphere of the sun opened a wide field of observation to astronomers, a field which the triumphs of the spectroscope have rendered so interesting as to claim the especial attention of scientific men; and in no other department of science have such wonderful discoveries been made, and in so short a time, as in the department of solar physics. The invention of the telescope enabled men to explore the depths of space, to measure and examine the surfaces of the heavenly bodies, but that of the spectroscope has discovered to them their very composition.

The prominences of the chromosphere, as such, were first observed during the eclipse of 1842; red clouds had indeed been seen prior to this, but no suspicion of their character had entered the minds of the observers. The eclipse of 1842 found a corps of observers, composed of the first scientific men in all Europe, among whom were such men as Arago, Biele, and the younger Struve, awaiting the phenomena. The appearance of the prominences was an object of surprise, and various theories were entertained in regard to them, some believing them to be mountains on the sun, others flame, and some entirely denied their existence, believing the sight of them to be an optical delusion.

The prominences were next seen during the eclipse of 1851. Observations made during this eclipse dissipated, in a measure, the doubts entertained in regard to their reality. Drawings were made of the prominences by many observers, but the time had not come for a general acceptance of their solar origin; this was to be proved and acknowledged by the scientific world in 1860. The observations made during this eclipse were especially directed to the solving of this problem to the satisfaction of all. M. Goldschmidt's account of his observations at this time is very interesting. In addition to sketches of the prominences made by M. Goldschmidt and others, the aid of the photographic art was brought to bear upon the solution of the prominence problem by De La Rue and Secchi. Every photographer well knows the feeble actinic power of red light; against this they had to contend, but in spite of all difficulties they succeeded in obtaining several good pictures.



The following engravings represent the prominences as photographed by De La Rue, in 1860. Fig. 1 represents the earliest phase, while, in Fig. 2, the prominences on the left are nearly obliterated; those on the right are revealed. The problem was never solved to the satisfaction of all. The prominences were proved to be solar beyond a doubt. A solar envelope or atmosphere, beyond the photosphere, in which the prominences had their origin was revealed; in fact, the chromosphere was discovered. Science could measure the dimensions and copy the forms of the solar appendages; but it remained for the spectroscope to reveal their composition Kirchoff and Bunsen, quietly working in their laboratories, were soon to open an avenue leading to discoveries which should rival those of the telescope.

Some idea of the delicacy of spectrum analysis may be gained when we know that the $\frac{1}{180000000}$ of a grain of sodium can easily be detected; and we have only to take a book from our shelves, and open it over a lighted taper to detect in its flame the presence of sodium in the dust which has fallen from the leaves. An instrument having such a power of delicate analysis was now to be employed in the investigation of the chromosphere and its prominences. Nine years must pass away before an eclipse would occur whose path would furnish accessible stations for observation. The total eclipse of August 18, 1868, furnished unusual advantages, and it was at this time that the spectroscope was first directed toward the solar prominences.

The results of the observations made during this eclipse will be given in another article.

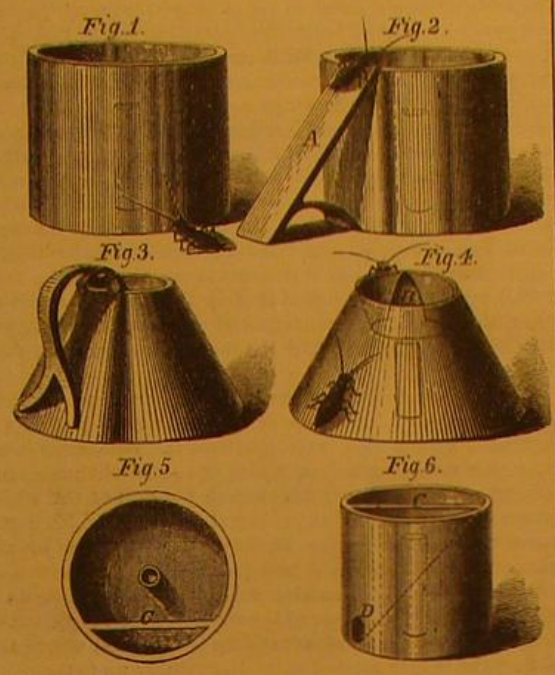
THE RAILROAD ACCIDENT NEAR SPRINGFIELD, MASS.—The danger of heating railroad cars by stoves has received a further illustration by the conflagration of the ruined cars in the Springfield, Mass., accident. There is an opportunity for an ingenious mechanic to invent some means of heating the cars by the exhaust steam of the locomotive. Many attempts have been made to perfect such an arrangement, but none capable of practical application has been produced.

CHEAP PAINT.—A cheap paint may be made for out-buildings and general use, by taking milk and cement—or water lime, as some call it—mix and apply three or four coats; a dry color may be added. This will last for years, and by renewing once in two or three years, a building will be kept looking well at small expense.

LIVE within your means, if you would have the means in which to live.

A PATENT OFFICE CURIOSITY, AND A SPECIFICATION IN RHYME.

Among nearly 20,000 specifications, including substitutes, now on file in the United States Patent Office, the following is one of the most remarkable and amusing. In this case, a late Commissioner decided that no patent should issue upon a poetical specification which was in other respects entirely sufficient. This specification was written by the inventor, Dr. D. Breed, late of the Patent Office.



ROACH TRAP.

To all those whom it may concern:
By this description, you may learn
That I, D. Breed, a District man,
Have made invention of a plan,
Both new and useful, of a trap
For catching roaches while you nap.

In setting forth my new invention,
Of first importance I would mention
My trap's a novel earthen cup
Outside of which the roach creeps up
And, jumping in to eat molasses,
The well glazed mouth he ne'er repasses.

In drawings, figures one and two
Show simple forms, yet something new;
The first has rough outside or way;
The next, an inclined path at A.
The central stem (in dots you see),
Is crowned with bowl like half a pea,

To hold molasses, say a drop,
And smoothly glazed from base to top.
But this is no essential thing;
Without it, in the roaches spring,
If, in the bottom of the cup
You place the sweet whereon they sup.

The figure three shows form unique
Of which in highest praise I speak;
'Tis glazed on in and outer sides,
Except between the handle strides
Where creep the roaches up a track
Without a fear of sliding back.

In figure four, at B, a spout
Is made, to wash dead roaches out;
This form is glazed entire within,
Also the mouth up to the brim.
But on the outer side, all round,
No trace of glazing can be found.

In five and six, a septum, C,
Cuts full two thirds the cup from three.
The smaller part has open door
At letter D, close to the floor,
And inclined way to top of cup
Where Mr. Roach with ease walks up;

Nor needs his wife or child his hand
To reach the highest brink and stand.
A little trip in balance hung
May o'er the mouth of cup be swung;
But that, an almost useless thing,
To save expense, away I fling.

Of varied traps, with spiral walk
And sundry forms, I yet might talk—
Of clay or other mortar made
To suit the fancy or the trade;
Forms now conceived, yet not revealed,
That sleeping lie in fancy's field.

From this description, you may make
Whatever form you choose to take,
From figure one to six, made part
Of this to aid the potter's art.
I recommend said figure three
Of porcelain, like cup for tea.

CLAIM.

As manufacture new, I claim
Said pottery trap, or porcelain.

If, while you sleep,
The roaches creep
Into your sugar bowl,
And, when you wake,
They quickly take
Safe to their hiding hole
Before your head,
Upon your bed,
Again you lay to nap
Be sure to get
And bait and set
The rhyming roaching trap.

D. B.

THE richer a man makes his food, the poorer he makes his appetite.

[For the Scientific American.]

FRICTIONAL GEARING.

BY E. S. WICKLIN,

NUMBER I.

Frictional Gearing is the term applied by Webster to wheels that transmit motion, by surface contact, without teeth. Among mechanics and practical men, who build and use them, such wheels are usually called "friction gear." When spoken of separately, that is, without reference to their combination, they are called friction "pulleys," especially those with faces parallel to the axes. When made conical, they are termed "bevel friction," and are usually spoken of as "wheels."

This style of gearing is now in use in the lumbering region of the northwest, and is fast gaining favor wherever used. It has some advantages, not possessed by other modes of communicating motion, which do not appear to be counteracted by any peculiar disadvantages. As a rule, however, it does not strike the mind of the mechanic favorably when first suggested, but must be seen to be appreciated. The first impression appears to be that the point of contact is too small to possess any considerable amount of adhesive force. It is generally received as a law that friction, or adhesion of contact, is not in proportion to the extent of contact, but to the amount of pressure and the condition of the surfaces. But to many minds, this law appears more as a learned theory than as a practical truth. In fact, there are few, even of our best mechanical thinkers, who do not manifest some surprise when, for the first time, they see with what apparent ease one smooth wheel will drive another equally smooth, by what appears to be a very slight contact; and that the second wheel is not only itself driven, but carries with it ponderous machinery, involving the expenditure often of more than fifty horse power. Nor is it strange that many minds are unprepared for such results, since most of our mechanics rely, to some extent at least, upon books, in the absence of personal experience. And here books fail.

There are, perhaps, no other means of transmitting motion about which so little has been written, in proportion to its importance, as frictional gearing. And most that has been written is upon the grooved wheels, which are frictional with a vengeance, and are, by the unequal motion of the parts in contact, as well calculated to absorb the motive power as they are to destroy each other.

As examples: In the latest edition of Webster's "Unabridged" we find the following definition: "Frictional gearing, wheels which transmit motion by surface friction instead of teeth. The faces are sometimes made more or less V shaped, to increase or decrease friction, as required."

In a recent work on mill building, perhaps the latest published in this country, a work of large pretentions, the only allusion to this class of machinery is a single seatence, in the chapter on friction, as follows: "Friction also furnishes a convenient medium of communicating and transmitting motion in machinery, as in gigging back the carriage and log in saw-mills; and in some modern mills, the whole driving power for both saws and mill stones is communicated by friction of iron upon iron."

Another late mechanical work gives us the following information upon friction gearing: "The surfaces of the wheels are made rough so as to bite as much as possible."

The above quotations furnish a sample of what may be learned from books of this very important mode of transmitting motion. And yet, in all the vast lumbering region of the northwest, comprising a large part of two or three States, and furnishing building and fencing material for several millions of people, there are few mills in which some part of the work is not done by friction gear. And in many mills the whole power, amounting to from 100 to 300 horse power, is thus transmitted.

The growing popularity and importance of this rather new style of gearing cannot fail to make it a subject of interest to mechanical engineers and manufacturers.

With this view, the writer now proposes to give, in a short series of articles, some observations taken from a practical stand point, and also the results of a few experiments, made to determine the percentage of adhesive force or traction of these wheels as compared with belted pulleys.

Now a word as to what friction gearing is, where it has become an undoubted success. In large mills where this gearing is used to transmit power to drive five or six gangs, one or two large circular saws, a muley, gang edgers, trimmers, slashers, lath mills, shingle mills and more besides: where 20,000 feet of boards may be sawn in an hour: the faces of the wheels are not "made more or less V shaped so as to increase or decrease friction as required." Nor is the power "communicated by the friction of iron upon iron." Neither are the surfaces of the wheels "made rough so as to bite as much as possible." On the contrary, the surfaces are made smooth and straight as possible; one wheel, or pulley, is made of iron, and the other of wood, or of iron covered with wood. So it is seen that the books are wrong, at least so far as applied to the localities where this gearing is most used.

Where it is practicable, this gearing is so arranged that the wood drives the iron. This is done so that the "slip," in starting up machinery while the driving wheels are in full motion, will tend to wear the wooden wheel round rather than to cut it in grooves, which is done to some extent when the wheels are reversed; though this tendency is much less than might be supposed, as in most cases the "hull wheel," used for drawing logs into the mill, is a large wooden wheel driven by a small one of iron. And these wheels, though started and stopped with the driver in full motion a hundred times a day, work well and last for several years. But for

machinery in constant use, the wooden wheel should always drive the iron.

For driving heavy machinery, the wooden drivers are put upon the engine shaft, and each machine is driven by a separate counter shaft. Two or more of these counter shafts are usually driven by contact with the same wheel, and each is arranged so as to be thrown out from the driver and stopped whenever required, and again started at any moment without interference with other machinery. This is easily accomplished, as a very slight movement is sufficient for the purpose.

To drive small machinery, these friction drivers are put upon a line shaft so as to drive a small counter shaft, from which the machine is driven by a belt, and stopped and started, by throwing out the counter shaft and throwing it in again.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

A Visit to a Watch Manufactory.

To the Editor of the Scientific American:

For many years I have had a great desire to become acquainted with the manufacture of watches by machinery. None of the many articles published on the subject seemed satisfactory, and I gladly availed myself of an invitation to visit the works of Giles, Wales, and Co., at Marion, N. J. Here I found an immense building devoted to the manufacture of the movements of watches. The building is constructed almost entirely of iron and glass, and is remarkable for its excellent facilities for light and ventilation. Inside, it is a perfect hive of industry, more than five hundred men and women being busily engaged in their various duties. I spent three days in wandering through the building, and trust the notes of my observation will be interesting to the general reader. The work is all done on four different floors and a basement. I will begin with the basement, which is devoted to the engine room, smith shops, hardening room, punching room, etc. On this floor, all the heavy work is done. Here all the parts are wrought into shape from the crude material. All the steel used here is of American manufacture, and has been found to be superior to all other as it is not so liable to spring, when hardening the pinions, staffs and springs. The company is able to supply itself in America with all the material necessary for its watches, except the stones for jeweling purposes.

Ascending to the first floor, we find it occupied by the office, forwarding rooms, and machine shop. In these latter shops, the company makes all the various machines used in making the different parts of the watch. They have four or five hundred of these machines, some of them performing very novel work. Many of them require the greatest accuracy and leave nothing to the eye or touch of the workman. Exactness is secured by gages, the coarsest measuring to the $\frac{1}{250}$ of an inch, the next, to the $\frac{1}{1250}$ of an inch, and the finest, to the $\frac{1}{100000}$ of an inch. The workman has only to trust to the guidance of these gages.

The second floor, I find devoted to the balance and pinion department. Here the expansion balances are made and the pinions finished. The operations of making and polishing the pallet jewels are also going on. I was astonished at the skill and ingenuity displayed in the machinery constructed for these purposes. The machines cut and polish the hard stones, with all their perfect angles, of the greatest exactness in size, and so small that it takes one hundred thousand of them to weigh a pound. The facility with which the precious stones are cut up into jewels is indeed astonishing, considering their hard and brittle nature. The rough stone is first sawn into slabs, then these into squares. The latter are then cemented to the chuck of a lathe which runs with lightning rapidity. They are then cut by a diamond pointed chisel, fixed to an arm which moves around in a horizontal semicircle. Thus they receive a convex form. By another application of the diamond point, the little cup shaped cavity for holding the oil is formed. Then the minute perforation for the pivot is made by a fine diamond drill, first applied to one side and then to the other. These perforations are then brought to the required size and smoothness by a hair-like wire covered with diamond dust. In this room are also made steel screws, perfect in every particular and yet so small that it takes 40,000 of them to weigh one ounce.

I next ascended to the motion room on the third floor. In this room all the motion works are fitted, including the mainspring barrel, the winding and stop works, the enameling, marking the figures and gilding the plates. Here also, in a room with locked doors, is performed the damascening, a process which gives to the metal the appearance of watered silk. This is a secret known only to the operators.

Thence I go to the fourth floor which may be called the great workroom of the establishment. Here the different parts of each watch are brought for final adjustment. Every part is made to harmonize. Each pivot must have its proper side stake and end stake, lest an atom of dust or a change of temperature lock the wheels and stop the watch. The greatest attention is given to the adjustment of the watches. Every watch is carefully tested with reference to the effect of heat and cold, and position. The springs and driving powers are so carefully harmonized that all work with the greatest precision.

Since my visit to this wonderful manufactory, I am satisfied that the old way of making watches is superseded, and that American industry and genius has surpassed Europe in one of her oldest and most difficult branches of manufacture.

Jacob Sayler.

Testing Turbine Wheels.

To the Editor of the Scientific American:

I have read your remarks in the Scientific American of March 16th, on the subject of turbine wheels, with much interest, and the common sense of your conclusions seems to me so apparent that I ask leave to say a few words in following them up.

The fact which you state, that every competent hydraulic engineer concedes a different percentage of water power under different heads, seems to me to prove that more patents are yet to be obtained before the best effects can be had. The power, as we get it, is a fitful uncertain thing and difficult to calculate in advance, and is by no means what is claimed as the proportion of the whole power of the weight of the water. If it were definitely determined what proportion of the good effect upon a turbine wheel is impact, purely a blow, and what the weight of the water in quiet pressure, we could at least make an approximate prediction as to what a well constructed machine would do under any known head; but, so far as I am informed, speculation, for this, is our best basis at present. It seems to me also that the fact, which you state, is sufficient to show that no such result as the utilization of 90 per cent, or 80 per cent, or even 70 per cent of the whole weight of the water has ever been realized.

I have seen a turbine of small size, accurately and nicely constructed, for the purpose of using as a cross test with a hydraulic engine also well constructed. Both were used upon the same stream and under the same circumstances. The wheel exhibited a little over 40 per cent of the whole power of the water, as shown by the engine, which registered the whole, less the friction. Certainly, one of the phases of which you speak was present. The water was of great head, the wheel making some 3,000 revolutions in a minute. It lost the power of the water, out of proportion to the work put upon it, apparently up to the point where the more quiet weight pressed upon it, probably up to the point in speed where the wheel nearly ceased to urge the water in "meshing" through.

The relations between a turbine wheel and a water pressure engine may be pointed out as much the same as those between a reciprocating and a rotary steam engine. The aim of inventors of both rotary steam engines and turbine wheels is to imprison their respective forces until no more work is left in them.

No other test for economizing power would be so satisfactory as for claimants—on wheels already competing, or any others—to force back to its normal head 90 per cent, 80 per cent, or 70 per cent of the water used, giving credit for friction in returning it.

R. H. A.

Extracting the Precious Metals from their Ores.

To the Editor of the Scientific American:

On page 168 of this volume of your valuable journal, you call the attention of your readers to the importance of a new method of extracting the precious metals from their ores. The article leaves no doubt as to the paramount importance of this widely absorbing topic. You justly point to the disappointment experienced by the miner in obtaining so small an amount of the gold and silver, compared with the assay value. This gives rise to the questions, are our present methods scientifically worked, or are they for the most part chimerical? From the attention I have given to this subject, I am inclined to take the latter view, perhaps from a certain amount of obtuseness that prevents my seeing things as others see them. I admit the utter impossibility of my seeing the newness of the method for the reduction of gold and silver by means of the caldron for the boiling of the ores, and I cannot comprehend the acumen of the metallurgical chemistry proposed for the refractory metals. Assuredly, Barba (who invented the *beneficio de cazo*, in South America in the year 1590, for the reduction of the *plata cornea* or horned silver of the mineralogist, and also employed chloride of sodium and magistral or sulphate of copper) ought not to be ignored; especially as that method has been in use for nearly 300 years, and is used both in North dan South America. Substituting iron for copper is the only new feature, and I think its advantages quite problematical. The refractory ores are treated, in this newly devised apparatus, with chloride of sodium, nitrate of potassa, lime, bisulphuret of carbon, fixed and volatile oils, hydrochloric acid, and sulphuretted hydrogen, an array of specially selected chemicals sufficient to break the bonds that hold together substances of the most refractory nature. The *rationale* of the chemical changes, I leave others to formulize.

The ultimate effect of boiling the ores in the caldron with the above substances may be anticipated: The oxidation of the mercury and its loss in the subsequent washings, and the risk of explosion by treating the ores with the hydrocarbons in the heated caldron, also the great expense of such a process for poor ores, where such a method is admissible.

I am glad to see this matter open for discussion in the columns of your valuable journal; it is the precursor to the settlement of this troublesome question.

Newark, N. J. J. Tunbridge.

Some of the good people of Boston are indignant at the action of the city authorities of Hartford, Conn., for enacting a resolution for erecting a statue, in their public park, of Horace Wells, for whom they claim the discovery of anæsthetics. Boston claims the discovery for her citizen chemist, Dr. Jackson.

Work does not wear men so much as worry.

Huano Manure.

An important improvement in the manufacture of artificial guanos, the discovery of which affords for many cases a practical solution of the difficulty of disposing of sewage, has just been announced in Great Britain, having reference to a substance called Huano manure. This material, it is claimed, is as rich as Peruvian guano, and its manufacturers furnish a guarantee to that effect. It is worth, according to the scale of fertilizers, from $40 to $45 per ton, although its first cost, as manufactured, is less than $13 per ton. In the course of inquiries leading to the invention in question, it was first ascertained that Portland cement transforms night soil into stone, which, upon being crushed, gives 18 per cent of phosphate of lime; and when applied as a manure for growing turnips, it has produced 26 tons to the acre. Owing to the insoluble nature of the phosphates, however, the action was slow, and the next step in the process was to utilize this property of cementation in the superphosphate manufacture, in which night soil is substituted for water in the decomposition of the phosphates. During this process the phosphates part with the two portions of their lime, uniting with sulphuric acid to form sulphate of lime, (plaster of Paris), from which is derived the valuable property of cementing night soil from a liquid into a solid mass. This solidification produces simultaneous deodorization, removing all offensive and foul effluvia, as well as any capability of giving out deleterious gases, and such powers of destruction are transformed into fertilizing endowments. It will thus be seen that cementation lawfully usurps the place hitherto occupied by fermentation and evaporation, and hydrates all the moisture—which, being chiefly urine, possesses manurial value to the last drop—together with the incorporation of the whole of the ammonia, alkaline salts, and other valuable constituents existing in the night soil.

The inventor, Mr. Hughan, has made arrangements with an extensive manufacturer of superphosphates to carry on the process, and great expectations are expressed as to the value of the results to be anticipated. The advantages of working the new patent, in connection with such a manufacture, are: 1. The night soil gives that pasty condition to phosphates essential to the reception and dilution of the acid employed in superphosphate manufacture. 2. The phosphates are increased one fourth in quantity from the alkaline phosphates and phosphoric acid of the soil; thus, if 75 units of phosphate of lime are introduced, 100 are withdrawn. 3. The phosphates receive a new supply of nitrogen equal to from 2 to 4 per cent of ammonia from the soil. 4. The phosphates obtain 5 to 8 per cent of alkaline salts, containing 1 per cent each of magnesia and potash, from the soil. 5. The phosphates receive, in addition, 16 per cent of organic matter intermixed with the urea and uric acid, possessing the latent quality of evolving ammonia to the last atom, and inducing nitrification, as well as the ammonia and nitrates as returned in the analyses. On the other hand, night soil receives from phosphates the following advantages: (*a*) Cementation; (*b*) solidification; (*c*) deodorization; (*d*) portability by rail or sea in the service of agriculture; (*e*) the bringing within the pale of sanitary laws, contributing to health and to municipal revenues. It is even suggested that the present superphosphate manufacture must ultimately pass over into night soil utilization, either voluntarily or by legislative enactment.

A Gigantic Mastodon.

The farm of Mr. Arden Mitchell of Otisville, Orange county, New York, has become suddenly famous by the recent discovery, in a swamp upon the premises, of the entire skeleton of one of the largest mastodons that ever tramped the earth. According to the New York *Times*, the discovery was made by a laborer who had been hired to dig muck.

The man had excavated to the depth of four feet when he came upon an enormous bone, shaped like a rib. He stopped work and informed Mr. Mitchell of his discovery, who, thinking it must have belonged to some monstrous animal, directed that deeper and more extended digging be done. At a depth of fifteen feet, the pelvis, head and other large bones were found. Search has been continued until almost the entire skeleton has been exhumed. It is said to be much larger than the famous remains in the Boston Museum, which were also found in Orange county, and which were the largest known specimen of these extinct mammalia. The upper jaw and main portion of the head of this new marvel weighs about five hundred pounds, and measures three feet seven inches across the top. There are four teeth in the upper jaw, two on each side. The back teeth extend seven inches along the jaw bone, and are four inches across. The openings where the tusks have been are three feet and eight inches deep and eight inches in circumference. The vertebræ was found in forty pieces, but lying all together, while the pelvis was taken out whole and uninjured. The channel where the spinal cords lay when the monster was alive is five inches in circumference. Among the missing bones are the tusks, the lower jaw bone, and those of the hind legs. One bone of a leg that has been found weighs alone over 350 pounds. When the skeleton is reconstructed, it will measure fourteen feet from the bottom of its feet to the top of its head, and over twenty-five feet from head to tail.

A singular incident connected with the skeleton is that in its stomach was found a quantity of undigested matter. Among it were fresh looking and very large leaves, of odd form, and blades of strange grass, of extreme length, varying from an inch to three inches in width, and looking as if freshly cropped from the earth.

Speak nothing but what may benefit others or yourself; avoid trifling conversation.

SOCIETY OF ARTS OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

MEETING HELD AT THE INSTITUTE IN BOSTON MARCH 14, 1872.

The President, J. D. Runkle, in the chair.

Mr. S. Dana Hayes read an interesting paper on the history and manufacture of petroleum products. This industry, though less than twenty years old, has become one of great importance in this country, and petroleum and its products take a high rank among our exports.

The crude and refined petroleum exported from the United States in 1871, estimated at a low average value of twenty-five cents per gallon, amounted to nearly $35,000,000.

Mr Joshua Merrill, of the "Downer Kerosene Oil Company" of Boston, has done more perhaps than any one else to bring this new manufacture to its present advanced state.

THE FIRST COAL OIL

manufactured in this country was made by Mr. Atwood in Waltham, Mas's in 1852. This oil was used for lubricating purposes, and was made in connection with picric acid, benzole, and other products, from coal tar; 175,000 gallons of this oil were made, and it was considered as one of the best lubricating oils of that day. Its odor was very offensive, which, with several other comparatively poor qualities, would render it quite unmerchantable if compared with the neutral hydrocarbon lubricating oils of the present day.

It appears that some of the lighter coal tar products were used for illuminating purposes in this country as early as 1856, and it was found, upon the introduction of the Knapp and Deitz lamps, which were designed for burning resin and other oils, that some of the light hydrocarbons, obtained by Mr. Merrill from Trinidad bitumen, burned readily in them, giving a brighter and more beautiful light than the common animal oil lamps and candles.

The first attempt to produce lubricating oils from the Albert coal of New Brunswick was made in South Boston by Mr. Merrill early in 1857. By the autumn of that year he had six retorts, with a capacity of 1,200 pounds of coal each, in operation, producing 360 gallons of crude oil in twenty-four hours. The number of retorts was soon after increased to fifty, and the establishment then yielded at the rate of 900,000 gallons of crude or 650,000 gallons of refined oil per annum.

It was found that the first products of the distillation were several thin, light colored hydrocarbons which, being unfit for lubricating purposes, were considered valueless; and as considerable loss of material resulted from their production, attempts were made to prevent the decomposition which caused their appearance; but all endeavors in this direction only served to show that any distillation of these hydrocarbons is destructive; and as it was soon after discovered that these lighter hydrocarbons were valuable for illuminating purposes, further attempts were not made to prevent their production.

The lightest product of the distillation of the Albert coal was called "keroselene;" its specific gravity is only ·634, and boiling point, 85° Fah. It possesses remarkable anæsthetic properties, which have been utilized to some extent.

The production of illuminating oil from

PENNSYLVANIA PETROLEUM

was commenced in 1858, and in 1860 there were fifteen establishments in the United States engaged in this manufacture exclusively. After the introduction of petroleum, the use of Albert coal steadily diminished until 1865, when it was finally abandoned.

By distillation, petroleum breaks up into thin hydrocarbons even more readily than Albert coal, and the process may be so modified that the entire contents of the retort will be converted into illuminating or burning oils. By the present process of distillation, nine distinct commercial products are formed, as follows:

Name.	Spec. Grav.	Boiling Point.
Rhigolene	·625	65° Fah.
Gasolene	·665	120° "
C. Naphtha	·706	180° "
B. Naphtha	·724	220° "
A. Naphtha	·742	300° "
Kerosene oil	·804	350° "
Mineral sperm oil	·847	425° "
Neutral lubricating oil	·883	575° "
Paraffin	·848 (?)	575° "

Mr. Hayes exhibited specimens of these products before the Society.

RHIGOLENE

is the lightest of all known liquids, and it evaporates so rapidly at common temperatures as to reduce the temperature to 19° Fah. below zero in twenty seconds. It corresponds to the keroselene produced from Albert coal, and, like that, has been used as an anæsthetic in surgical operations; its value for this purpose is due to its rapid evaporation.

The most noticeable characteristic of the heavy lubricating oils produced from Albert coal and petroleum was their offensive odor, and though many experiments were made by various manufacturers, it was not until November, 1867 that any success attended the effort made to produce a neutral odorless lubricating oil. At this time, Mr. Merrill, partly as the result of an accident, succeeded in making a clear, nearly odorless, neutral oil. Subsequent experiments demonstrated that this desirable result was attained by employing a very moderate fire in the distillation, and withdrawing it gradually toward the close of the operation; thus removing all the light odorous hydrocarbons, without decomposition either of the distillate or the heavy oils remaining in the still.

This important discovery was secured by letters patent in this country and Europe, and the demand for these oils is steadily increasing. In 1871, 50,000 gallons were sent to England alone, where it was used for lubricating spindles, oiling wool, etc.

PARAFFIN

is one of the products of the destructive distillation of petroleum, and was made by Mr. Merrill in 1859, and since then he has made 50,000 pounds in a single month. Its principal uses are for making candles, waterproof fabrics, chewing gum, etc.; and a manufacturer of friction matches in New York has used 100,000 pounds in one year.

MINERAL SPERM OIL

is a heavy and perfectly safe illuminating oil, first made by Mr. Merrill while experimenting with paraffin oil in lamps; he produced it by subjecting the heavy paraffin oil to a partially destructive distillation, which, without sensibly increasing its volatility, made it less viscid, so that it would ascend the wicks freely, and still retain its character as a fixed oil.

This oil is comparatively inodorous and will not influence or give off an inflammable vapor at any temperature below 300° Fah.

Mr. Merrill estimates that the present yield of petroleum is sufficient for the production of 100,000 gallons of mineral sperm oil every day—a quantity double that of the whale and sperm oils obtained in the best days of whale fishing.

It costs at present somewhat more than common kerosene, but it burns more slowly and gives as bright a light, so that the actual cost of the light obtained is about the same; a single lamp, burning mineral sperm, costs one half cent per hour. Its perfect combustion requires more oxygen, and a different form of burner, as the Argand or Dual, is necessary; these burners are as cheap and as easily obtained as and others, being made by the same manufacturers.

Referring to the origin of petroleum, Mr. Hayes said the prediction made by the chemist Liebig, many years ago, that he should live to see the sunlight of past ages shining in his house, seems to be now practically realized for the whole civilized world.

That ancient sunlight has come down to us, stored up in the vast deposits of coal and petroleum.

He performed a number of interesting experiments to show the different degrees of inflammability possessed by the different petroleum products, and demonstrated that the ordinary kerosene now in use is but little safer than naphtha.

The mineral sperm was ignited with difficulty; and a burning torch was instantly extinguished, when plunged beneath the surface of this oil, without inflaming it.

A vote of thanks was tendered Mr. Hayes for his interesting communication.

W. O. C.

VALUABLE PHOTOGRAPHIC IMPROVEMENT.

Among recent photographic improvements is the process of Colonel Stuart Wortley, of London, long distinguished as a scientific observer and amateur photographer.

Instead of the usual nitrate of silver bath, Colonel Wortley employs what is known as an emulsion. That is to say, he mixes with the usual collodion a few grains of nitrate of silver and also of nitrate of uranium. These substances give to the collodion a remarkable sensitiveness to light. In taking pictures, the operator simply pours the sensitized collodion upon the glass plate, and then rinses it in water. The plate is then ready for immediate use, or it may be kept, in a dark place of course, and used at convenience. The picture is readily developed by means of pyrogallic acid, ammonia, and bromide of potassium, and the finest pictures are produced with more certainty and much less trouble than by the ordinary process. A trial was recently made in London before a photographic committee, for the purpose of exhibiting the relative merits of the old and the new process, the latter being conducted by Colonel Wortley, and the former by Mr. Gordon, a celebrated photographer. Both parties used the same lenses. Repeated trials upon all sorts of pictures, outdoor views and gallery portraiture, revealed the fact that the new process was the best. It proved to be more sensitive than the wet process, finer pictures with less labor being the result.

Colonel Wortley promises soon to give us the exact formula by which he prepares his plates, when we shall place it before our readers. The process is attracting much attention abroad, and it would seem that the days of the wet bath and its troublesome paraphernalia are nearly ended.

THE HOLTZ ELECTRICAL MACHINE.

On page 380, Vol. XVI. of the SCIENTIFIC AMERICAN, we published an illustrated description of the Holtz electrical machine, the most powerful instrument known for generating frictional electricity. Sparks of unprecedented length are produced by this machine, with very small expenditure of power in operating it.

Mr. E. B. Benjamin, 10 Barclay street, New York, has just imported from Berlin an improved machine of the same kind, the largest yet made. It is destined for the University of Pennsylvania, and is said to be the most powerful electrical machine in the world. It was constructed under the supervision of Mr. Poggendorff, and has all the improvements devised by Holtz, Bokhardt, and other celebrated electricians and physicists.

When adjusted properly and working under favorable conditions, this machine gives a spark eighteen inches in length, with a loud detonation. The effects produced by this elegant specimen of scientific and mechanical skill are highly interesting, and it is a matter of congratulation that such an instrument is to remain in this country. The revolving plate of glass is thirty-four inches in diameter.

SCIENTIFIC AND PRACTICAL INFORMATION.

TREATY BETWEEN CHINA AND JAPAN.

There is at last a prospect that China, the most impenetrably conservative nation in the world, may yield somewhat to external influences, and allow the introduction, into her interior, of the productions of America and Europe. This hope is held out to us by the conclusion of a treaty between China and Japan, arranging the terms of commercial intercourse between the two countries, stipulating the conditions on which certain ports, to be afterwards selected, in each country shall be open to the commerce of the other, and appointing a system of arbitration for the settlement of disputes. In spite of the rigorous conditions under which the English have traded with the Chinese in the five treaty ports, Amoy, Ningpo, Shanghai, Foochow and Hong Kong, much good effect on the prejudices of the Orientals has been made by the traders there, and the opening of some more localities to similar influences, especially to a nation of the same branch of the human family, is likely to widen the beneficial result of that interchanged commerce which has already done so much, and which will in the future do more, for the cause of civilization.

RAMIE.

Our readers have been informed of the advantages to agriculture likely to result from the introduction of this fiber into our country, and many, if not all, will be interested in knowing that its cultivation in California has been entirely successful. Some cloths of great strength and delicacy of texture, possessing a high finish that is not usually seen except on silk goods, were recently exhibited at the California State fair, and attracted much attention. The farmers of the State are very anxiously making enquiries on the subject, and a company has been formed in San Francisco to promote the cultivation, and to give the necessary information to agriculturists. The great strength and fineness of this fiber give it a place among materials for textile manufactures which only silk can rival, and there must be many States in our extensive country in which the cultivation can be successfully carried on.

AN ABSCESS CURED BY INADVERTENCE.

Dr. Du Hadway reports the singular restoration to health of a man afflicted with a psoriatic abscess. The Dr. tried several remedies without success, and at last prescribed two drams iodide of potassium in six ounces distilled water; dose, a tablespoonful three times a day. The patient, a foreigner, misunderstood the directions, and swallowed the whole at once. Strangely enough, the 120 grains iodide of potassium did him no harm; but, on the contrary, his appetite, which had been very poor, was restored, and in ten days the abscess was healed. He needed no further medicine, and is completely restored to health.

WEIGHT OF WROUGHT IRON AND STEEL.

Many of our readers, who send us inquiries as to the weight of wrought iron and steel of different sections will find the following formulæ useful: The weight of a bar of round iron is the square of the diameter in inches × the length in feet × 2·63. The product shows the weight in pounds avoirdupois. The weight of a bar of iron of any section is the area of the cross section in inches × the length in feet × 3·36; and the product also shows the weight in pounds. For round steel bars, change the constant factor from 2·63 to 2·67, and proceed as for round iron bars. For steel bars of other sections, substitute 3·4 for 3·36, the other factors remaining the same as for wrought iron bars.

FRICTION GEARING.

We commence this week a series of able articles upon Friction Gearing, a subject which is of great and increasing mechanical importance. The use of this kind of gearing has proved very economical and satisfactory for many kinds of work, and our readers will receive with interest the theoretical and practical information contained in these contributions. They are from the pen of an able engineer, Mr. E. S. Wicklin, of Black River Falls, Wis., who has had a large experience, in designing and constructing this class of gearing, in the western lumber mills.

WE are indebted to E. Furse, banker, No. 9 Piazza di Spagna, Rome, Italy, for specimens of asbestos wall paper, and plain thick paper for enveloping books, valuable papers, and choice goods. Mr. Furse would like to introduce the article into this country if he can negotiate with reliable parties.

ANTS ON PEACH TREES.—A writer in the Boston *Cultivator* says that in his experience he has been led to look upon the black ant as his best friend in the peach orchard, his only object in traveling up and down the tree being to destroy lice, which frequently cover the young and tender leaves of the peach tree.

A CANDLE TO BURN ALL NIGHT.—When, as in case of sickness, a dull light is wished, or when matches are mislaid, put powdered salt on the candle till it reaches the black part of the wick. In this way a mild and steady light may be kept through the night by a small piece of candle.

TO PRESERVE CLOTHES PINS.—Clothes pins boiled a few moments and quickly dried, once or twice a month, become more flexible and durable. Clothes lines will last longer and keep in better order for wash-day service, if occasionally treated in the same way.

Self-acting Trap for Sewer and Drainage Reservoirs.

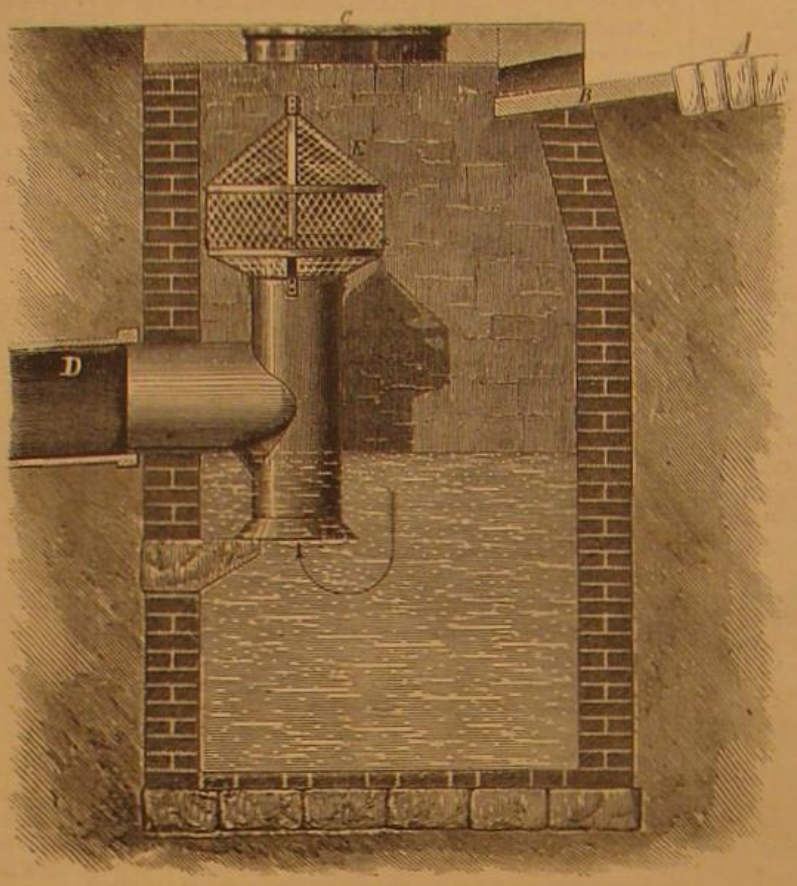
Our engraving is an illustration of a self-closing sewer trap, invented by M. K. Couzens, civil engineer, Yonkers, N. Y., for which a patent was issued, through the Scientific American Patent Agency, January 10, 1871.

The inefficiency of the various traps in use, to prevent the clogging of pipes leading from street receiving basins to sewers, led to this invention, which secures a secondary, self-closing, and higher outlet to the sewer of the drainage waters received, whenever the lower or ordinary one is clogged by sediment.

The body of the trap is of cast iron or other metal, and the horizontal portion that enters the connection pipe is of double capacity or area of section to the vertical part. A float valve of non-corrosive metal is fitted to the trap, and, in its elevation and depression by the rise and fall of waters in the basin, is guided by, or plays upon, a vertical rod, suspended from the metal bucket frame that is attached to the upper part of the trap. A permanent conical hood is seen above the valve to protect the central opening therein. The peculiar shape of the basket frame and its wire covering protect the valve from sticks or blocks that may enter the basin. The compression of air in sewers by freshets has often occasioned damaging explosions, before air escape valves were invented and applied.

This invention incidentally supersedes such valves, entirely accomplishing that object in a more certain and preferable manner. The simplicity and details of the plan will, from the clearness of the illustration, be readily conceived by practical men. A represents the surface of the street, B the drip stone, C the iron cover in the sidewalk, D the connecting pipe with the sewer, and E the basket frame inclosing the float valve and its attachment, as described.

We are told that Strickland Kneass, Esq., Chief Engineer of Philadelphia, and other eminent engineers, who have examined the invention, have recommended its general adoption. For further particulars, address the patentee as above.



SELF-ACTING TRAP FOR SEWER AND DRAINAGE RESERVOIRS.

The Use of Earthquakes.

The usefulness of earthquakes was a favorite subject with the late Sir John Herschel. Were it not for the changes in the earth's crust which are constantly being effected by the action of subterranean forces, of which the earthquake is the most active manifestation, there can be no doubt that the action of the sea beating upon the land, together with the denuding power of rain, would inevitably cover the entire earth with one vast ocean. "Had the primitive world been constructed as it now exists," says Sir John Herschel, "time enough has elapsed, and force enough directed to that end has been in activity, to have long ago destroyed every vestige of land." Mr. Proctor shows most clearly the beneficial manner in which the restorative action of the earth's subterranean forces is arranged. Of course, every upheaval of the surface must be either accompanied or followed by a depression elsewhere. "On a comparison of the various effects, it has been found that the force of upheaval acts (on the whole) more powerfully under continents, while the forces of depression act most powerfully (on the whole) under the bed of the ocean. It seems as if Nature had provided against the inroads of the ocean by seating the earth's upheaving forces just where they are wanted."

KEHOE'S IMPROVED STRIKING BAG.

The name of Kehoe is familiar to every athlete in America. The Indian clubs of his manufacture have long been held to be the best in market. Those of sedentary habits have received much benefit from the use of the apparatus made by him, which consists not only of the clubs and the striking bag herewith illustrated, but of wooden and iron dumb bells, wands, rings, etc., etc.



The latest of these contrivances to secure healthful exercise and muscular development is the striking bag, illustrated herewith and patented March 12, 1872. It is intended to be a substitute for the flimsy and unsatisfactory ones hitherto in use. It is constructed scientifically, with a view to avoid all possible injury to the hand, and yet to enable the full exertion of the muscles of the hands, wrists, arms, shoulders, back, loins, legs, and particularly of the abdomen, to be put forth in the act of striking. It is covered with buff leather, or English buck, and is accompanied with the necessary rope and hook for its suspension. It consists of an inner bag filled with sand, to give the proper weight, which is inclosed in an outer bag containing cork shavings, sponge, or other soft elastic material, and which, surrounding the hard sand bag, prevents any injury to the hands. Gentlemen of sedentary habits will find this exercise particularly beneficial. A few minutes sparring in the morning will quicken the circulation and equalize it for the day, giving a warm and healthy glow to the whole body. These bags may be obtained of Mr. Sim. D. Kehoe, 100 William street, New York.

Structure of the Albuminous Substances.

It has long been known that urea is capable of undergoing transformation into carbonate of ammonia, under the influence of alkalies and water; and I have indeed recently, in these pages, proposed a ready method of estimating urea by the quantity of ammonia which it furnishes on being maintained at a temperature of 150° C. in contact with alkali. If however, instead of being heated with caustic alkali alone, the urea be boiled with strongly alkaline solution of permanganate of potash, it yields no ammonia, but undergoes oxidation to the state of nitrogen gas, or nitric acid, according to circumstances. No other substance is known which gives up all its nitrogen in the form of ammonia when acted on by alkali, and gives no ammonia on treatment with alkaline permanganate of potash.

In investigating the albuminous substances, I have observed the following facts: If casein be heated to 150° C. with alkali, it yields about 3 per cent of ammonia; and if the residue be afterwards boiled with permanganate, some 7 per cent of ammonia is then obtained. Now, if casein be at once boiled with permanganate of potash, it yields only 7 per cent of ammonia.

Albumen, if heated with potash to 150° C., gives 3 per cent of ammonia, and on subsequent boiling with permanganate, about 12 per cent of ammonia. If it be at once boiled with permanganate, it yields only 12 per cent of ammonia.

Creatine (which contains urea conjugated with sarcosine) behaves in a parallel manner. The two thirds of its nitrogen, existing in the condition of urea, are evolvable as ammonia by proper treatment with alkali, but only the other one third of its nitrogen is evolvable as ammonia by the action of permanganate of potash.

The structure of creatine is known; but the structure of casein and albumen is unknown. Let a similar explanation be applied to casein and albumen as to creatine. In casein, about one sixth of its total nitrogen exists in the form of urea, being transformable into ammonia by alkalies, and oxidisable to nitrogen or nitric acid by permanganate of potash.

In albumen, too, about one sixth of the entire nitrogen exists as urea.

On extending my experiments to gelatin, I was much interested in observing that no ammonia is evolved when that substance is heated with alkali to 150° C., but that abundance of ammonia—some 9 per cent—is formed by the action of the permanganate. Gelatin, therefore, *differs totally from* the protein substances—it contains no conjugate urea.—*J A. Wanklyn, in Mechanics' Magazine.*

Photo-Intensifying Process.

A new process, by M. Merget, is as follows:

The negative, no matter how feeble, provided all the details are indicated, is fixed with hyposulphite of soda, and washed thoroughly; a solution, more or less strong as the case may require, of corrosive sublimate ("mercuric chloride," as it is now called) is then poured over it. This at first blackens and then whitens the image. If but little intensification be required, the solution should be very weak, and it should be washed off as soon as the negative has been blackened by it, and before the white stage is reached; but if the negative be very feeble, the solution should be strong, and should be left upon the film until the whitening process has reached its maximum effect. The film is then to be thoroughly washed, and the image is to be blackened by pouring over it a solution of pyrogallic acid—strength, three grains to the ounce of water—to which has been added an alkali in sufficient quantity to impart to the mixture its maximum of reducing power. The alkali may be either potass or soda, caustic or carbonated, or it may be ammonia; in fact, the old discolored alkaline developer, strengthened with a little more ammonia or carbonate of soda, will answer the purpose, although a fresh solution is better. The application of this alkaline pyrogallol (as pyrogallic acid is now called) immediately blackens the negative and intensifies it to the required degree—that degree depending upon the extent to which the previous action of the mercuric chloride has been carried. The negative is now to be well washed, dried, and varnished in the usual way

New Type Foundery.

We learn, by a letter which we have seen from London, that the advertising agents, G. P. Rowell & Co., and S. M. Pettengill & Co., of New York, have been offered one of the large type founderies of London at a great sacrifice, and the writer proposes that the whole machinery and equipment shall be removed to New York, and put up and operated.—*Milwaukee paper.*

CURRIER'S TEA AND COFFEE POT STAND.

Our engraving illustrates a new and ornamental tea and coffee pot stand, patented November 14, 1871, by Thomas D. Currier, of Waldoborough, Me. The pedestal may be formed in any desired style to suit the taste. From it arise two standards, as shown, to the tops of which is connected a bail or handle for convenience in carrying.

The pot is supported in a ring which is pivoted to the standards in such a way that it hangs perpendicularly when not tilted. From one of the pivots projects, upward and forward, a handle, as shown, by which the pot is turned so as to deliver its contents from the spout.

By these means, the pot may be carried and used without burning the hands, so that the advantages of the coffee urn are secured without the expense of a faucet, the latter being likely to get out of repair and difficult to clean.

From the ring, which supports the pot, descends an arm or brace, which engages the bottom of the pot, as shown, and assists in supporting the vessel. In the pedestal is deftly concealed a call bell, which is operated by the knob shown at the front. The whole is susceptible of tasteful ornamentation, and the device is fast winning popular favor. Address the patentee, as above, for rights to manufacture, etc.



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Contents:

(Illustrated articles are marked with an asterisk.)

African Diamonds—An Invention Wanted 231
A Gigantic Mastodon 228
Answers to Correspondents 233
*A Patent Office Curiosity 224
A Remarkable Telegraphic Improvement 231
A Visit to a Watch Manufactory 228
A Word to Boys 224
Beware of Green Colors 224
Brown Tint for Iron and Steel 224
Business and Personal 232
Carpeted Floors 226
Cheap Paint 227
*Currier's Tea and Coffee Pot Stand 230
Cut your Hay and Clover before they Ripen 226
Declined 233
Electric Probe for Wounds 225
Epidemics of Disease, Disaster, and Crime 231
Extracting the Precious Metals from the Ores 228
Frictional Gearing—No. 1 227
Huano Manure 233
*Improved Portable Fence 226
Inventions Patented in England by Americans 226
*Kehoe's Improved Striking Bag 230
New Books and Publications 230
New Stuffing for Cushions 226
New Type Foundery 230
Notes and Queries 232
Official List of Patents, Extensions, Designs, etc 234
*Palmer's Stave Jointing Machine 226
Photo-Intensifying Process 230
*Portable Spring Grist Mill 223
Price's Composition Pavement 223
Recent American and Foreign Patents 235
Recent Decision by the Commissioner of Patents 225
Scientific and Practical Information 229
*Self Acting Trap for Sewer and Drainage Reservoirs 230
Small Pox—Its Prevention, etc 231
Society of Arts of the Massachusetts Institute of Technology 229
Structure of the Albuminous Substances 230
Testing Turbine Wheels 228
The Administration of Chloroform, etc 225
*The Discovery and History of the Chromosphere 227
The Government Works at Hell Gate 224
The Holtz Electrical Machine 229
The Imitation of Gems 225
The Present Status of Organic Chemistry 232
The Railroad Accident near Springfield, Mass 227
The Tobacco Manufactories in Brooklyn 224
The Use of Earthquakes 230
Transplanting Hair 229
Valuable Photographic Improvement 229
Wood Ashes 226

AFRICAN DIAMONDS---AN INVENTION WANTED.

Mr. J. L. Babe, of 3217 Sansom street, Philadelphia, Pa., has lately returned from the diamond regions of South Africa, and during a recent call at our office gave us a variety of interesting particulars concerning the localities and methods of searching for the precious gems. More than thirty thousand persons are now engaged in this novel business, and thousands of diamonds are constantly being found, many of large size and great value. Mr. Bale brought with him several hundreds of the diamonds, one of which, a fine large one, is valued at not less than $120,000. In its natural state, the African diamond is smooth and polished, and when set without cutting is quite ornamental; but its beauty is, of course, greatly enhanced by cutting in the usual manner.

The new diamond fields of Africa are at the present moment the focus of attraction for adventurers from all parts of the world. From this country and Europe the intending diamond searcher steers for Cape Town, a large and flourishing British colony at the extreme southern point of Africa, the Cape of Good Hope. Here, by steamer, he coasts up the eastern shore of the continent for 500 miles, over the waters of the Indian ocean, to the British city of Port Natal; thence on foot, or in ox carts, overland north westerly, through African wilds for some 400 miles, to the Vaal river. This locality is almost midway between the Atlantic and Indian oceans, where the Vaal river empties into the Orange river, and the latter into the Atlantic ocean. This is the present South African diamond region.

The diamonds are found in a certain species of cement-like earth, whitish in color, which, under the blow of a wooden mallet, is readily reduced to powder. This earth is of peculiar formation, and its constituents have not yet been fully determined. It occurs in pockets, of considerable depth and of about an acre in superficial area, which pockets are scattered about, at little distances apart, over the region we allude to. The pockets are walled in by slaty rocks, which rise to or nearly to the surface of the ground. The indications are that these cavities or pockets in the rocks have been filled by the oozing up from below of this cement The diamonds are found in the cement, which is mined by picks and crow bars, and the following is the general operation:

The pockets are staked off into "claims," a claim consisting of a plot of ground thirty feet square, and for which the operator pays the proprietor from two hundred to eight hundred dollars. The mining is carried down vertically as far as paying earth is found, a narrow wall being left standing between each claim. Some of the pits have now reached a depth of 70 feet. The mining is chiefly done by the native blacks, the earth being raised in buckets to the surface, and carried to a sorting table. Here the cement is pulverized by hand, by means of wooden mallets, care being taken not to strike so hard as to injure the diamond. The pulverized cement is then spread out upon a table in a thin layer, and the anxious eyes of the searcher carefully scan the particles. Good eyes are in demand. Fortunate is he who after days of hard work finds at last one or two of the bright little stones to reward his labors.

The work of crushing and separating is, as we have stated, all done by hand. An invention is greatly needed by which the crushing, at least, may be done by mechanism. Mr. Babe thinks that a machine turned by a couple of men, or by mule power, would be the best. It must have a crushing power sufficient to break up chunks of the earth, and pulverize them to particles of not less than one thirty second of an inch in size. It must also effect the crushing without injury to the diamonds contained in the cement. The natural adhesiveness of the cement is rather more than that of common dried mortar. Here is a problem for the ingenious to work out.

Another problem is to construct a diamond separating machine that shall be reliable and require no water. The present diamond fields are dry diggins, the river diggins having been exhausted.

It is said that these diggins were accidentally discovered by the observance of some protruding diamonds in the plastered walls of a small farmhouse, the cement having been used in making the mortar. This building still stands, says Mr. Babe, an object of veneration and interest to all diamond hunters.

SMALL POX---ITS PREVENTION---THE TREATMENT OF PATIENTS WITH REFERENCE TO THE PROTECTION OF THE PUBLIC.

We shall take as a basis for our remarks upon this subject the following well established facts:

First, since small pox has been known to mankind, there has not been one instance where, introduced into the borders of any country, it has been thereafter wholly annihilated.

Second, the utmost that has been accomplished toward extinguishing the disease has been to render communities proof against its becoming epidemic.

Third, this has been accomplished through the two agencies of vaccination and the isolation of those who have contracted the disease.

Fourth, that the disease, once contracted, will run its course till, by its self limited character, the patient either dies or recovers.

It has been claimed that vaccination, repeated at intervals of about seven years, is an absolute preventive of small pox, even of the lighter form of the complaint called varioloid. This we do not believe, since we have known at least one case of fatal result from small pox where repeated attempts at prevention had failed, the patient being apparently unable to contract the vaccine disease. But admitting that vaccination may sometimes fail, when persistently attempted, the cases in which it fails are so rare that they are not worth mentioning as an argument against the value of revaccination. The fact remains that, probably, not one out of a million persons, who intelligently practice revaccination, will ever have small pox. Clearly, then, if revaccination was universally practiced, this one means might be considered as ample protection to the public.

But we have proof, in the almost epidemic character this disease has assumed, that vaccination is neglected by a large portion of our population. It is, therefore, thought necessary to supplement its protective effect upon the public by the isolation of those so unfortunate as to contract small pox, and laws are enacted empowering health boards and officers to remove—forcibly if need be—these sufferers from home and friends, to indiscriminately thrust them into pest houses, where those accustomed to kind care and pleasant homes must feel the depressing influences of foul air, filth, the sight and smell of all that is loathsome, and receive only the cold care of paid nurses, whose gratification is scarcely concealed at the death of a patient and the consequent lessening of their burdens. Now, on the principle that whatever is necessary to protect society is justifiable, and on no other, this course may be justified. The patient who has lead a cleanly life, who has tried to protect himself and society from small pox by vaccination, yet still has taken the disease, must feel that such treatment is a social crime. He reasons: "I have done my duty to the public, have taken every possible precaution. Those who have not done their duty now stand in fear of me, and shut me in this lazar house. It is they who are the criminals, not I. Is it right to punish one innocent for the protection of many guilty? No." There can be but one answer to such a question.

How can we avoid such injustice then? At present the law has no power to discriminate, because there are no adequate means for making discrimination. People are born, move about where they like, live where they please, sometimes change their names, and finally die unknown to and untraced by any public authority. They are earnestly requested to conform to sanitary laws, but rarely compelled to do so. When they have conformed, they have nothing to certify that they have done it. No record is kept either of compliance or non-compliance. An imperfect scar received in any way may be taken for the vaccine cicatrix, and a person may claim to be protected by vaccine disease who never had it. Others who are protected may be thought to have neglected it, and so there is no means whatever, in any locality, of determining its degree of immunity from small pox.

The State Board of Health of Massachusetts, in their late able report, lament that the law of that State does not empower them to isolate small pox patients, and ask that this disability may be removed, leaving it to the judgment of health officers whether such isolation is necessary to public protection or not. We do not quarrel with isolation in and of itself. We believe in it. Small pox patients should be isolated. Their houses should be closed to visitors and warning signals placed upon them; but in the large majority of cases, occurring among those residing out of tenement houses, this is enough. We do not think isolation in pest houses would ever be needed were vaccination compelled by law, and a proper system of registration adopted. Nevertheless, as aid to the easy enforcement of such a law, we would make every patient who cannot show certificates of vaccination, performed once in seven years, liable to isolation in a pest house, and only these, with the exception of those living in houses containing more than one family, hotels, barracks, etc. Such of these latter as can show the proper certificates and can provide for private isolation by procuring a proper tenement where their cases can be treated like those occurring in private families, should be allowed to do so.

A great deal of hardship might thus be prevented, while in our opinion the total risk to the public, and the death rate among cases which occur, would be greatly lessened.

We should, moreover, be correcting an injustice and relieving the responsibility of physicians, who are frequently mulcted by fines for non-compliance with the imperative law of Health Boards which requires the reporting of every case coming to the physician's knowledge.

A REMARKABLE TELEGRAPHIC IMPROVEMENT.

The Western Union Telegraph Company has acquired the exclusive ownership of the patents of 1868 of Joseph B. Stearns, of Boston, Mass, for instruments by which telegraph messages are transmitted in opposite directions, by the use of a single wire. This improvement is one of the most important that has been made in connection with telegraphy since the introduction of Henry's inventions by Professor Morse.

Many of the Stearns instruments are now in use, and the Western Union Company is introducing them upon its lines as fast as they can be manufactured. The importance of the invention will be understood when we state that *it practically doubles the transmitting capacity of every telegraph wire owned by the Company.*

Let none of our readers suppose that the chimera of "sending two currents in opposite directions on the same wire" has been realized in this invention. Not that, but its practical equivalent is realized, to wit: Two messages are transmitted simultaneously in opposite directions by means of one wire while the electrical current is always moving in one circuit, in the usual manner. By ingenious arrangement of instruments at the two ends of a line, say between New York and Boston, the operator at New York is enabled to transmit a message to Boston while the operator in Boston is at the same instant transmitting a message to New York, one set of signals being transmitted by that portion of the current which passes over the wire, the other set of signals being transmitted by that portion of the current which returns through the earth. We shall, on a future occasion probably, illustrate and fully describe this marvel in telegraphy.

The actual money value, of this remarkable invention, the Western Union Telegraph Company is estimated, to-day at a quarter of a million of dollars; and each year, as business increases, its value must augment.

We ought to add that Mr. Stearns, the inventor, is one of the best of living electricians, and his discovery is the simple result of profound and exact study of the laws of electricity. As a man of genius, who has conferred lasting benefits upon his fellow men, Mr. Stearns is entitled to the highest respect.

EPIDEMICS OF DISEASE, DISASTER, AND CRIME.

It would almost seem that the old saw "It never rains but it pours" was meant specially to apply to the calamities of the human race, and that accidents and crimes are epidemic as well as disease. To a certain extent this is assuredly true. Diseases become epidemic when a particular combination of conditions favorable to their rapid spread are established in an infected district. So when the moral atmosphere becomes tainted, when judges and legislatures are bought up by rings, when gambling houses, rum shops, and brothels are numerous; when news stands teem with corrupting literature, the conditions are established for an epidemic of crime. When legislatures are thus corrupt, and valuable franchises are granted to grasping corporations, permitting them to monopolize avenues of travel without any proper guarantees that the safety and convenience of the public will be considered, when inspectors can be tampered with and induced to report as safe what is unsafe, when in the haste to make money the people of young cities build block after block of inflammable materials, when tenant houses are put up in the most shabby manner and with shameless disregard to everything except the anticipated and exaggerated rents to be extorted from their unfortunate occupants, the conditions are well established for an epidemic of disaster.

The philosopher studying the conditions of epidemics can easily trace at least one fundamental condition common to them all, namely, moral infection. It is this corrupting influence that leads to neglect of duty on the part of officials who are paid to establish, so far as man can control them, the conditions of health. Thus we have streets and slums in our large cities reeking with filth, and foul with noxious fumes. Thus we see buildings little better than traps for human beings, erected under the very eye of those appointed by law to correct such evils. From moral laxity follows the judicial laxity that allows those justly accused of crime to escape conviction, and convicted felons to escape punishment. What wonder, then that in this era of social corruption the three epidemics have simultaneously come upon us?

The kerosene explosions, boiler explosions, explosions of fireworks, falling of buildings, disasters on railways, the burning of cities and vast tracts of most valuable timber, small pox raging in our midst and extending itself through out the land, the murders and the long list of minor crimes that have passed into the history of the last twelve months—what a terrible, soul-appalling list would they make, were we to blacken our pages with their enumeration!

But we see the signs of a healthful and hopeful reaction. The patience of a long suffering public is exhausted. There is an under current of public opinion setting in that will soon render it dangerous for criminals to practice their offences against society, or public servants to shirk their

plain duties. Already this effect is indicated in the decisions of courts, in the altered tone of public offenders, and the general feeling that better times are at hand.

Let us, from the painful recollections of the era of epidemics out of which we hope soon to emerge, learn permanently the lesson that there is no safety in a society where morals are generally corrupted.

THE PRESENT STATUS OF ORGANIC CHEMISTRY.

The different compounds belonging to the vegetable and animal kingdoms, as well as those which, by chemical operations, may be obtained from the same, possess certain peculiarities which distinguish them, in many respects, from the compounds belonging to the mineral kingdom. Some years ago, the opinion prevailed that the cause of this difference was to be found in the fact that they were formed by so called vital forces; it was assumed that there is an essential difference between inorganic and organic compounds, and chemistry was therefore divided into inorganic and organic chemistry. It was found that, while, in regard to mineral compounds, the synthesis is just as easy as the analysis (that is, it is as easy to make them as to decompose them into their elements), in regard to organic compounds, on the contrary, their synthesis (formation out of their elements) was surrounded with difficulties which appeared for a long time so insurmountable that the hypothesis was adopted that the elementary substances followed other laws in living nature than they did in dead; and that it was only possible to change the products of living organisms into inorganic elements, but that it was utterly impossible to do the reverse, that is, to make an organic compound out of its inorganic elements.

The modern development of chemistry has, however, demonstrated that this view is totally erroneous; a more intimate knowledge of the organic substances has revealed methods to manufacture chemically those substances thus far only obtained by the intervention of organic life.

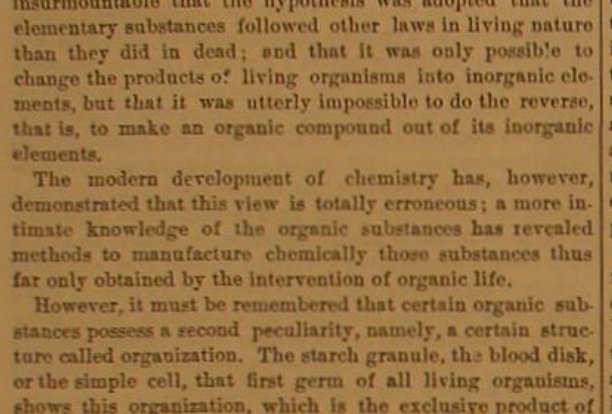
However, it must be remembered that certain organic substances possess a second peculiarity, namely, a certain structure called organization. The starch granule, the blood disk, or the simple cell, that first germ of all living organisms, shows this organization, which is the exclusive product of the so called vital processes; and this cannot be produced artificially. But homogeneous liquid compounds, or solids, either amorphous or crystalline, all thus far exclusively derived from organic sources, have now been made, by simple synthesis in the laboratory, in such enormous numbers that there is no more any doubt but that the rest of them will soon be made in a similar manner.

We have come, therefore, to the conviction that the same chemical laws prevail in living as in lifeless nature; and that the peculiar properties which characterize the compounds built up by living organisms are not owing to their organized origin, *but simply to the fact that they are carbon compounds* and that therefore the cause of those peculiar properties has to be sought in *the chemical nature of carbon itself*. And this is easily ascertained when we compare the chemical properties of carbon with those of the other elements. That there is a peculiar power in the carbon itself, was already recognized several years ago, when, by the most prominent chemists, carbon was designated as *the great organizer*.

In order to understand this peculiar property of carbon, we must first explain what is meant by the modern term "atomicity."

Without deciding the reality of the existence of the indivisible so called atoms, we need only accept the chemical fact that different elementary substances combine in definite proportions by weight; and that if there are atoms, and we suppose that they combine, atom with atom, the definite proportions referred to could be best accounted for by assuming that these atoms possess, for each elementary substance, a definite weight. Therefore, the name "atomic weight," if objected to by reason of the hypothetical basis on which it is founded, may be exchanged for "chemical equivalent," or "combining equivalent," and the word "atomicity" for "quantivalence."

Among all elementary bodies, hydrogen is distinguished by the simplicity of its combinations; and the latter are therefore adopted as types of all other compounds, which are simply formed by the substitution of the atom of another element for an atom of hydrogen. Hydrogen alone, pure, consists of a double atom, for one of which only the other substance may be substituted:



The elements of the first group contain one atom of hydrogen combined with one atom of another substance. Therefore, chlorine, fluorine, bromine, and iodine, are called monatomic or univalent. In the second group, two atoms of hydrogen are combined with oxygen, sulphur, selenium or tellurium; the latter are therefore called diatomic or bivalent. In the third group, nitrogen, phosphorus, arsenic and antimony are each combined with three atoms of hydrogen; they are triatomic or trivalent; while, in the last group, carbon is combined with four atoms; it is, therefore, called tetratomic or quadrivalent.

Monatomic elements form among themselves but few and simple compounds, while polyatomic elements form different combinations. Chlorine forms but one compound with hydrogen, and the chemical affinities are satisfied; but when an atom of oxygen is combined with only one of hydrogen, one equivalent is unsatisfied, and this may be filled up by hydrogen, and form water, or by chlorine, and form hypochlorous acid, or again with oxygen; when again one affinity of oxygen will be unsatisfied, which can only be closed up by another atom of hydrogen.

Water = H — O — H
Deutoxide of Hydrogen = H — O — O — H.

This latter graphic representation is coming into great favor to represent the manner in which the atomicity of the elements is satisfied. The univalent hydrogen is only attached to one element, while the bivalent oxygen is attached to two.

The polyatomic elements have also the property of combining with themselves. It is very characteristic of the tetratomic carbon that the capacity in its atoms to satisfy its own affinities by combining with itself is developed in the highest degree. Therefore, a great number of carbon atoms may combine to a single group, and behave like a chemical unit. To this property a second one must be added, which makes it distinct from all other elements, namely: all free affinities of such an atom group of carbon can be satisfied by hydrogen. Therefore, most carbon compounds contain also hydrogen.

That part of chemistry ordinarily called organic is therefore now named *the chemistry of the carbon compounds and its derivations*. Their number is indeed something startling. Weltsien published in Brunswick, Germany, in 1860, a systematic review of the same, and described more than 3,000, and since that time we have become acquainted with several hundred more.

We ought here to remind our readers that, in the modern chemical theory on which the above speculations are based, hydrogen = 1 is considered as a double atom, and is written $\frac{H}{H}$, so that H becomes in fact = ½, or, what is the same, by taking H = 1, we have C = 12, O = 16, S = 32; also, Se and Te are doubled. Many other elements remain as they are. Not only does this theory agree better with the views of organic compounds explained above, but there are two other satisfactory reasons why the new numbers should be adopted. To these we may recur later.

IF a person "faints," place him on his back and let him alone; he wants arterial blood to the head; and it is easier for the heart to throw it there in a horizontal line than perpendicularly.

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Peck's Patent Drop Press. For circulars address the sole manufacturers, Milo, Peck & Co., New Haven, Ct.

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Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—DYEING QUESTIONS.—Will some reader of the SCIENTIFIC AMERICAN inform me how to dye a bright Prussian blue, also a dark green, and a solferino on raw cotton?—W. H.

2.—ADHESION OF RUBBER BELTS TO PULLEYS.—What is the best preparation for moistening heavy rubber belts, put to heavy strains as in saw mills, etc., to make them adhere to the pulleys, and preventing slipping, at the same time not injuring the belt or gruming the pulleys?—O. E. S.

3.—POTATO STARCH.—What percentage of starch can be obtained from the potato; and what machinery is required for its manufacture?—X. Y. Z.

4.—FORCING CEMENT INTO FISSURES.—What is the best means to force cement (hydraulic) into a wall or cavity extending upward higher than the point of injection, as into the roof of a dam built across an adit in mines, so as to make a water tight job?—T. S. M.

5.—RELATIVE STRENGTH OF IRON AND WOOD.—Can any one tell me of what thickness of plate a hollow iron spar would require to be built—of say 20 inches diameter—to equal in strength a first rate pine spar of the same diameter, supporing them each to be 60 feet in length? Also, whether there would require to be any angle or T iron up the inside of it? Or would the boiler plate alone be sufficient?—H. A. C.

6.—VACUUM IN CASKS AND MINES.—Upon what principle of physics is it that, when the faucet of a liquor cask is opened without any vent above having been provided, the air, by jerks, seeks to enter in? Is the answer be that it mounts to fill the empty place which the liquor, by jerks, leaves in descending, the question is why that liquor does not stay up steadily, being so far within the limit of thirty feet in hight? Again, is it, or is it not, a cognate phenomenon, that a current of air is set agoing in a deep mine, along a gallery having communication with the upper air only by a single orifice through a partial partition wall along the middle of such gallery, partial because, stopping short at the farther end, or breast, it so gives room for a round of motion of the air? It is frequently resorted to, in the mining region, as a means of ventilating the deep mines. The questions are: In the first case, if the weight of atmosphere was sufficient to counterbalance hydrostatic pressure of liquor in the cask, why did it not do it? Secondly, in the case of the mine, since the heavier air was already at the bottom, why did it not stay there?—J. A. P.

7.—VARNISH FOR VIOLIN.—Will some of your readers tell me how I can prepare varnish for a violin? I have been told that there must be no oil about it. How can I stain the violin a darker color than the natural wood?—J. D.

8.—POISON FOR WOLVES.—Will some of your correspondents inform me of a quick and deadly poison for wolves, other than strychnia crystals, which they are too sharp to eat?—S. C.

9.—DRIVING ELEVATOR.—I wish to use a long elevator where I cannot get power to the upper pulley conveniently. Will driving the lower pulley make it work? The ascending side will need to carry a load of about two hundred pounds.—C. W. W.

10.—GOLD SOLUTION AND BRONZING.—Will some of your readers please inform me how I can make a gold solution for gilding to be used by boiling, without a battery? And how can I do antique bronzing with a green shade?—F. M.

11.—PREPARATION OF INDIGO.—What amount of sulphuric acid is required to dissolve one pound of indigo? What is the best substance to use for neutralizing the acid, and how much is necessary for that purpose? What kind of a vessel is to be used for the process?—D. C.

12.—BOILER QUESTIONS.—Is there any cheaper or simpler method of feeding boilers, from a tank a little above the water line in boiler, than with a steam pump? What is the best way of bringing the flame down the outside of an upright tubular boiler to increase its steam making capacity?—C. S. B.

13.—SALT IN THE EARTH.—During our late war, the men would occasionally get a piece of fresh meat to eat, and, when out of salt to season it, they dug the soil from under old houses and, leaching the water through it, cooked the meat in it. The latter would be found to be agreeably salted. How do you explain the presence of salt in the soil? There were no cellars under the houses. It was only necessary to procure the dirt where it was protected from the sun.—C. E. W.

14.—TENSION OF BELTS.—My plan for driving burrs from an upright shaft is condemned on account of the pulleys being too close. They are 6 feet between centers, and are respectively 2 feet and 3 feet in diameter. It is reasoned that a short belt requires a greater tension—which therefore is harder on the belt and spindle,—and will not transmit the same power. I contend there is no difference under like conditions, if tightener pulleys are used in each case, and the belts present the same surface to the pulleys. The tension may be given by tighteners or by the weight of the belt; they would be just the same, and transmit the same amount of power, and be no harder on the spindle. If I am wrong, why?—T. S. L.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1 W a line, under the head of "Business and Personal.

ALL reference to back numbers must be by volume and page.

D. M., of Mich.—We think the specimen sent is what is called chrome iron, made from the ore known as spiegeleisen.

C. A., of Mass.—A body floating in a stream moves with the mean velocity of that part of the section of the current occupied by the submerged portion.

W. B. W., of Mo.—Judging from your description, your boiler furnace is all right. What is meant by furnaces out of shape, in boiler reports, is that such furnaces as are made of iron, in the boiler and forming a part thereof, are distorted.

W. H. W., of Conn.—You can use the differential screw for the purpose named; will publish your other query.

G. N. L., of —.—Your theory of vibrating flames is corroborated by modern research. Consult Tyndall's Lectures on Sound.

E. A. L., of —.—Water has been proved to be more compressible than some solids. Its density increasing, therefore, as the depth increases, there is a theoretical depth at which water would become as dense as, say, iron, and at which, therefore, iron would cease to sink. Practically, however, it is probable that there is no depth in the ocean to which any known solid that sinks at the surface will not descend. This answers your other queries.

T. B., of N. J.—Your plan for balloon propulsion by inclined floats is old; it has been tried and found wanting.

CHAPPED HANDS, ETC.—For these, or chapped lips, or chafed skin in any part of the body, no application is so good as glycerin, rubbed in twice a day. Two applications will generally cure any case of the sort.—B. T., of —.

MELTING ASPHALTUM.—Query No. 1, March 23, 1872.—The best solvent for asphaltum is oil of turpentine. Put in the mineral, and heat till it is dissolved. As the vapor of turpentine is dangerously inflammable, a water bath is the best vessel for the purpose.—D. B., of N. J.

LAKE DWELLINGS.—Query No. 11, March 23, 1872.—Sir Charles Lyell's work "The Antiquity of Man" contains all the information on this subject which has hitherto been obtained.—D. B., of N. J.

ANTS.—In answer to No. 20, page 169: Sprinkle lime on the places the ants frequent. If on shelves, spread paper over them. I think also that moles will not work among it.—H. C. M., of Pa.

FRUIT JELLIES.—M., No. 27, page 169, is exercised about fruit jellies. He will doubtless be surprised to learn that they are called "fruit jellies" because not a particle of fruit is used in making them. They are simply gelatin dissolved in water, colored, and flavored with the so-called flavoring extracts.—Alex., of —.

MOLES.—T. M. G. had better keep his moles till the wire and other worms in the soil are killed off by these useful animals. Moles would not be in his garden were there not pernicious worms, bugs, etc. to feed them. The moles won't touch his vegetables, but they are great on small deer like worms. As regards the ants, let T. M. G. get some quicklime and grind it fine; sift plenty of it on the ground where these insects make their holes. The lime should be fresh, so as not to have lost any causticity by slaking.—Alex., of —.

STOPPING CRACKS IN IRON.—If H. P. S., query 20, Feb. 24, will take some litharge and common glycerin, and make a paste or cement, he will be able to stop the leakage.—C. W. D., of Wis.

FRUIT JELLIES.—Query 27, page 169.—To M. Fruit jellies, so called, are made by putting half an ounce of alum in one pint of water; let it boil a minute, or till dissolved, then add four pounds white sugar; boil two minutes longer and strain; when cool, add half a two shilling bottle of vanilla, lemon, or strawberry extract or other flavor.—Mrs. K., of —.

TRANSFERRING TO GLASS.—Query 17, page 169.—K. W. can transfer engravings to wood or glass by first coating the wood or glass with copal varnish, then press on the picture, face downwards, smoothly and tightly; let it dry. Then damp the paper slightly, and rub it off with the finger, leaving the picture to be looked at through the glass, or, if on wood, to be varnished.—Mrs. K., of —.

CEMENTING EMERY TO WOOD.—To J. J. T., query 28, page 169. The following cement is wonderfully tough, as I have good reason to know: Melt together equal parts of shellac, white resin, and carbolic acid in crystals; add the last after the others are melted. The effect of the carbolic acid is surprising.—E. H. H., of Mass.

GINGER BEER.—Query 14, page 122.—To F. L. C. Take white sugar, 5 pounds, lemon juice, 1 gill, honey, ¼ pound, bruised ginger, 5 ounces, water, 4½ gallons. Boil the ginger 30 minutes in three quarts of the water; when cold, put in the other ingredients and strain; add the white of an egg well beaten with a teaspoonful of lemon essence. In four days bottle; it will keep longer with the honey than with yeast.—Mrs. K., of —.

CLEANSING HAIR BRUSHES.—Query 25, page 169.—To F. C. To cleanse a hair brush, take a basin of cold suds, add a spoonful of spirits of ammonia, put in the brush, and draw a coarse comb through the bristles as many times as necessary; a cloth too may be used to help the cleansing. Finally rinse in clear water.—Mrs. K., of —.

TANNING RABBIT SKINS, ETC.—Query 4, page 169.—To L. H. T. A simple way to tan skins is, first, to wash them in cold suds; then dissolve pulverized saltpeter and alum in hot water, add cold water, and soak the skins in it all night; then hang them over a pole to drain; when nearly dry, sprinkle with powdered saltpeter and alum; fold the flesh sides together, lay them where they will not freeze, turn every day till dry, then scrape the flesh side with a blunt knife and rub with pumice stone and the hands.—Mrs. K., of —.

PAINTING SHEET IRON.—Query 18, March 16.—Let J. C. try asphaltum varnish on his sheet iron smoke stack.—V. S. V., of O.

TO DESTROY ANTS.—Take of flowers of brimstone, half a pound and potash, four ounces. Set in an earthen pan over the fire till dissolved and united; then pulverize and make, with water, a strong solution and sprinkle where the ants frequent.—F.

IGNITION OF STEEL FILINGS.—A. M., of Oregon.—The fact you mention is a familiar and convincing illustration of the nature of combustion. Steel in a mass is a very incombustible substance, but, reduced to a fine powder and sprinkled so as to allow a large proportion of the oxygen of atmospheric air to each granule, it burns readily. The experiment is a good illustration of the increase of chemical action secured by pulverizing materials.

EYE STONE.—A friend gave me an eye stone, and said it was a common article in the drug market, and used for removing dust, etc., from the eye. It looks on one side like a bivalve shell, but is plane on the other side. Is there such a thing known in the market? F. M. E., of Mo.—Answer: Yes. It is taken from the head of a fresh water crab.

COLORING SHELLS.—Query 3, March 16.—Dissolve a little lac dye in a solution of chloride of tin; and having made the shells thoroughly clean, dip them in this preparation until they are of the desired color. The dye should be allowed to stand (first after boiling) to allow of any settlement.—E. H. H., of Mass.

RAILROAD ACCIDENTS.—P. B. P., of Pa.—The device you send is not new, and the very great expense attending its use has prevented its general adoption.

ANTS AND MOLES.—T. M. G. should drop one or two castor oil beans in their holes, and he will then get rid of them.—K., of Md.

ELASTIC CEMENT.—W. M. S., query 10, March 16, can mend his gas bag by putting on a patch with a solution of rubber in bisulphide of carbon.—D. G. P., of Ill.

PAINTING IRON BATH TUB.—If C. A. H., query 15, March 16, will mix his paint to a proper consistency with best coachmaker's japan varnish, it will give him satisfaction. For white lead paint, use half turpentine and half coachmaker's japan. It will not darken much. Venetian red is best for a first coat, for any color but white.—P. D. W., of —.

O. E., of La.—We hardly think there would be danger of explosion from pulverizing chlorate of potash on clear white paper by rolling it with a bottle. Should there be, however, a small fragment of camphor, sulphur, phosphorus, resin, etc., upon the paper or bottle, you might produce an explosion. Violent friction will sometimes explode chlorate of potash, without the contact of other combustible materials. In such cases the explosion is not very dangerous, however, a small part only exploding, while the remainder deflagrates and decomposes more gradually. We should prefer a mortar and pestle, taking care not to use the pestle violently.

FLUID AND LIQUID.—Query 2, March 16.—To H. W. H. The words fluid and liquid are often used synonymously. Water is both fluid and liquid, but oxygen is fluid but not liquid. Both terms apply to those substances whose parts change their relative positions upon the slightest pressure.—D. G. P., of Ill.

BRASS COLORED PAINT.—O. W. V., query 9, March 16, will will find copper bronze varnish as near to a brass colored paint as anything he can get.—D. G. P., of Ill.

PIN SPOTS IN STEEL.—Let H. M. H., query 23, page 185, get a small iron box with a sliding top to it, fill it with pulverized charcoal, and imbed his pieces of steel in it, put in the top, and lute with fire clay. Heat it in a slow fire to a red heat, then take out and let it cool off.—J. H., of Md.

GAS IN WELLS.—Being much troubled some time ago with a foul well, down which it was necessary to send men to repair a pump, all other remedies having failed, I found the following treatment a perfect success: Having attached one end of a common hydrant hose to a steam boiler, I ran the other nearly down to the water, and blew the well full of steam. It soon condensed, with the aid of a little water sprinkled down, and having displaced (or perhaps absorbed) the carbonic acid, the air was perfectly purified. In the absence of a steam boiler, probably as good an effect would be produced by forcing air down through the hose, with a common force pump or otherwise.—O. S., of N. J.

BLOWING OUT BOILER.—D. & N., query 21, March 9, had better let the water cool in their boiler, and then let it out and wash with cold water. Query 20: They will see that it is not right to wash a hot boiler with cooler water. The consequences might be fracture by irregular contraction.—S. F., of Pa.

ANTS AND MOLES.—Query 20, March 9.—For ants, place a fresh meat bone where the ants can get at it, and they will flock to it in large numbers. When they are on it, dip it in hot water; repeat it a few times and the ants will have disappeared. For moles, dig a hole like a post hole across one of the mole holes, and in the bottom, place some rags previously dipped in sulphur. Set fire to them, and, when once well on fire, cover up close with a board, and the mole hole acts as a pipe. The mole leaves.—A. M., of Ky.

PREPARATION OF NITROGEN.—Professor A. W. Hoffmann, of Berlin, recommends the use of nitrite of ammonia for the preparation of nitrogen gas. It is only necessary to heat this salt when it is decomposed into nitrogen and water, thus:

$$NH_4NO_2 = 2H_2O + 2N.$$

The nitrite of ammonia is very easily prepared from nitrite of potassium and chloride of ammonium. The nitrogen prepared in this way is very nearly pure, the only contamination being a little nitrous oxide, a gas very soluble in cold water.—E. J. H., of —.

TEST FOR NITRIC ACID.—P. C. H., No. 19.—The most delicate test is brucine, which is said to indicate one part of nitric acid in 100,000. One part of brucine is dissolved in 1,000 parts of water. To half a drop of the solution to be tested, add one or two drops of the brucine solution, and from one to five drops concentrated sulphuric acid. Sulphate of aniline will detect one part of nitric acid in 1,000 parts of water. To the solution to be tested, add two drops sulphate of aniline and from two to six drops concentrated sulphuric acid. The ordinary laboratory test is to place, in the test tube containing the solution, a crystal of copperas or sulphate of the protoxide of iron. One or two drops of strong sulphuric acid are then allowed to run down the side of the test tube to the bottom of the liquid; and this sets free the nitric acid, and this in turn oxidizes the iron, forming a dark brown ring or zone.—E. J. H., of —.

ELASTIC CEMENT.—No. 10, March 16.—Dissolve one dram of gutta percha in one ounce or more of bisulphide of carbon, so as to make a fluid that will easily pass through coarse filtering paper. After filtering, add about fifteen grains of pure india rubber, and let it dissolve; or, when it has become soft and gelatinous, quickly rub the whole smooth with a palette knife on a slab. Paint four or more coats of this varnish over and around the hole in your bag, allowing each coat to dry before the application of the next. Treat a piece of fine strong calico in the same way. The last coat on each should be pretty thick, and when nearly dry, apply the patch to the bag, and press evenly and quite firmly together. When at last the whole is supposed to be dry, press with a warm iron, and then paint the surface of the new piece with a coat or two. If nicely done, your bag will be as strong as ever. Chloroform may be used in place of the bisulphide.—E. H. H., of Mass.

FLUID AND LIQUID.—No. 2, March 16.—These are practically synonymous terms, and I would venture the following definitions, even if they appear far fetched: Liquid, a form of matter allowing of perfect mobility of particles or atoms. Fluid: a term whereby we may imagine the perfect mobility of the particles of matter not ordinarily visible. Thus we speak of water as a liquid. But carbonic acid gas we might speak of as a gaseous fluid, since in pouring it from one vessel to another, it may, under certain arrangements, be seen to flow, and comport itself much in the same manner as when pouring water. Its particles are perfectly mobile. We speak metaphorically of the electric fluid, as the term there again conveys to the mind the impression of mobility, and thus its condition in passing along or through a wire. This I give as a popular illustration, not that such a theory is by any means correct.—E. H. H., of Mass.

CLEANING DISCOLORED GLASS.—Query 16, March 16.—I have frequently cleaned glass that appeared smoky, when soap, turpentine, alcohol, or scouring with whiting would make no impression on it, by applying dilute nitric acid.—W. G. B., of Mich.

FAST COLORS.—Query 8, No. 12.—A dye of logwood an blue vitriol is made fast by wringing out the goods in a solution of blue vitriol and then plunging in a hot solution of logwood. After sufficient coloring, dry and air the goods one day; wash them in soapsuds until little color escapes; then immerse in cold urine and bring to a boil, leaving the goods to cool in the urine. Remove and wash thoroughly in soapsuds, rinsing in clear cold water. It is of the utmost importance that the goods be absolutely clean before coloring commences.—W. D. P., of Wis.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

ATMOSPHERIC ELECTRICITY.—G. W.
BOILER EXPLOSIONS.—J. M. H.
CANAL BOAT PROPULSION.—
FORCE.—S. H. T.
RIFLES.—G. W. T.
SCIENCE IN THE COURTS.—ALEX.
SHAVING WITH PUMICE STONE.—A. K.—R. B. F.
SMALL POX CURE.—J. H. V.—A. M. L.
SOLAR PHENOMENON.—C. S. M.
SPIRITUALISM.—E. G. J.
THE DAVENPORT BROTHERS.—F. J. I.
WATER WHEEL TESTS.—S. & S.—L. B. A.
ANSWERS TO CORRESPONDENTS.—G. W.—J. E. M.—C. H. W—J. T. B.—L. H. & Co.—L. H. S.—P. D. W.—J. F. A.—J. G. W.—G. A. B.—C. T. T.—D. H. B.—J. L.—C. G.—H. F. R.—J. L. G.—G. & H.—T. H. J.—A. H. N.
NOTES AND QUERIES.—J. A. Y.—S. T. W.—J. D.—C. L.—B—P.—M. C. W.—N. Y.—G. E. P.—S. H. S.—M. P. B.—D. H. B.—P. C.—J. D. J.—J. H. P.—M. S.—C. W. A.—T. V.—Q.—J. G.—F. M. G.—T. H. J.—R. H.—J. K. C.—M. A. R.—W. L. H.—A. H. B.—B. F. A.—W. M. D.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

ATMOSPHERIC ENGINES.—Silas E. Tuttle, of Evansville, Wis.—This invention has for its object to furnish a simple, convenient, and effective atmospheric engine, so constructed that a partial vacuum may be formed in the cylinder by burning the oxygen of the air, causing the piston to be forced forward into said vacuum to make its stroke by atmospheric pressure on the other side of said piston. The two cylinders are open at one end and have numerous holes in the heads at the other ends to allow the air to pass through freely. The pistons work air tight in the cylinders. Valves are so arranged upon a cross bar, actuated by suitable mechanism, that when one of said valves is opened the other will be closed. A reservoir contains alcohol or some other suitable inflammable substance which is led through to the interior of the cylinders near their open ends. Wicks pass through the pipes from the reservoir to the cylinders. The pipes are provided with stop cocks to enable the flow of the inflammable substance through the pipes to be regulated or stopped, as desired. Air pipes, connected with the cylinders, near their open ends, admit air to said cylinders, which are opened and closed by the valves so arranged that one will always be opened as the other is closed. Lamps are placed just below the open ends of the cylinders and as close to them as is possible without having the valves in their movements interfere with the lamps. To the valve rod is attached a lever, to allow the valves to be opened by hand in starting the engine. By this construction, as each valve is opened, the flame from the lamp sets fire to the wick, which forms a vacuum in the cylinders as the valves are closed, and the atmospheric pressure forces the pistons forward alternately, and they thus keep up a constant motion in the shaft.

UPRIGHT PIANO.—Oscar Altenburg, of New York city.—This is an improved arrangement of the case or frame of an upright pianoforte, which consists in hinging the face plate of the top to the case so that it can be folded down, and in providing it with a rib or device for the support of the music when thus folded down. The object of the invention is, first, to allow a convenient and full display of the action and a free escape of the sound waves; also, ready approach to the pins for tuning, and to dispense with the necessity of opening the top of the case, which may be used as a support for various articles.

FENCE.—Albert C. Betts, of Troy, N. Y.—This invention consists of a portable wire fence formed of longitudinal parallel lines and vertical pickets, the wires being fastened to the pickets by staples, and the pickets being placed at such distances apart as to prevent the wires from being forced apart by animals so as to pass through, and not so near as to interfere with rolling the structure thus formed up into a roll for convenience in carrying it from the factory or shop to the place where it is to be set up, or for removing it from place to place. The wires and pickets thus arranged and connected are made in sections of greater or lesser lengths, according to convenience in handling, and secured in position in the field by erecting the pickets upon the ground and fastening the wires or pivots to posts set permanently in the ground, a rod apart or thereabout, the said wires being secured by staples, which may be readily pulled out again to release the wires and pickets when the fence is to be removed. The inventor proposes to secure the wires to the pickets by machinery adapted to secure all the wires to one picket at once, the wires, pickets, and staples being fed or supplied to the machine in regular course, and thus to provide this part of the fence for market at a very cheap rate, so that the only labor required in the field will be the setting of the posts and securing the said wires and pickets thereto. Stakes driven in the ground will answer well for the posts, for the weight of the wires and pickets is not such as to require great strength.

FENCE.—John A. Stone, of Chapel Hill, Texas.—This invention relates to a new fence of very simple construction and claimed to be of great strength and durability. A series of posts is secured in the ground at a depth of from eighteen to twenty-four inches, and at distances apart about twelve inches shorter than the rails to be used. The rails are placed obliquely against the fronts and backs of the posts, and so that the ends of the rails between one pair of posts rest on the ends of the rails between the adjoining pairs. After the rails have been placed—say, to about half the hight of the posts—false posts are, by means of wire bands, tied to the true posts, against that face of each with which the rails are in contact. The false posts reach from the ground to the hight to which the rails are to extend, and serve to confine the latter in their positions. After the false posts have been secured, the remaining rails are applied. The height of the fence may be cheaply increased without the use of rails by having one or more strands of wire stretched between or through the posts. Such wire may, however, be dispensed with.

SLED.—John K. Reichert, Lancaster, Ohio.—The invention consists in avoiding the usual mortise in sled runners, which weakens and renders them liable to break, by making the standards, which support the cross-pieces of metal, and providing them with a socket at one end and a bifurcation at the other.

FARE BOX.—John C. Schooley, New York city.—The patentee has contrived a fare box so constructed that not only the valves which prevent escape of the fare shall operate automatically, but the fare itself shall proceed on its course from the first or inspection chamber to a safe deposit chamber whenever the box is lowered or suspended by the handle in the most natural and easy way. When the box is again presented for a fare, the valves swing open as before.

CORN CRIBS OR HOUSES.—Commodore B. Clark, Pleasant Grove, Iowa.—This invention relates to an improvement in corn cribs or houses, intended especially for storing and preserving corn in bulk, and it consists in the peculiar construction of parts when combined in such a manner as to form a crib or house, from which the corn can be taken as desired for use with the greatest facility, and which shall serve to exclude both rain and snow, and noxious or destructive vermin or animals, and yet permit a thorough circulation of air through the body of corn.

CARTRIDGE BOX.—John Miller, U. S. A., Lexington, Ky.—The invention consists in the peculiar construction and arrangement of parts in a cartridge box whereby 40 rounds may be carried with convenience, and 50 in case of emergency, while ready access is always afforded to the single cartridges, and the rattle of screw driver against box is prevented by securing it within the box. This improvement seems to possess decided advantages over its predecessors, and will doubtless be appreciated by those acquainted with military accoutrements.

FENCE.—John McKnight, of Romulus, N. Y.—This is a new arrangement of the supports and fastening devices of a fence, which has for its object to facilitate the putting together of parts and their transportation, and thereby to reduce the expense of putting up a fence. The invention consists in the application to the fence posts of elbow supports for the panels, and in their combination with a face post and bolt for holding the panels in contact with the posts. The posts of the fence are firmly secured in the ground. The panels are made in suitable style and of the necessary or desired lengths. To the lower part of each post is fastened, by a bolt or pin, the upright part of an elbow piece or angle iron. The horizontal part of the angle iron has an aperture for the reception of the tenon formed at the lower end of a false post or face piece. From the upper part of each post projects a horizontal bolt or pin, through a slot in the upper part of the face piece. The ends of the panels are placed upon the angle irons either so as to overlap or abut against each other, and are then confined to the posts by the face pieces. Forked plates are slipped over the bolts in front of the face plates to prevent the bolt heads from cutting into the wood.

TOOL HANDLE FASTENING.—Alanson R. Sweat, of Harlan, Iowa, assignor to himself and B. B. Mastick, of same place.—The object of this invention is to provide ready and convenient means for fastening axes, hatchets, hammers, and similar tools on to handles, so that such tools may be readily removed in case of failure, and so that the handle itself will be greatly strengthened thereby. It consists in a combined key and wedge attached to a head plate. The handle is fitted to the eye of the ax or other tool in the ordinary manner, except that the handle shank is made narrower so that a space is left at the back of the eye for the key. The key the wedge, and the head plate are made in a single piece of metal, and may be forged or swaged and made of malleable iron or other metal. The end of the handle is split in the ordinary manner, and the wedge is driven into the split with the key at the back of the handle. The key projects through the eye, which forms a support to the handle and allows the key and wedge to be driven out with ease. By this method the handle and ax or other tool is readily separated, and the handle may be changed from one tool to another as may be found convenient.

BUCKLE.—Robert F. Russel, of Hazleton, Pa.—This invention relates to buckles for harness and other purposes, where the ordinary tongue buckle cannot be used without annoyance or trouble. It consists in a metallic loop, and a slide, and a ring, constructed, combined, and arranged in a peculiar manner. The adjustment is made by pressing the end of the loop inward, thereby detaching a stop from the slide, and then slipping the slide from the loop, which allows the strap to be adjusted as may be desired. When the strap has been adjusted, the slide is slipped back toward the ring and is caught by a stop lug. The inventor does not limit or confine himself to the precise form or arrangement of the parts described, nor to any particular use or purpose for the buckle, but designs it for all the purposes for which it may be adapted.

GATE.—William H. Phillips, of Staunton, Ind.—As a vehicle approaches this gate, the driver guides the horses in such a way that the wheels may strike against the erect cranks and force them down. This operates mechanism to open the gate, and, at the same time, raises other cranks into an erect position, so that the driver, by guiding the horses so that the wheels of the vehicle may strike the erect cranks at the other side of the gate, may thus close the gate and, at the same time, raise the first named cranks ready for the next vehicle in whichever direction it may be moving.

WATER WHEEL.—Vincent M. Baker, of Preston, Minn.—This invention relates to an improvement in gates and gate mechanism for water wheels; and has for its object, by the improved arrangement, to gain larger spaces for water entrance and avoid unnecessary friction. The invention consists in sinking the gate rings, in a new form of flanged gates, and mode of connecting them, in such manner that the greatest pressure of water shall be on the inner end of the gate. This causes it to open and close more easily than it would if the pivots were placed in the center. The greatest pressure of water, being on the inner ends of the gates when closed, helps to open them, and the draft of water around the wheel when they are open helps to close them. Balls may be placed in a recess for the lower gate ring to rest on, by which the gate move more easily. Two balls may be placed back of the segment that moves the gate rings, to remove the friction by hoisting. The gate thus made with straight inner face, beveled inner end, curved outer end, and with a flange at top and bottom, is claimed to be superior to other gates. On the straight inner face the water is conducted to the wheel in a straight line; hence less friction than there would be if said face was curved. Leakage is prevented by the flanges covering the joints between the rings and ease when the gates are closed.

OYSTER STEAMER.—William A. Jones, Erie, Pa.—This is an improved steamer for steaming oysters, enabling the juice from the oysters to be preserved, so that it may be put back upon them when served. The steamer is made to be placed in the griddle hole of the stove or range, like an ordinary kettle. It supports a vessel inclosed in another vessel which rests on an annular support. Below is a support for a vessel to catch the juice. A perforated plate receives the oysters to be steamed. A funnel shaped band conducts the juice from the oysters to a dish to preserve it, so that it may be poured back upon the oysters when served. The parts may be made large, so as to contain any desired number of sets of the attachments for use in hotels, saloons, etc., where several dishes of steamed oysters may be wanted at a time

TRUSS.—Edmund P. Banning, Jr., New York city, assignor to "Banning Truss and Brace Company," of same place.—This invention relates to a new manner of securing the pad of a truss to the supporting plate, with the object of insuring stability of the pad during the motion of the body. It consists in the combination of a double slotted abdominal plate and a single longitudinally slotted hernia pad, held loosely together by set screws, thereby admitting of a rotary motion of the pad. The body of the patient is thereby enabled full freedom of motion, and will not displace the pad. This improvement is claimed to be of vast importance. It is maintained that it produces an absolute closure of the rupture, where, heretofore, with the ordinary trusses, every motion of the body, nearly, was followed by a greater or less dislocation of the pads.

BACK BRACES.—Edmund P. Banning, Jr., New York city, assignor to "Banning Truss and Brace Company," of same place.—This invention consists in a new arrangement of parts, more particularly in the method of the adjustable application of an up and down adjustable and partly flexible fulcrum for a back brace. The back bone brace is made of a flat spring of proper length, width, and thickness, and sufficiently powerful for the purposes to which it is to be applied. The spring is inclosed in a sheath or covering of suitable fabric. Its upper end carries a pivoted transverse piece of plate, to the ends of which the upper parts of the shoulder straps are secured. The lower ends of these shoulder straps are secured by links, or otherwise, to a short strap projecting from the sheath, or directly to said sheath. The straps contain buckles, or equivalent devices, for being lengthened or shortened, according to the figure of the patient. The upper plates, being pivoted, allow free side motion to the body without affecting the position of the spring. To the lower end of the spring is pivoted another transverse piece or plate, to which the body belt is connected. The pivoting of the piece offers the same advantage as that of the upper plates. The fulcrum of the brace is formed by two small metallic pads or plates, which are, by more or less flexible joints, secured by a transverse bar that slides on the spring. By means of a plate, secured or bolted to the transverse bar, the latter is transformed into a sleeve that embraces the spring, and can be vertically adjusted thereon. The pads can therefore be set up or down at will to fit the small of the back of the patient.

UTERINE SUPPORTER.—Edmund P. Banning, Jr., New York city, assignor to "Banning Truss and Brace Company," of same place.—The object of this invention is to construct a uterine support which will be light, cleanly, and under the complete control of the wearer, and which can be used in cases of anteversion, retroversion, or to relieve the bladder from all pressure by the displacement of the womb, by a reversal of the concave tip. The invention consists, first, in making the stem and spring of one V shaped wire, which, at its outer end, is adjustably connected with the supporting brace, while its inner end sustains a tip of suitable material for the support of the uterus or for its lateral displacement, this tip being concave, and by its reversal made adjustable for both ante and retroversion. The invention also consists in the use of a peculiar concave shaped tip, to be used in cases of anteversion.

VELOCIPEDE.—David Martin, Harrisburgh, Pa.—This invention consists of an arrangement of propelling and steering apparatus for operating a four wheeled carriage by using both hands and feet. The four wheels have each a separate cranked axle, having two bearings inside the wheels upon the top of a T headed vertical arm, of a connecting bar or auxiliary axle, cranked downward to mount the connecting beam and operating gear as low as possible. The connecting beam is rigidly attached to the hind auxiliary axle, and to the front one by a saddle, fifth wheels, and a king bolt. The front cranked axles are each connected to a hand lever, pivoted on the top of a standard, supported on the auxiliary axles, and rising to a suitable hight for being worked by hand by a person in a standing position, or nearly so, above the connecting bar. The double acting connections will, it is believed, cause a more uniform action of the force on the crank than a single connection will. The hind crank axles are connected to the cranked treadles, pivoted to the connecting beam by links, and the treadles extend forward under the seat, and a little in front of it where they have each a foot piece, mounted on a pivot, with a spring under it conveniently for being acted upon by the feet of the operator, partly sitting on the seat and partly standing on the treadles, and at the same time working the hand levers. The carriage is guided by mechanism, actuated by an oscillatory movement of the body. It is believed that a carriage constructed and operated on this plan, by which both the power of the legs and arms can be applied, being made light and with large wheels, may be propelled at a high rate of speed.

FIRE ESCAPE LADDER.—Carl Gustav Buttkereit, Toledo, Iowa.—This ladder is composed of U shaped metallic sections, so connected that each side bar of one section embraces or is coiled around the side bars of the next, which thus allows the ladder to be packed in a small space or extended with great facility. The sections are connected so they can slide on one another, and be contracted into a small space, and a long ladder can be preserved in a box close to a window to be thrown out when needed. The rounds of the ladder are the middle parts of the sections, and may be enlarged, if desired, by having plates or steps secured to them. The ends of each section, coiled around the upright parts of the next section below, may be extended out laterally, to form braces against and keep the ladder a desired distance from the wall. The ladder, if used as a fire escape, can be suspended by a pin from the inner side of the window. This pin may be readily drawn out, after the ladder has been used, by pulling on a cord which is suspended from it. Then, by an extension rod, the ladder may be held up to another window to assist in the escape of others.

LADDER.—George W. Willis, of Atchison, Kansas.—This invention relates to improvement in the class of ladders which are provided with an extensible foot or leg, whereby they are adapted to stand upon inclined or uneven surfaces. The lower end of one of the side bars of the ladder is sawn off, so as to make it shorter than the other. A rod or bar, which may be made tubular, if desired, to combine lightness with strength has upon it a foot, which may be the piece sawn from the side bar. The rod passes through and works up and down in keepers attached to the side of the shorter side bar. The rod has a knob or handle formed upon or attached to its upper end for convenience in raising or lowering it. Upon the outer side of the rod are formed teeth upon which a pawl takes hold to hold the said rod securely in any position in which it may be moved. The pawl is pivoted to lugs formed upon the keeper, and its engaging end is held against the teeth of the rod by a spring. The rod may be kept from turning upon the side bar by flanges or wings attached to it. By this construction the ladder can be readily adjusted to stand firmly upon an uneven or inclined surface.

GOVERNOR.—John S. Warren, of Fishkill-on-the-Hudson, N. Y.—Balls and links move a collar vertically in the governor shaft in the usual way. The collar carries a sleeve which revolves with the governor shaft. To the upper and lower ends of this sleeve are keyed bevel friction gears which act upon a bevel friction gear on the end of a horizontal shaft which controls the water wheel gate. When the speed is accelerated, the lower friction gear acts to close the gate, and when the speed slackens, the upper one opens the gate. When the speed is at the proper rate, neither gear acts.

MINERS' BOOTS AND SHOES.—George Latham and John Burton, of Jeddo Pa.—The miner is compelled to work much on his knees, and to lie on his side during the process of working veins of coal. The toe and the sides of his shoes and boots, if not specially protected, soon wear out. Much of the time the miner is compelled to stand in water which holds mineral substances in solution, which are very destructive to leather. Boots and shoes for such hard service, to be durable, must be made different from those for ordinary wear. To accomplish this the inventors re-inforce the toe by a piece of strong leather sewed with the upper securely to the sole. This piece reaches up over the toe two inches, and extends back on each side, with diminished width, not less than one inch, except at termination, and is strongly secured to the upper. A re-inforce counter piece of sole leather at the heel is sewed with the counter to the heel, extending up in the middle of the heel three inches, more or less, and secured to the counter. A metallic plate is riveted to the counter piece and to the upper over the sewing, which not only makes the connection of the two parts strong, but protects the parts from wear when the miner lies on his side, as he frequently does in working veins of coal. The counter extends in a single piece around the heel, and is sewed and protected by the plate on each side With shoes and boots constructed in this manner, it is claimed, the miner much better prepared for the hard labor which he performs than with oot gear of the ordinary construction.

SPRING BED BOTTOM.—Warret Owen and Stephen Harter, of Pierceton, Ind.—This invention has for its object to furnish an improved spring bed bottom, simple, comfortable, and not liable to get out of order, and so constructed as to be level when supporting the weight of the sleepers, and to tend to rise somewhat in the center when the weight is removed, and thus

side bars, wedges, longitudinal slats, cross bars, wires, or equivalent connections and short longitudinal bars with each other, by which the above named advantages are secured.

GIRDER FOR RAILWAYS.—Richard M. Upjohn, of New York city.—This invention relates to a new form of girders and supports for elevated and other railway tracks. Inverted T beams and channel beams are used, and formed of wrought iron, steel, or any other suitable metal. The channel beams may form one or more stories, according to the purpose or use which the girder is to subserve, and are placed on opposite sides of the vertical part of the T beams, so that the lower flanges of the channel beams rest on and are bolted to the base of the T beams, while their upper flanges are bolted to those of the beams resting on them, and so on. The several opposite channel beams are bolted together through the vertical part of the T beam, so that all are firmly bound together. The girder thus formed may be used in all positions, from a vertical to a horizontal, and for any purpose for which girders are employed, the size and weight of parts being varied to suit the conditions of location, etc. The girder is, however, specially adapted to form a support for the track of an elevated railway. In adapting it to this use, the vertical part of the T beam is extended above the channel beams, so as to form a ridge, and an inverted U shaped rail is laid or fitted on the same, and is bolted to the channel beams and the T beam in a suitable manner. The usual provision of slots is made in each length of girder, to permit the bolts to slide, for the expansion and contraction of the beams. Iron plates or tarred felt, sheet lead, or any other suitable material, for the purpose of preventing the transmission of sound from the girder when cars are passing over the track, may be used.

FUNNEL ATTACHMENT FOR LIQUID MEASURES.—Cornelius C. Jadwin, of Honesdale, Pa.—The inventor constructs liquid measures with a funnel instead of the ordinary lip, so that introducing the nozzle into the mouth of a jug, can, or bottle, the latter may be filled conveniently without employing the common funnel, which is usually more or less covered with fluids of previous delivery, and is likely to soil the hands. The improvement will be found specially adapted to measuring vessels for molasses, oils, varnishes etc.

BOAT DETACHING APPARATUS.—Christian Quaritius, of Canarsie, N. Y.—This invention consists of a detachable connection of the hoisting and lowering pulley block tackle with the boat and stop chains in connection with the detaching bolts for pulling them out when the boat strikes the water, or just before, and a drum with a friction brake in the boat, whereon the bight of the "fall" rope between the pulley tackle is wound for paying off therefrom sufficient rope, under the control of one in the boat, to let it down by the friction brake. It is claimed that this arrangement has the advantage of being entirely under the control of the person in the boat, and the rope pays out alike for both ends, of necessity, so that there is no danger of either end falling before the other. Also, that the complete detachment of the boat is insured. This invention has been patented in several countries in Europe, and is highly commended for safety and simplicity of operation.

BOB SLED.—John Wampach, of Shakopee, Minn.—The tongue and the front beam of the forward bob sled are connected together by a chain, the object of which is to apply the draft directly to the beam instead of through the runners, as heretofore, and to do it in such manner as to allow the runners to vibrate freely as much as required without twisting or cramping the connecting device, as it would be if a rod or any rigidly arranged connection was used. The reach which connects the two bolsters is made in two parts jointed together, so that they may work vertically and horizontally, to allow the bobs to work more freely in running over uneven ground. T bars are used to strengthen the connection of the knee posts with the braces and for further strengthening the knees in the lengthwise direction of the sleds, in which they are exposed to very great strains.

MACHINE FOR CUTTING STAVES.—Adam Cook, of St. Clair Borough, Pa.—This invention consists in the adaptation of an improved cutter to stave machines, by which better means for adjusting the hight of the cutter and securing it in place are attained. There has also been made an improvement in the method of holding the plate which carries the guides to the frame so that this plate may be adjusted nearer to the cutter as the guides wear away. This mode of securing the cutter also admits of its more ready removal than the common mode does.

HEATING STOVE.—William H. Landon, of Princeton, Canada.—This invention consists of a combination of an interior fire shell and a damper with that class of stoves comprised mainly of a horizontal elliptical shell with its major axis in a vertical plane, in such manner as is claimed to greatly economize the heat. It also consists of a novel arrangement of ventilating damper. The stove is composed of two end plates of cast iron, of an oval form, the front one having an extension forming a hearth and ash pit, and near the bottom of the hinder one is an opening for a ventilating damper, and also for removing any ashes which may be deposited within the hot air space. On the inner side of these plates, near their edges, a groove is formed in the casing to receive the outer shell, which is made of Russia or other suitable sheet iron. Within the latter there is another parallel groove, extending about three fourths the distance around the stove, to receive the inner shell or fire plate. The space between the shells, which is called the flame flue, is about two inches, more or less. The inner shell or fire plate commences about the center, vertically, of one side, and, curving downward under the fire chamber, upward along the opposite side, terminates at the center of the top, where it is made, by means of a sharp reverse curve, to touch the outer shell, and also to divide the pipe hole into two equal parts. A semicircular damper is placed here, with its crank shaft lying parallel with and touching the top of the fire plate, outside the pipe. This damper, turned in one direction, closes the direct communication between the fire chamber and smoke pipe, and forces the flame into the flame flue and around the shell. When turned in the other direction, such connection is direct, and a strong draft is obtained for kindling the fire or quickening the combustion. The ventilating damper is cast upon a shoe which fits the curve of the shell, on which it rests, and keeps the damper in position.

FERTILIZER.—James Fox and Andrew Fox, of Avoca, N. Y.—An ordinary farm wagon has one of the wheels provided with a belt rim. A long hopper or trough, such as commonly employed on machinery for sowing plaster, is provided with an agitator, a pulley for driving it by a crank, said pulley being worked by a belt, driven by the rim of the wagon wheel, and the crank being connected with said pulley by means of a disk and a shaft. The trough is suspended from the box of the wagon at the under side between the wheels transversely by means of bails, hooked rods and a cross bar, resting on the top, and extending across it and beyond the sides at each end. The hooked rods pass up through holes in the cross bar, and are held by nuts at the top. The trough is provided with pieces on the top, to be held up snugly against the bottom, for steadying it; or the said pieces may rise up between or outside of the side boards, close to them, as preferred. In addition to the central vertical rods of the agitator, bent V shaped rods work near the surface of the sides of the hopper to prevent the plaster clogging them; the said ends being connected to the said sides at the upper ends, and operated by suitable mechanism. The trough is provided with a slide at the bottom for regulating the feed, said slide being provided with screws for working it.

WINDOW SASH SUPPORTER.—Ralph L. Young, of Topeka, Kansas.—The window frame has boxes on each side. Spiral springs are securely attached to the frame at the top of the boxes at their upper ends, and to guide blocks at their lower ends. The inner portion of the boxes is slotted, and a portion of each of the blocks projects through the inner portion of the boxes and into the sash grooves. This portion engages with the sashes by entering a recess or cavity therein. The outer portion of the boxes is grooved, and the blocks have shoulders by which they are kept in the slots and grooves as the sashes are worked up and down. This arrangement is very simple and cheaply made. The springs are claimed to be much more durable than cords, and they work noiselessly.

[OFFICIAL.]

Index of Inventions

For which Letters Patent of the United States were granted

FOR THE WEEK ENDING MARCH 26, 1872, AND EACH BEARING THAT DATE.

Animal matters, treating, M. J. Stein ... 125,111, 125,112
Animal and vegetable substances, drying and curing, M. J. Stein ... 121,982
Auger, H. Pitcher ... 125,076
Bag clasp, traveling, R. W. Chapman ... 124,934
Bales, hay, straw, and other, L. Dodge ... 125,031
Barrel heads, machine for cutting, J. B. Stanhope ... 124,917
Bed bottom and sofa, spring, W. D. Adams ... 124,927
Bedstead, sofa, W. Walcutt ... 124,990
Bee hive, H. A. King ... 124,962
Bell, call, H. A. Dierkes ... 125,029
Blacking and brush holder, E. H. Sweetzer ... 124,984
Boats, method of detaching, L. H. Watson ... 124,923
Boats, etc., apparatus for steering torpedo, J. G. Foster ... 125,039
Boot and shoe, T. T. Hartford ... 125,047
Boiler feeder, automatic, D. Vaughn ... 124,921
Boiler feeder, automatic steam, J. Wheelock ... 125,106
Boiler, water tube steam, C. G. Beitel ... 124,929
Boiler for ranges and other cooking apparatus, back log, B. Hunter ... 124,899
Bowls, lamps, etc., to their stands, attaching, S. S. Barrie ... 125,002
Box, R. B. Davis ... 125,028
Boxes, manufacture of, A. N. Allen ... 124,907
Brace and suspender combined, shoulder, Pratt and Whitney ... 124,913
Braiding machine, J. D. Butler ... 124,882
Brick machine, G. C. Bovey ... 125,012
Brick machine, Phillips and Williams ... 125,075
Brush, whisk, B. S. Blunt ... 125,010
Buckle, trace, J. Lindsey ... 125,060
Burner, gas, S. Gardner ... 125,042
Burner, hydrocarbon, S. J. Whiting ... 124,993
Camera, solar, Dille and Poston ... 125,030
Car axle, J. W. Hard ... 125,046
Car, stock, Z. Street ... 125,097
Car brake and starter, C. M. Hinckley ... 125,049
Cars, brake for railway, Tatzel and Kinn ... 124,985
Carbureting air, apparatus for, G. Reznor ... 125,085
Card, cattle, W. M. Warren ... 124,991
Carriage wheel, M. Johnson ... 125,053
Carriage tires, device for tightening, J. B. West (reissue) ... 4,826
Carriage wheels, to their axles, attaching, W. Elder (reissue) ... 4,830
Carriage wheels, method of securing tires to, P. D. Crosby ... 124,937
Carriages, handle for children's, R. G. Elder (reissue) ... 4,823
Cartridge box, J. Miller ... 125,069
Case, rotary show, T. E. Wood ... 125,109
Centrifugal machine for draining sugar, etc., A. Fesca ... 125,036
Churn, A. J. Cox ... 124,883
Churns, apparatus for operating, D. W. Ketcham ... 124,900
Cigar mold, J. Baxter ... 125,005
Clamp, line, W. A. Ford ... 125,038
Clocks, multiple time dial for, J. F. Niehaus ... 125,073
Cloth, instrument for folding, M. Moschcowitz ... 124,968
Clothes pin, R. W. Huston ... 124,955
Cock, valve, P. C. Rowe ... 125,086
Cock, conical stop, J. E. Jones ... 124,959
Collar, shirt, V. N. Taylor ... 124,920
Composition for coloring leather, L. C. May ... 124,965
Compound for writing fluid, I. Popper ... 125,077
Compound, deodorizing and fertilizing, J. M. Loewenstein ... 124,901
Compound for hardening bar iron, F. E. Blake ... 125,009
Cooking apparatus, back log boiler for ranges and other, B. Hunter ... 124,899
Cord, double stretching strands of banding, T. Unsworth ... 124,988
Corset, children's, Emery and Fuller ... 124,891
Corset, skirt supporting, L. H. Foy, (reissue) ... 4,831
Crib, corn, C. B. Clark ... 125,021
Crib, children's, D. Cox ... 124,884
Crib, folding, A. J. Bettridge ... 124,877
Cultivator, C. Warner ... 124,922
Cultivator, J. W. Spangler ... 125,093
Cultivator, cotton, N. F. Sandelin ... 125,087
Cultivator and potato digger, J. G. Lacy ... 125,057
Derrick, H. S. Blood ... 124,878
Digger, potato, W. Starkey ... 125,094
Dough mixer, A. E. Muth ... 125,072
Drawing board, L. F. Schwenkel ... 125,089
Dredging machine, sand, J. T. Clarkson ... 125,023
Dress goods holder, A. S. Grant ... 124,948
Dryer, Foote and Smith ... 124,944
Dryer, lumber, E. J. Sumner ... 125,098
Drying fruits, etc., F. H. Smith, (reissue) ... 4,834
Electric belt for the body, J. E. Bazault ... 125,006
Electromagnetic apparatus, J. W. Powell ... 125,078
Elevator, M. Hanford ... 124,952
Engine, reciprocating steam, Shepherd and Clark ... 124,980
Engines, valve for steam, J. Watson ... 125,105
Engines, utilizing the exhaust steam of, E. Körting ... 125,056
Epergnes for fruits and flowers, S. S. Barrie ... 125,003
Fabric, pile, G. Crompton ... 124,926
Fare box, portable, J. C. Schooley ... 125,088
Fastener for leather, metallic, H. Beals ... 125,007
Fat, etc., process and apparatus for rendering, M. J. Stein ... 124,983
Fence, L. Moore ... 125,071
Fertilizers, etc., treating sewage for, H. H. Parish ... 125,074
Fertilizing materials from earth, etc., preparing, S. Brown ... 125,017
File, paper, L. P. Keech ... 124,961
Fire extinguisher, T. J. Martin ... 125,063
Fire arm, breech loading, E. Whitney ... 124,994
Fires, apparatus for extinguishing, H. Baker ... 124,875
Flanging machine, G. A. Bowers ... 124,879
Furnace dead plate, A. C. Rand ... 125,080
Game, J. M. Rix ... 124,915
Gas tube support, flexible, A. Honsinger ... 124,897
Gas, apparatus for manufacture of coal, A. M. Giles ... 125,043
Glass ware, mold for, J. H. Reighard ... 125,083
Governor for steam engines, Reynolds and Herreshoff ... 125,084
Grate, stove, B. Franklin ... 125,040
Grate bar, furnace, W. Mellor ... 124,966
Grinder, flock, E. T. Marble ... 124,903
Guard and brush holder, paint, W. T. Bailey ... 124,923
Gun lock, J. C. Dane ... 124,939
Hair restorative, S. M. McNett ... 125,066
Harness pad, J. H. Van Riper ... 125,101
Harness, metallic layer loop for, R. J. Algeo ... 124,996
Harvester, Hay and Shalters, (reissue) ... 4,824, 4,825, 4,826
Heater, car, C. F. Pike ... 24,973
Heater, cotton seed, W. M. Force ... 124,945
Hides, tanning, Carter and Keith ... 125,020
Hoisting apparatus, N. S. McFarland ... 125,064
Hold back, G. F. De Vine ... 124,888
Horses, apparatus for checking, S. S. Ingalls ... 125,052
Hose, waterproof, T. L. Reed ... 124,914
House, drying, J. J. Allen ... 124,998
House, brick drying, G. C. Bovey ... 125,013
Ice cream freezer, T. Weaver ... 124,992
Iron, sad, J. H. Vail ... 125,100
Iron, manufacture of sheet, D. L. Pratt ... 125,079
Jack, lifting, S. McGuffin ... 125,065
Knife cleaner and sharpener, Houmann and Nielson ... 125,059
Knitting machine, H. Guenther ... 124,950
Knobs, rose for door, E. A. Craw ... 124,936
Ladders, combined splice and safety hook for, J. Edmunds ... 124,940
Lamp, E. L. Lamble ... 125,058
Lamp chimney, W. Sedgwick ... 125,090
Last, shoe, W. J. B. Mills, (reissue) ... 4,828
Latch, cupboard, Sparks and Bradford ... 124,981
Latch, reversible, A. D. Judd ... 124,960
Letters on the circumference of metal disks, forming, S. M. Ott ... 124,970
Lifting machine, T. S. Crane ... 124,885
Light, buoy, L. Stevens ... 125,096
Lock for pianos, T. Powers ... 124,912
Locks, key hole guard for, J. M. Alden ... 124,874
Loom shuttle, F. Miller ... 124,967
Loom picking mechanism, H. A. Whitten ... 124,995
Lubricating device, C. Hirsch ... 124,954
Lubricating talc for machinery, A. Bridges ... 125,016
Lubricator, steam engine, J. Foster ... 124,946
Lubricator, steam engine, W. A. Clark ... 125,022
Marrow from hams, apparatus for extracting, W. N. Macqueen ... 125,062
Match box, T. Crommelin ... 124,886
Medical compound, P. R Myers ... 124,910
Milk pail rest, G. C. Taft ... 124,919
Mill, fanning, H. K. Stoner ... 124,918
Music leaf turner, W. Weaver ... 124,924
Nail, picture, S. C. Cary ... 124,933
Nail blanks, punching horseshoe, G. L. Hall ... 125,045
Pans, machine for making, J. Dane, Jr ... 124,938
Pantaloons, stretching board for legs of, E. F. Smith ... 124,916
Paper making machine, Burns and Campbell ... 124,881
Paper, apparatus for stamping and feeding out, Montignani & Gibson ... 125,070
Parer, fruit and vegetable, A. G. Batchelder ... 125,004
Pavement, wood, W. W. Ballard ... 125,001
Pavement, wood, L. Caldwell ... 125,019
Pavement, wood, W. W. Ballard, (reissue) ... 4,822
Photo-engraving on metals, McGill and Pine ... 124,905
Picker, cotton, N. F. Sandelin ... 124,978
Pictures, etc., apparatus for mounting and exhibiting, J. W. Hardie ... 124,953
Pin, shawl and breast, Hockensmith and Coester ... 124,896
Pipes, apparatus for manufacturing tin lined lead, E. W. Newton ... 124,911
Planter, corn, A. Windeck ... 124,926
Planter and cultivator, combined, J. N. Burton ... 125,018
Potash and phosphate of lime, manufacture of, Manwaring & Birch ... 124,964
Pottery ware, etc., process for burning, G. C. Hicks ... 125,048
Preserving sweet potatoes, J. C. Tilton ... 124,987
Preserving meat, Vazquez and Rosenberg ... 125,102
Printing press, T. N. Morse ... 124,907
Pump, J. Bean ... 125,008
Pump, air, W. H. Flanigan ... 125,037
Pump, bucket for chain, W. Hutchison ... 125,051
Railroad tie, A. B. Tripler, (reissue) ... 4,838
Railroad ties, preserving wood for, A. B. Tripler, (reissue) ... 4,837
Railway rail, R. S. Sanborn ... 124,977
Railway rails, machine for straightening, G. I. Kinzel ... 125,055
Refrigerator, E. B. Jewett ... 124,957
Rings, machine for rolling stock for finger, J. S. Palmer ... 124,971
Roofing, metallic, C. Lewando ... 124,963
Rules, perforating edged column, J. C. White ... 124,925
Saddle, harness, V. Borst ... 125,011
Sash holder, A. and L. L. Griffin ... 124,949
Sash holder, Johnson and Bottner ... 124,958
Saw gage, W. P. Miller ... 124,906
Sawing machine, scroll, S. Ide ... 124,956
Scraper, road, E. E. Coy ... 125,025
Separating middlings, machine for, W. R. Middleton, (reissue) ... 4,827
Separator, grain, G. A. Dabney ... 125,027
Separator and bagger, grain, J. J. Bradner ... 125,014
Sewing machines, treadle for, A. H. Wagner ... 125,103
Sewing machines, hemmer for, G. E. Dolton ... 125,033
Sewing machines, ruffling attachment for, G. E. Dolton ... 125,032
Sewing machines, ruffling attachment for, Gray and Joy ... 124,894
Shears, J. Gardner ... 125,041
Shears, R. Renz ... 124,979
Shoemakers, heel block for, J. H. Morton ... 124,908
Shovel, snow, W. P. Wentworth, (reissue) ... 4,829
Signal for railway crossings, C. F. Pike ... 124,974
Slaughtering apparatus, M. Brenner ... 125,018
Sled, J. K. Reichert ... 125,085
Slide, extension, J. Dourson ... 125,054
Soda water draft tube, D. Fergus ... 124,895
Soldering can caps, machine for, W. B. Bishop ... 124,909
Sonnette, G. W. Sherman ... 125,091
Square, attachment to carpenters', J. Dalgleish ... 124,887
Starching machine, P. O'Thayne ... 124,969
Steam generator, H. Howard ... 124,899
Steam generator, T. Merriam ... 125,068
Steam generator, H. M. and J. F. Rulon, (reissue) ... 4,835
Steel, manufacture of, G. F. Wilson ... 125,107
Stool and chair, combined, E. Worch ... 125,110
Stoves, damper regulator for, L. Boore ... 124,931
Sugar, etc., centrifugal machine for draining, A. Fesca ... 125,035
Table slide, extension, S. R. Garner ... 124,947
Tassel, H. C. Lees ... 125,059
Tempering apparatus, H. H. Ray, (reissue) ... 4,829
Tin from scrap, apparatus for separating, F. W. Dorn ... 124,890
Tobacco hanger, A. G. Ferriss ... 124,943
Tobacco machine, J. Scales ... 124,979
Transplanter, J. C. Fuller, (reissue) ... 4,832
Trap, animal, J. Rollins ... 124,976
Trap, fly, L. M. Gould ... 124,951
Trunk lids, stay brace for, S. H. Amidon ... 124,999
Tubes, casing copper, J. F. Guthrie ... 125,044
Umbrella, G. F. Child ... 124,905
Urn, ice and water, E. A. Parker ... 124,972
Valve bucket, A. A. Moulton ... 124,909
Valve, safety, T. D. Rand ... 125,081
Vegetable cutter, J. S. Mace ... 125,061
Vehicle wheels, metallic hub for, S. T. F. Sterick ... 125,095
Veneers, machine for cutting, J. C. Brown ... 124,880
Vessels, rigging for, G. Taylor ... 124,986
Wagon, hay, A. B. Barlow ... 124,876
Wagons, brake lock for, L. and H. Egeberg ... 124,941
Wagons, end gate for, G. Lounsbery ... 124,902
Washing machine, Epstein and Braker ... 125,055
Washing machine, C. Gates ... 124,893
Washing machine, J. Key ... 125,054
Washing machine, G. L. Witsil ... 124,108
Washing machine, J. M. Walker ... 125,104
Washing machine, J. Taylor ... 125,099
Water ejector, steam, Habermehl and Kleiman ... 124,895
Water closets, valve for, W. Smith ... 125,092
Well tube, driven, W. D. Andrews ... 125,000
Wells, tool for enlarging oil, C. Bullock ... 124,932
Whip socket, G. F. De Vine ... 124,889
winding frames, stop motion for, Unsworth and Whalley ... 124,989
Wringer, clothes, R. E. Ferguson ... 124,942
Writing apparatus for the blind, J. R. Coles ... 125,024

DESIGNS PATENTED.

5,705 and 5,706.—CARPETS.—M. Blatchford, Halifax, England.
5,707 to 5,719.—CARPETS.—A. Cowell, Kiddermirster, England.
5,720.—CARPET.—J. C. Johnston, Scarborough, N. Y.
5,721 to 5,723.—CARPETS.—H. S. Kerr, Philadelphia, Pa.
5,724.—OIL CLOTH.—J. Meyer, Lansingburgh, N. Y.
5,725 to 5,727.—OIL CLOTHS.—J. H. Park, Burlington, N. J., Byerly Hart, Philadelphia, Pa.
5,728.—TYPE CASE.—A. H. Bailey, Somerville, Mass.
5,729.—TYPE.—C. E. Heyer, West Roxbury, Mass.
5,730.—CLOCK FRONT.—N. Muller, New York city.
5,731.—BIRD CAGE.—G. R. Osborn, B.A. Drayton, New York city.
5,732 and 5,733.—CHANDELIERS.—F. R. Seidensticker, West Meriden, Conn.

TRADE MARKS REGISTERED.

712.—GIN.—Adams, Blake & Taylor, Boston, Mass.
713.—TICKINGS, ETC.—Amoskeag Manufacturing Co., Manchester, N. H.
714.—PAINTERS' LEAD.—Boston Lead Company, Boston, Mass.
715.—ESSENCE OF GINGER.—F. Brown, Philadelphia, Pa.
716.—COTTON FABRICS, ETC.—Hamilton Woolen Co., Southbridge, Mass.
717 and 718.—HAIR NETS.—A. G. Jennings, New York city.
719.—SHIRTINGS, ETC.—Langdon Manufacturing Co., Manchester, N. H.
720.—TEA.—E. Pavenstedt & Company, New York city.
721.—ROOFING MATERIAL.—New England Felt Roofing Co., Boston, Mass.

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APPLICATIONS FOR EXTENSIONS.

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

20,635.—REPAIRING CAST IRON CYLINDERS.—S. Falkenbury. June 5, 1872.
20,636.—SEWING MACHINE.—A. F. Johnson. June 5, 1872.
20,571.—DOOR LOCK.—J. R. Marston. May 29, 1872.
20,616.—FURNACE.—G. Bantz. June 5, 1872.
20,678.—RESTORING VULCANIZED RUBBER.—F. Baschnagel. June 5, 1872.
20,389.—PLATE FOR SAFES.—I. S. Cady. July 10, 1872.
20,685.—RIVETING MACHINE.—P. B. Tyler, W. Jones, B. Lathrop. June 5, 1872.
20,679.—VAULT COVER.—E. L. Brown. June 5, 1872.
20,672.—CAR SEAT, ETC.—S. C. Case. June 5, 1872.
20,631.—EVAPORATING PAN.—D. M. Cook. June 5, 1872.
16,537.—POWER LOOM.—A. Smith, H. Skinner. May 6, 1872.

EXTENSIONS GRANTED.

19,638.—FLOATING ANCHOR, ETC.—J. Humphries, Washington, D. C.
19,654.—TRIMMING MACHINE.—M. H. Semple, Lowell, Mass.
19,707.—SPRING TESTING MACHINE.—P. G. Gardiner, New York city
19,626.—PHOTOLITHOGRAPHY.—A. G. Butman, Boston, Mass.
19,619.—PLANING BLIND SLATS.—C. Carlisle, Woodstock, L. Worcester Brattleborough, Vt.
19,644.—SAWING MACHINE.—H. L. Low, Galena, Ill.
19,770.—DOLL'S HEAD.—L. Greiner, Philadelphia, Pa.

Practical Hints to Inventors.

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How Can I Obtain a Patent?

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

How Can I Best Secure My Invention?

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

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

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention, if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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Vol. XXVI.—No. 16. [NEW SERIES.] NEW YORK, APRIL 13, 1872. $3 per Annum [IN ADVANCE.]

Improved Method of Propelling Canal boats.

We have heretofore expressed the opinion that screws or paddle wheels at the bows, of boats designed to run in narrow channels, when properly applied would be most likely to effect the propulsion of such boats with economy of power, and without the liability of producing injurious side swells. Our opinion is based partly upon general principles, and partly on experiments performed with the method of propulsion herewith illustrated, which we witnessed some two years since, and which have been recently repeated in our presence. These experiments have confirmed us in what before was merely a theoretical view, derived from the consideration of the nature of the problem.

The boats experimented with were placed first in a channel so narrow that just sufficient space was allowed for their passage without binding at the sides, and subsequently in a wider channel, which gave ample room for the generation of side swells, as these would have been produced by any of the ordinary modes of propulsion.

The propeller is a hollow, water tight drum, with paddles upon its outer surface, as shown in Fig. 1. The paddles are bent or inclined from the ends of the drum to the middle, where they form an obtuse angle, as shown, being obtusely V shaped, the outer ends coming in contact with the water first, and the immersion of the blade taking place gradually and without shock. A little space is left between their inner edges and the periphery of the drum. This construction inclines the water moved by the paddles toward the center, and aids the wings, which extend from the bow to each side of the paddle wheel, in collecting and displacing the water longitudinally under the bottom of the boat, as shown in Fig. 2.

Another effect produced by this shape of the paddles is that they rise from the water without lifting it, as the straight paddle or bucket does, the easy inclination of the paddle giving the water more time to escape.

The boat is a flat bottomed scow, the bow turning up in circular form, as shown in Fig. 2. It has a rudder at the stern; and it is proposed to put one also at the bow, in order that the boat may be made to move laterally and obliquely, while its longitudinal axis shall remain parallel to itself, which will be a great convenience in getting close to docks, etc. The bow rudder will also be very convenient in turning sharp bends in canals.

Before describing the experiments referred to, we will make some general remarks on the propulsion of boats, which will render the results of the experiments more intelligible.

Fig. 2

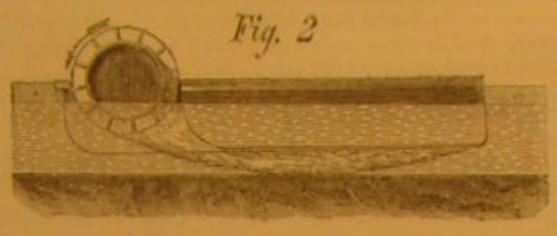


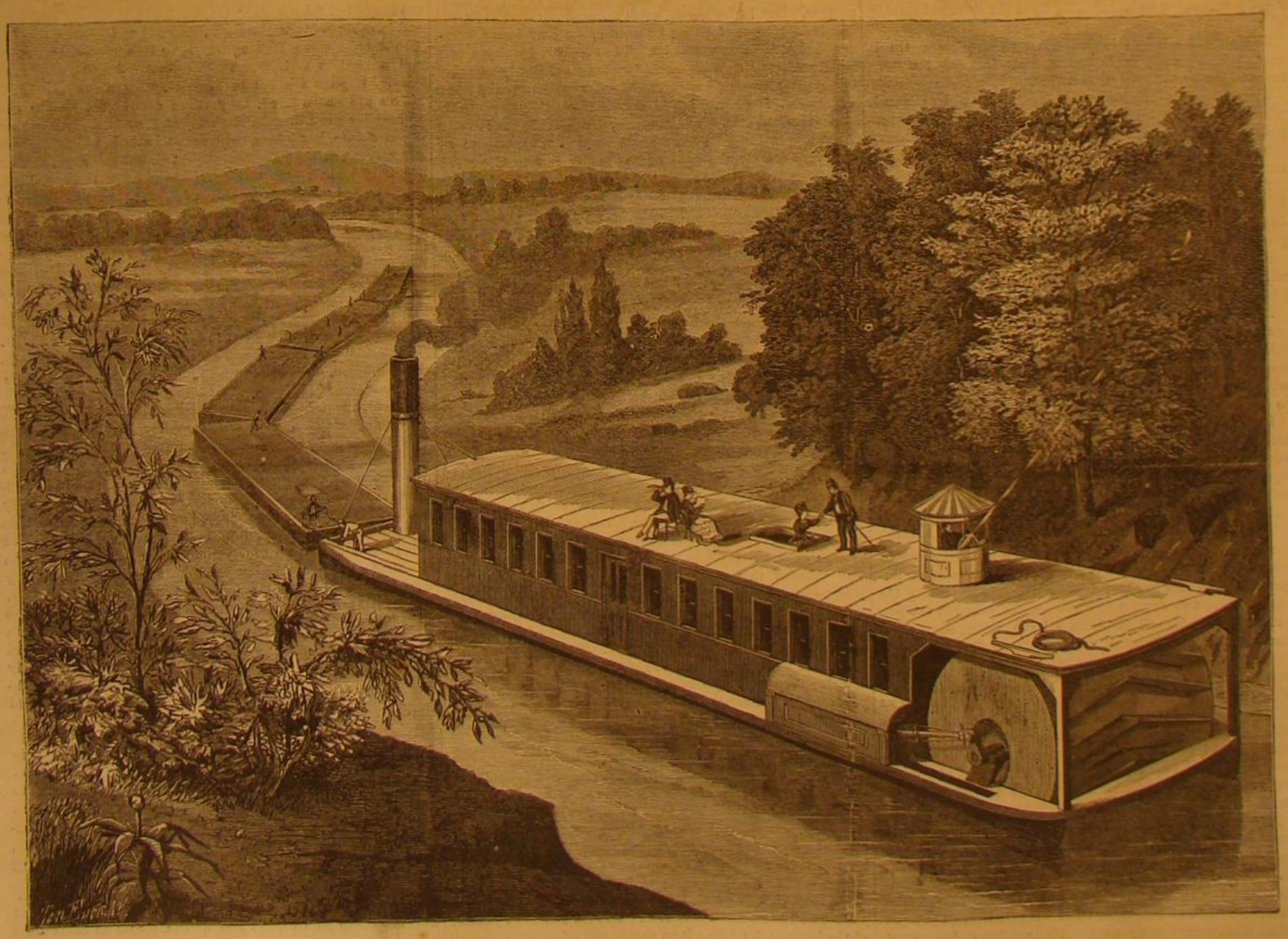
Fig. 3



Let the reader bear in mind that the combined weight of a boat and its cargo is just equal to that of the water it displaces in floating. If the boat weighs, say, fifty tuns and carries a cargo of two hundred tuns, then there is a displacement of two hundred and fifty tuns of water. Theoretically, this weight of water must be displaced from the front to the rear of the boat, or a horizontal distance equal to the boat's length, for every time the boat advances its length, and the power required to do this and to overcome the friction on the sides of the boat (skin friction) is the very minimum required for its propulsion. But as power is force expended through distance in time, it *follows* that, as the velocity of advance increases, not only must the amount of water displaced increase in the same ratio, but the velocity with which the displacement is effected also increases in the same ratio. The forces required to impart different velocities to a body is as the squares of these velocities; so that to move the same amount of water the same distance with twice a given velocity would require four times the expenditure of force necessary to move it at the given lesser velocity. But as in the advance of a boat the amount of water displaced increases also directly with the velocity, we have velocity again entering as a factor in the product of force expended, so that the latter is as the cube of the velocity. This principle is enunciated, in books on physics, as follows: "The resistance of any medium, to the motion of a body moving therein, will be as the cube of the velocity with which the body moves."

This law holding good for displacement of water laterally, which displacement does not aid the boat's advance, we may say that the waste of power in propelling boats also increases as the cube of the velocity. It is well known that, with steamboats or locomotives, a given number of miles can be accomplished at low speed with a consumption of much less fuel than would be the case were the same distance passed over at high speed, the variation confirming the law laid down.

As the boat can only advance by the longitudinal displacement of water, it has been the study of naval constructors to eliminate, as far as possible, all other displacement; and to this end, the modeling of vessels and the construction of screws and paddle wheels have received the most profound attention, and all the aids which science affords have been brought to bear upon the subject. The inventor of the method of propulsion under consideration does practically remove lateral displacement. With a propeller wheel or screw at the



GOODWIN'S METHOD OF PROPELLING CANAL BOATS.

stern, with side wheels, or with a tow line, the displacement of water in front of a vessel takes place more or less laterally, and it flows by the action of gravity into the chasm made by the advancing vessel. With blunt bowed vessels, a certain portion is displaced in the direction of the advance of the vessel. The action of these displacements is to produce an inclined plane, up which the boat must, so to speak, climb, so that gravity acts constantly against progress. The stern is lowered, as shown in Fig. 3 while the bow is raised. This effect increases as the channel narrows, so that, if the latter be only wide enough for the boat to pass, the water would be heaped up in front; and if the channel be only deep enough to float the vessel, the water would be caused to overflow the banks in front, while the stern of the boat would ground on the bottom.

The water only being able to reach the stern and get behind by flowing under the bottom, and doing this only by virtue of its own gravity, the speed of the boat would be limited to that at which a volume equal to the displacement of the boat can find its way from the bow to the stern under the bottom, when acted upon by gravity. Thus if, in a channel seven feet deep, the boat draws six feet of water, the water must flow through under the boat by the action of gravity with a velocity six times as great as that at which the boat is advancing. But the action of gravity, which is uniform, cannot be hurried. A body falling one second moves sixteen and one twelfth feet and no more. The velocity of flow under the boat will be that due to the difference in depth of water before and after the boat; and as this can be much increased only by an enormous expenditure of power, to attempt to tow a boat in such a channel as we have described, or to propel it at the stern, is a practical impossibility. Widening the channel, we can force it along, but as the displacement now takes place by the sides of the boat instead of under it, side swells result, with waste of power and other attendant evils. These swells are the result of the manner in which the displacement takes place; and sharp models may lessen, but cannot wholly obviate them.

With the Goodwin bow propeller, illustrated herewith, all these effects are reversed; the displacement is under the bottom, and is caused not by gravity, but by the power of the propeller. An inclined plane is created which is the highest at the stern, so that gravity acts with instead of against progress. There are no side swells, and the boat runs as well or even better in a channel just wide enough for it to pass as in one wider.

Experiment 1.—The boat was placed in such a narrow channel as described, and a tow line attached. Result—the water was heaped up in front, overflowing the banks, and the boat only moved fast enough to create the overflow.

Experiment 2.—Power applied to the stern with same effect.

Experiment 3.—Propeller wheel in front. The boat made rapid progress, the water bubbling up at the stern but making no side swells.

Experiment 4.—Boat loaded down at the stern till it grounded. Propeller set in motion, when instantly the stern rose and the boat moved on as before.

Experiment 5.—The boat was placed in a wider channel, when it moved as before without side swells. When propelled from the stern, or drawn by a tow line, it gave heavy side swells, and moved much more slowly with an expenditure of the same power.

Experiment 6.—The boat was heavily grounded from bow to stern. Upon starting the propeller, she gradually rose and moved forward slowly, grounding again, alternately grounding and rising, but still making a fair rate of progress.

Experiment 7.—The narrow channel was filled to the brim, when the boat, moderately loaded, traversed it at high speed, producing scarcely a perceptible overflow of the banks.

Experiment 8.—A precisely similar boat, with three screws, propelled by the same power, at the bow instead of the propeller wheel, moved at less velocity through the channel, producing head and side swells. Grounded like the boat with the propeller wheel in experiment 6, she was powerless to move.

Experiment 9.—The boat with propeller wheel at the bow was attached to the stern of the boat with the screws at the bow. Both having the same power applied, and carrying equal loads, the propeller wheel boat towed the screw propeller boat stern foremost nearly as fast as the screw propeller boat could advance singly by the action of her screws.

The reason for this lies in the fact that the screws throw the water from the upper half of their reacting surface directly against the breast of the boat, and that the water tangentially displaced by them avails nothing in propelling the boat. These two sources of waste are not found in the bow paddle wheel, since it displaces all the water, except that carried about by friction, tangentially and in just the right direction for propelling the boat. A very large percentage of its power is therefore utilized for propulsion, while a large proportion of the power applied to the screws is lost. Indeed, the first experiments of Mr. Goodwin were with bow screws, but the decided superiority of the bow paddle wheel was so evident upon comparison of the two systems as to lead to an abandonment of the idea of propelling boats in narrow channels by screws at either bow or stern.

Another advantage of the drum paddle wheel is that its buoyancy and the increased buoyancy it imparts, to the boat when in motion, compensate for the room it occupies, while the screws are additional load to be carried.

Captain Goodwin is an experienced navigator of the Ohio river, on which, as well as on other western rivers, stern propeller wheels are largely used. He found that, in attempting to cross bars, he could get over by turning the boat and running stern foremost, when he would ground with the bow on, and also that in narrow channels he could make better speed by running stern foremost. This having been confirmed by trials on the part of others, we are told the practice has been adopted by many, and is gaining in favor.

As we have remarked, we are confident that for narrow channels and shallow water this system of propulsion offers advantages possessed by no other yet produced. Arrangements are now on foot to test the principle by practical working on canals with full sized boats, the inventor being confident that under such circumstances he will be able to prove the value of his invention to the most incredulous. Captain W. F. Goodwin's address is 91 Liberty street, New York, of whom further information may be had on application. See advertisement in another column.

THE REMINGTON WORKS, ILION, N. Y.

The Remington armory comprises twenty five different buildings, which occupy twenty-three acres of land in the heart of the town of Ilion. Two races, running from States Creek to the Erie Canal, pass through the works and furnish them with a valuable amount of water power. Not so very long ago the works, for a whole month together, turned out on an average 1,400 rifles and 300 revolver pistols a day. This was, of course, exceptional; but the average capacity of the works is rated by the firm at 1,100 rifles and 200 pistols a day. The firm have now contracts on hand which compel them to produce over 1,000 rifles a day. But in addition to this great production, the Remingtons make any number of rifles, guns or pistols to special patterns; and shot guns and fowling pieces all over the world.

The Remington rifle is a breech loader, of apparent simplicity but demanding the most skillful construction. This arm has been introduced in most of the armies of the world.

HOW THE BARRELS ARE MADE.

When I was at Ilion yesterday, a short, thick bar of steel, about six inches long and four inches in diameter, was placed in my hand. It was bored. "From Sheffield in England; that is the embryo gun barrel," I was told.

A workman produced one of these same bars, red hot from a heating furnace, ran a rod with a shoulder to it through the bore, and hurried with it to a rolling mill. Through it went, coming out longer, but preserving the bore, the rod left behind by reason of the shoulder preventing its passing through the rollers. Another rod was put in, again the growing barrel went through, and the process was repeated sixteen times, till there was the gun barrel in the rough.

The boring of it, after the quality of the metal, is the great thing. This and rifling are the most important features. The making of the locks, triggers, stocks, etc. is, in these days, purely a matter of mechanical operation; unless the automatic machinery goes wrong, they must be according to pattern. But in boring and rifling, mechanical skill is the one desideratum; if either be untrue, the barrel may burst, or the shot fail the truest aim. The rifling is done by a very small cold steel chisel inserted in a long rod firmly attached to a rapidly revolving wheel, which also moves up and down a platform. The barrel is run over this rod and placed firmly in position. As the wheel revolves, the chisel in the rod cuts the rifling in the barrel; and as the wheel advances and retires very rapidly, the twist of the rifling is very elongated The appearance of the rifling on looking through a barrel is very much like a long piece of apple paring. The next process is the polishing. This is done by a simple contrivance which polishes any number at one time. Several guns are attached to a machine which works up and down, each barrel passing through an expanding and contracting band of leather, well covered with emery powder, and outside a rod which simultaneously polishes the inside. From the polishing room the barrels are taken to the testing room, where they are put to the severest test. Two men work this department. They load forty barrels at a time, with 280 grains of powder and 500 grains of lead in each, and carry them into a small room, arranged for the purpose, to be all discharged at once. They are placed in position, wedged, and held down by a heavy beam. A train of powder is then laid to all the touch holes, every one hurrying out, and all is ready. The whole thing looks like an improvised mitrailleuse. The double doors having been carefully closed, the tester strikes a small rod of iron, protruding through the wooden partition, with a hammer. The rod is driven into a percussion cap at the end of the train of powder and the explosion of the charges in all the rifles immediately occurs. The value of this test is very great, the ordinary charge being seventy grains of lead. The barrels are afterward tested with 150 grains of powder to see if they have been strained by the first test. The roof and walls of the testing room show that gun barrels can burst. The barrels are then steeped in boiling acids, which give them the peculiar shade of color they generally have. The mottled appearance is produced by heating them in boxes filled with charcoal, and then dashing them, while red hot, into a solution of ammonia.

MAKING THE BAYONETS.

In other buildings, the rolling, tempering and polishing of the bayonets is carried on. The steel bar to be converted into a bayonet is passed through a succession of rollers with dies on them, each successive die being longer and smaller, and approaching more nearly in shape to the bayonet, as it leaves the last roller. The whole operation is similar, to a great extent, to rolling angle or bridge iron; with the exception that the shape is given by a pattern die, on the rollers, instead of by pattern of the rollers themselves. The slots in the shoulder of the bayonet, for fixing it on the barrel of the rifle, are all cut by punches. The polishing is done on the emery wheels.

STEAM STREET CARS.

One of the prominent features in the Remington character is restless activity. If business flags a little in the gun trade, they immediately turn the use of some of their innumerable machine shops to the production of other manufactures. After the close of the French war, they converted one of their buildings into a sewing machine factory, and are now able to turn out 500 machines a week, their gun lathes and drills being particularly suitable for working the smaller parts of a sewing machine. They have also quite lately taken up the construction of Mr. Baxter's new steam cars for street railroads, and have contracted to build 100 of them. Two will be completed within a month. The advocates of these cars, in summing up their advantages over the ordinary horse car, say that the boilers are entirely safe, and burn the smoke perfectly. There is no noise or puffing of steam, and the car can be stopped and started in half the time required by the horse cars, and can be run as slow or fast as may be desired; while the cost of fuel is less than half (in proportion to power) of that for any locomotive or dummy ever made. But the great point in the invention is its being able to ascend grades up to 400 feet to the mile, (1 in 13) without any complication of gearing or machinery, but having a simple direct connection similar to a locomotive. It does not do this by the force of momentum, but can be stopped and started on any part of the grade without difficulty. In fact, it can do all that the horse car can, and do it much better, and at a small fraction of the expense, both in first cost and in the running, and will actually save more than all the cost of the horses and their keeping.

THE REMINGTON AGRICULTURAL WORKS.

Here you see mowers, reapers, plows, hoes and rakes being made by thousands, all the work being done by machinery. I saw a lump of steel converted into a square hoe, and another into a heart shaped one, in what an Irishman would call "no time." I saw them tempered and polished. I saw them tested, and they were almost as pliable as a Damascus blade. I stood for several minutes in solemn contemplation of about 500 plow shares, and my respect for plow shares has increased immeasurably.

These Remington agricultural works sold last year, 2,500 mowers and reapers, 5,000 plows, 500 cultivators, 30,000 cultivator teeth, and a large number of hoes and rakes. The last item is always an exceedingly variable one. During the six years the works have been in full operation, they have made as few as 10,000, and as many as 23,000 hoes in one year.

But, even here, the Remington restless activity displays itself. I saw some cotton gins being put together, and inquired what they were doing there. The reply was: "Oh, we make cotton gins of a superior kind here. We often make two hundred or three hundred gins a year." In the foundery, I saw men at work on heavy iron beams. "What are they for?" I asked. "Oh, we build bridges about here and in other parts of the State, railroad and other bridges." The fact is these Remingtons inherit a mechanical spirit and a restless activity. They cannot be otherwise than busy. If guns are not in demand, they make pistols; if pistols are not wanted, they make cartridges; should cartridges become a drug in the market, they burst out in sewing machines, horse cars, cotton gins, bridges, plows, mowers and reapers, or anything else that strikes their fancy, or that Col. Squire, their able and energetic director in New York, may suggest. They have created Ilion; they are bound to see that Ilion gets along, and they attend to their own and Ilion's business. They build churches and homes; they give $100,000 or more to colleges, they treat their workmen like fellow creatures, and Ilion shies its cap in the air for the Remingtons and the Remington works.—*Correspondence New York Times.*

Bromine Water as a Test for Phenol (Carbolic Acid).

If we add bromine water in excess to a dilute aqueous solution of phenol, a yellowish white precipitate of tribromophenol appears. If the amount of bromine water added is insufficient, the precipitate disappears again. The reaction is very delicate. If one part of carbolic acid be present in 43,700 parts of water, or 0.0229 gramme in a litre, there appears, on adding the bromine water, a distinct turbidity. No other re-agent hitherto known is capable of detecting such minute traces of phenol. The method may be advantageously applied for detecting the presence of coal tar contaminations in potable waters. Acid liquids, before the application of this re-agent, must be nearly neutralized. To ascertain, in doubtful cases, whether the precipitate thus produced really contains phenol, it is filtered, washed, and put in a test glass, heated slightly with sodium amalgam, and shaken. If the liquid is then poured out into a small basin, and mixed with dilute sulphuric acid, the characteristic odor of phenol appears, and the acid itself separates out in minute oily drops. If phenol is suspected in urine or sewage, it is advisable to distil, when the phenol will be found concentrated in the first portion which passes over.

AUSTRALIAN LOCOMOTIVES.—Australia is making very rapid progress in the arts, and is destined ultimately to become a great center of civilization. The latest advance is the manufacture of locomotives. Three locomotives have been built at Ballarat, and three at Melbourne. They were constructed for the North Eastern Railway line, and are said, to have demonstrated the economy of hereafter building rather than importing locomotives.

THE very best way to clean a stained steel knife is to cut a solid potato in two, dip one of the pieces in brick dust (such as is usually used for knife cleaning), and rub the blade with it.

DIAMOND CUTTING IN NEW YORK.

According the *American Watchmaker's, Jeweler's, and Silversmith's Journal*, the New York Diamond Company has commenced the business of cutting and polishing diamonds, and the promise is good for its success. The premises are in 15th street, near Broadway.

The business is divided into three entirely distinct and separate branches. First, there is the cleaver or splitter, called the *klover*; then the cutter, or *snyder*; and, lastly, the polisher, or *slyper*. So much skill is required of each that it is hardly possible to imagine that any one could combine the three trades perfectly. The splitter or cleaver must be a person of the quickest possible perception. Seizing a stone, he looks at it quickly, and decides instantly in his mind how the stone must be cut, so as to give it the greatest weight and brilliancy. Instantly he detects any flaws, or *strix* or streaks in it; judges in a moment what minute fragments must be cut off in order to get rid of these flaws, and must be so thoroughly acquainted with his subject as to be able to tell whether the imperfection is at the surface or in the heart of the stone. As to color, he knows at once whether it will turn out of pure water or not. He must be both bold and cautious. Having decided in his own mind what that stone of a carat or more will turn out—having even calculated to a nicety how much the clippings of the rough diamond will be worth, whether they will make little brilliants or flat rose diamonds—he secures the stone in a wooden stick, the gem being held by a cement made of rosin and pounded brick dust. Taking another diamond, or a fragment of one before split, having a sharp edge, he secures it in another stick precisely in the same way. Steadying his two hands over a small wooden box, lined with brass, which has at the bottom a sieve to secure the precious dust, he applies the knife edge of one diamond to the face of the other. It cuts rapidly—there is a distinct notch made. Showing us the stone he is about to cut (in this instance a fine one of about two carats), he points out to us a minute flaw on its surface, which he proposes to remove. It might be ground off. But if this slow process was employed, it would take two or three days, may be a week, and that portion of the diamond capable of being turned into a pretty little rose diamond be lost. Now he takes something like a steel ruler, with a perfectly flat, square edge, about six inches long and say a sixteenth thick, places first this rule, not on the stone, but on the line where the cleavage ought to be; considers a moment, then, having as it were taken his aim, he deftly, with an instantaneous movement, places it in the little notch cut in the diamond, with the other hand seizes a small steel rod, something like the pestle to a mortar, gives the ruler or knife one, two quick taps, and, showing us the stone, there is a distinct, perfectly straight split. Now, warming his cement, he takes the stone out, now divided into two parts; he has taken off a piece which, it is true, is very small, but in looking at it closely we see he has cut right through a fault, and has so got rid of an imperfection. It is not difficult to describe, but the skill, accuracy, judgment and coolness required is wonderful. The stone might be worth in the rough $100 or $10,000; the process is the same. A single error on the part of the cleaver, an ignorance of the nature of the stone, or of what it ought to be like when perfect, might spoil for his employers more in one minute than they could make up in months.

The cleaver having determined what shape the diamond shall have, it is handed over to the cutter. The diamonds are secured precisely in the same sticks, and held over exactly the same kind of box. The stone to be shaped is held in the left hand, though both stones are in process of cutting. The thumbs are closely braced, the left hand being protected by a leather glove The process is a very slow one; the cleavage had a *presto* quick artistic slight of hand in it, but this has a dull plodding look. Slowly the faces are abraded as the two diamonds are ground together. In this condition they have not the least appearance of beauty; if, when split up by the *klover*, they still retained some little sheen and glitter, here they look like bits of very poor smoky glass, about as brilliant as a cinder. The shape required is approximated. Stones we saw, ready for the polishers, were rather more roughened out, apparently, than conforming to the required forms. It is a long and tedious process, requiring no end of patience and judgment.

After this, we visited the polishing rooms. Seated, before revolving steel disks running parallel with the floor, sat a number of men all intent at their tasks, the tables turning noiselessly with a speed of 2,000 revolutions to the minute. They were begrimed with oil. Each man held in his mouth something that looked like a tooth pick, which he complacently chewed. This they would dip occasionally into a little glass vessel containing an olive colored mixture, made of oil and diamond powder. A drop of this they would apply to the diamond they were polishing. The first process was that of soldering the stone into a brass cup, the solder rising above it until it looked like a big acorn, the stone being as the apex. To do this properly, to follow each workman through his work, and to present each facet in its proper position, seemed to us the acme of skill. Taking a tiny stone, the fractional part of a carat, but, minute little thing as it was, having no less than sixty-four distinct surfaces to be smoothed, a workman who does nothing else but fix the stones seized it between his forceps, placed it in its proper position in the solder, now in a plastic state, and heedless of burnt fingers, shaped the yielding mass of metal around it until it was thoroughly secured; then taking it, still hot, he plunged it into water, where the metal hissed; and we thought this workman must be endowed with salamander qualities. Taking the precious acorn with its diamond point, the polisher now commenced his work. First he touched the point with the olive oil and diamond dust, and felt with the end of his finger the exact position. It seems to us that in this process the senses have to play entirely novel functions. The polisher's eyes are apparently of little use, but the sense of touch has been so exquisitely educated that it supplies the other faculty. Placing the stone in the acorn with its point downward, he clamps it in a wooden rest, the diamond just touching the revolving wheel. To produce pressure, he puts on the wooden rest pieces of lead, weighing perhaps four or five pounds; sometimes he has the weight of three or four on it. One diamond at a time is not sufficient to absorb his attention: he has three, all mounted at the same time, going together. Occasionally he takes one of the rests off, and plunges the acorn into some water to cool it, looks at it a moment, feels it with his finger, and puts it down again. Sometimes he seems to be paying a certain slight amount of attention to the plate, looking at the streak the stone makes on the revolving disk. This seems to be all the process, only this and nothing more. Little does the observer imagine the years of assiduous and patient toil it has required to acquire this proficiency. All the workmen are Israelites, all from Holland. Those who understand the business inform us that from generation to generation they have carried on this trade, and that the persistency of this remarkable people, the dogged perseverance which they are famous for, has alone made them proficient in this branch of art. It may take months of this patient, monotonous toil to perfect a single stone of any size. Sometimes it happens that a surface is presented to them which defies even the mordant qualities of any other diamond powder. They may grind and grind away for months, and the smooth, glittering surface will not come. They have come across a bit of the poetical adamant. Still they work on with it; they will make it brilliant. It passes from hand to hand, from wheel to wheel. Everybody has tried it, and everybody has given it up. But still they keep on trying. Suddenly a bright little speck appears—you could cover it with the point of a cambric needle. The obdurate hide is getting worked off, and human patience is triumphant, and a magnificent luster rewards their labors.

African stones are particularly hard and obstinate, and give much more trouble than South American ones. The company have already a large proportion of the business of repairing diamonds. It happens frequently, even with the most skillful workmen, that in setting a stone an edge is chipped off or roughened, and requires some slight remodeling Again, when soldering and plunging into water a piece of jewelry containing a diamond, from the too sudden change of temperature, a film appears, on the surface of the diamond, which dims its luster. It then requires repolishing. Fires may occur, and diamonds subjected to a long heat lose their sparkle, and want retouching. All these accidents give constant employment; but it is rather with the idea of taking stones in the rough, making a market in New York for rough diamonds, and of bringing these productions to the utmost pitch of skilled perfection we would treat—and this has been fully accomplished by the New York Diamond Company.

Walking.

Walking briskly, with an exciting object of pleasant interest ahead, is the most healthful of all forms of exercise except that of encouragingly remunerative, steady labor in the open air; and yet multitudes in the city, whose health urgently requires exercise, seldom walk when they can ride if the distance is a mile or more. It is worse in the country, especially with the well-to-do; a horse or carriage must be brought to the door even if less distances have to be passed. Under the conditions first named, walking is a bliss; it gives animation to the mind, it vivifies the circulation, it paints the cheek and sparkles the eye, and wakes up the whole being, physical, mental, and moral.

We know a family of children in this city who, from the age of seven, had to walk nearly two miles to school, winter and summer; whether sleet, or storm, or rain, or burning sun, they made it an ambition never to stay away from school on account of the weather, and never to be "late;" and one of them was heard to boast that in seven years it had never been necessary to give an "excuse" for being one minute behind the time, even although in winter it was necessary to dress by gaslight. They did not average two days' sickness in a year, and later they thought nothing of walking twelve miles at a time in the Swiss mountains. Sometimes they would be caught in drenching rains, and wet to the skin; on such occasions they made it a point to do one thing—let it rain,—and trudged on more vigorously until every thread was dry before they reached home.

There is no unmedicinal remedy known to men of more value in the prevention of constipation than a few miles' joyous walking; let one follow it up a week—a walk of two or three miles in the forenoon, and as much in the afternoon—and, except in rare cases, when a longer continuance may be made, the result will be triumphant; and yet nine persons out of ten would rather give a dollar a bottle for some nauseous drops or poisonous pills than take the trouble to put in practice the natural remedy of walking. Nor is there an anodyne among all the drugs in the world which is the hundredth part so efficacious, in securing refreshing, healthful, delicious, glorious sleep, as a judicious walk.—*Hall's Journal of Health.*

Stopping Pinholes in Lead Pipe.

A correspondent in the *Industrial Monthly* writes: "The supply water pipe which extends from the street, along the top of our cellar to the sink in the kitchen, had a very small hole in one side, so that a stream of water spun out, not so large as a cambric needle. If I had known that the difficulty could have been remedied by placing the square end of a tenpenny nail on the hole and hitting it two or three light blows with a hammer, the knowledge would have saved me much trouble and expense. But I did not know that a small hole in a lead pipe can be stopped by battering the metal just enough to close the orifice, therefore I went and called a plumber. Of course he was employed by the day. He knew how to stop the issue in less than one minute; but he preferred to make a good job for himself and for his employer. He was too proud to be seen carrying his solder and tools along the street; hence a helper must be detailed to carry these appliances. His employer paid him twenty cents per hour, but charged sixty cents per hour for his services. He paid the helper ten cents per hour, and charged forty cents, whether they were loitering along the streets, or at work. They looked around, lit their pipes, smoked and chatted, and used about four ounces of solder, for which the charge was fifty cents, as they reported they had used one pound. The plumber reported one hour each for himself and helper. Thus the cost of stopping one pinhole cost me $1.50, when any one who can handle a hammer could have closed the issue in half a minute if he had thought of how to do it."

Bones and Bone Meal.

The complaint of fraud in the manufacture of commercial manures gives rise to many questions concerning the manufacture of bones into some available form by the farmer himself. This is a very important subject and yet it is one beset by many difficulties. To a majority of farmers in this country, bones are the only reliable source of supply to replace the phosphates carried away by the annual exportation of grain, beef and pork. But bones broken into fragments of not more than an ounce in weight each will, under ordinary circumstances, remain in the soil undecomposed for half a century, and consequently but little benefit will be derived from their use. Bones, to be of immediate value, must be ground fine; but this with "raw bones" is a very difficult process. Bones subjected to the action of high steam lose all their oil, and a large portion of the gelatin which so obstructs the grinding, and thus become brittle, and are quite easily ground in a common mill. The same end can be reached more directly by burning the bones, the waste being merely the animal matter contained in them. The phosphate of lime is unaffected by either steaming or burning.

The mineral part of the bones, thus separated, will be found to consist substantially of 45 per cent of phosphoric acid and 55 of lime. This compound is insoluble in pure water, and but very sparingly soluble in rain water charged with carbonic acid. If we take this "bone phosphate" and add to it a little more than half its weight of sulphuric acid (commercial oil of vitriol), we will in a few days produce a new compound, in which the sulphuric acid has removed two thirds of the lime from the bones, combining with it to form gypsum, supplying the place of the lime thus removed with water. This is a true soluble superphosphate. Its elements are:

Phosphoric acid	66·39
Lime (calcium)	23·93
Water	15·38
	100.00

This mass will be found very tenacious, and somewhat difficult to handle. To remedy this it should be mixed, in sufficient quantities to render it dry, with some good absorbent, such as dry swamp muck reduced to a powder, or with ground charcoal, or even with road dust. Lime or ashes should never be used for this purpose.

Several farmers can co-operate in the construction of a mill, and thus produce the bone meal which they use at prime cost. From this, they can make their own superphosphate, and use it either by itself or mixed with composted manure.

But bones may be reduced to a very fine state of division by use of strong wood ashes, and thus, presenting a large surface to the solvent action of water and carbonic acid in the soil, may be of great value in maintaining fertility. We suggest the following formula for using bones with ashes:

Ground bones	100 pounds.
Strong wood ashes	400 pounds.
Soda saltpeter	70 pounds.
Epsom salts	10 pounds.

Dissolve the soda saltpeter and Epsom salts in sufficient water to thoroughly moisten the ashes and bone meal. Mix well, and let it stand ten days, stirring it daily. Use some absorbent, such as dry muck pulverized, to dry the mass and reduce it to powder.

German potash (150 pounds) may be substituted for the ashes, in whole or in part. This amount used on an acre will have a marked effect on the crop.—*R. T. Brown.*

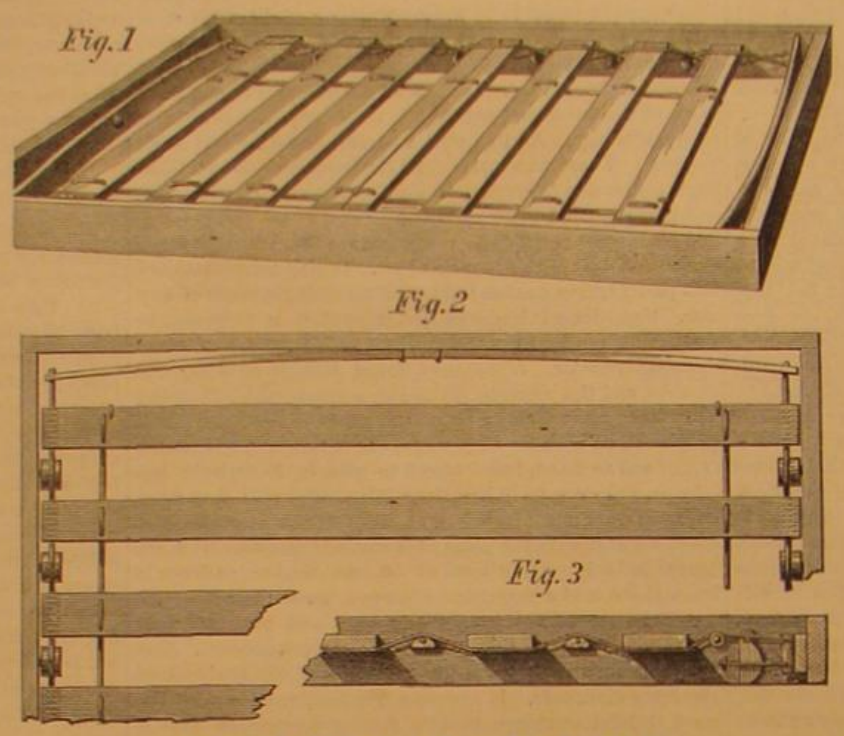
Fastening Loose Window Sashes.

The most convenient way to prevent loose window sashes from rattling unpleasantly when the wind blows is to make four one sided buttons of wood, and screw them to the stops which are nailed to the face casings of the window, making each button of proper length to press the side of the sash outwards when the end of the button is turned down horizontally. The buttons operate like a cam. By having them of the correct length to crowd the stiles of the sash outwards against the outer stop of the window frame, the sash will not only be held so firmly that it cannot rattle, but the crack which admitted dust and a current of cold air will be closed so tightly that no window strips will be required. The buttons should be placed about half way from the upper to the lower end of each stile of the sashes.—*Industrial Monthly.*

Adjustable Spring Bed Bottom.

The principal object of this invention is to make the slat bottoms, of the common slat bedstead, elastic, so that it may be used in place of the cumbrous spring bed bottom frame now in use, with the additional advantage that it may be made hard or soft at pleasure, to suit the season. It is claimed that it can be put up or taken down as quick, and will occupy as little space, as any other bedstead bottom, and that it can be made of cheap materials.

The engraving represents two styles of bedstead. Fig. 1 is a view of a bed bottom employing the double or endless bearing cord used for crosswise slats. Figs. 2 and 3 are detail views of a bed bottom having a single bearing cord used for the lengthwise slats. Two spring bars with grooved ends (one may be used), made fast at their centers to opposite sides of the bedstead, on the rails, communicate their motions by means of the bearing cord or cords passing over pins or rollers between the ends of the slats on the inside of rails, the bar acting like an archer's bow. In the double or endless cord for the crosswise arrangement, both cords rest in two grooves or pins, but divide and pass on each side of the slats and around the end of the spring bars, in such a way that the end strain bears up alternate slats. The adjacent slats, then resting on different cords, do not interfere with each other's vibration. The cord never touches the upper surface of the slats, for the weight of the mattrass depresses the slats between the pins, and keeps them in the centers of the spaces. The web of slats need not be fast in any way to the bedstead, as represented, but can be lifted off and rolled up. With lengthwise slats, the single cords will answer, for the reason that the weight of the occupant comes on but few slats. The cord is not attached to the spring bar, but passes around the end, and is brought back a few inches and made fast to a screw in the bed rail. As the bearing cord always slips on the end of the spring bars, the motion is multiplied, so that a little spring in the spring bars gives great elasticity to the slats, and the bars and slats can be made of the cheapest material, pine, spruce, or fir answering perfectly for this purpose.



ADJUSTABLE SPRING BED BOTTOM

There is a groove on the under side of the slats, which are held in position by two small stay cords passing through two converging holes in such a way that, although loose in the holes, there will be no slipping if the cord is made taut, as it should be. At each corner of the bedstead there is, on the rail, an oblong button, nearly in front of the end of the spring bar, and by turning this up against the end of the bar, the bearing cord is made taut, thus rendering the bed hard for hot weather.

When no spring bars are used, the double bearing cord is passed around rollers placed on screws in the bed posts. This makes a very cheap spring bed. The reciprocating motions of the slats allow them to adjust themselves to the varying shapes of occupants of the bed. The slats can also be used, divided, the halves being held apart by a piece of cord to make them more elastic.

This invention is covered by two patents, dated August 15, 1871, and Feb. 27, 1872, taken out through the Scientific American Patent Agency. The patentee, being a disabled soldier and not able to attend to active business, would like to correspond with parties for the sale of rights, at moderate prices. For further information address Geo. Brownlee, Princeton, Ind.

THE BALTIMORE BOILER INSPECTION LAW.

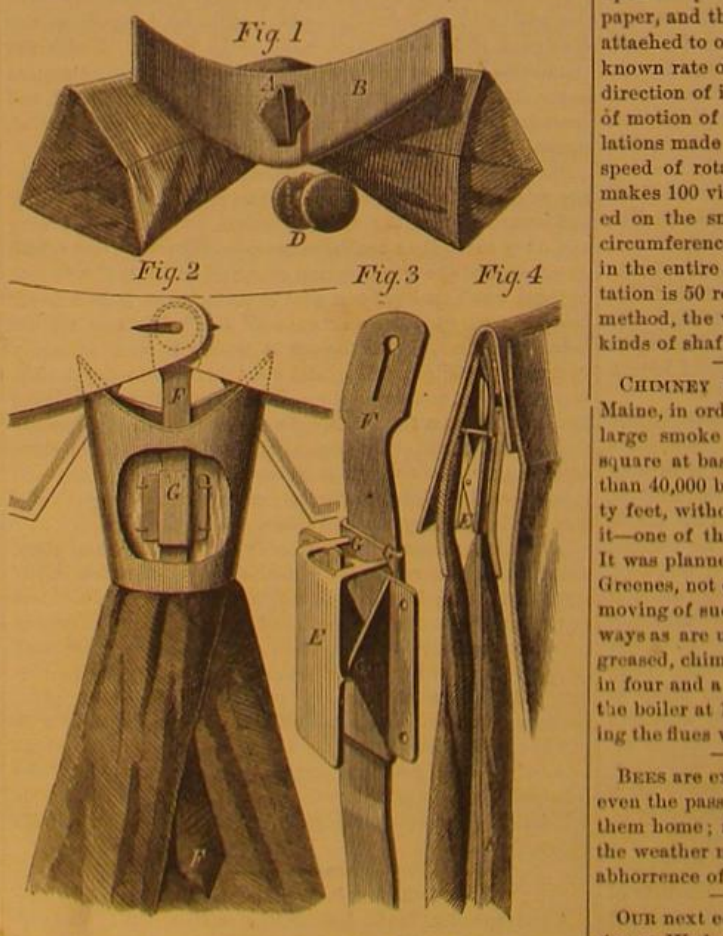
At the last session of the Maryland Legislature, a bill was passed authorising the appointment, by the governor, of two inspectors of boilers for the city of Baltimore. It names, as the qualifications of these inspectors, that they shall be well skilled in the construction and use of steam engines and boilers, and fixes their salary at fifteen hundred dollars per annum. With this munificent provision for their support they are to be content, and not to engage in the manufacture of steam boilers, engines or machinery applicable thereto, and are not to receive any money, gift, gratuity or consideration from any person or persons. With the kind of inspectors and inspection likely to be obtained from any ability such salaries will secure, the Baltimoreans might, in our opinion, about as well be without any. The other features of the bill are not objectionable.

Blood Crystals.

An interesting volume has just been published by M. W. Preyer, on blood crystals. Though blood crystals were first observed by Hünefeld, the merit of discovering them is due to Reichert, who first recognized their nature. The fact of the crystallization of a complex organic substance like blood was first received with some amount of incredulity, but the corroborative testimony of many microscopists soon cleared away all doubt, and a variety of methods were suggested by which the crystals could be obtained. The best plan for obtaining them is thus given by M. Preyer: The blood is received into a cup, allowed to coagulate, and placed in a cool room for twenty-four hours. The serum is then poured off, and a gentle current of cold distilled water passed over the finely divided clot placed upon a filter, until the filtrate gives scarcely any precipitate with bichloride of mercury. A current of warm water (30°—40° Cent.) is now poured on the clot, and the filtrate received in a large cylinder standing in ice. Of this a small quantity is taken, and alcohol added, drop by drop, till a precipitate falls from which an estimate may be made of the quantity required to be added to the whole without producing a precipitate. The mixture, still placed in ice, after the lapse of a few hours, furnishes a rich crop of crystals. The forms of the crystals obtained from the blood of different animals do not vary to any great extent, and are all reducible to the rhombic and hexagonal systems. The vast majority are rhombic prisms, more or less resembling that of man. The squirrel, however, with several of the rodentia, as the mouse and rat, and the hamster, are hexagonal. The hæmoglobin of several corpuscles is required to form a single crystal. All blood crystals are double refracting. The animals whose blood has been hitherto examined and found to crystallize are—man, monkey, bat, hedgehog, mole, cat, lion, puma, fox, dog, guinea pig, squirrel, mouse, rat, rabbit, hamster, marmot, ox, sheep, horse, pig, owl, raven, crow, lark, sparrow, pigeon, goose, lizard, tortoise, serpent, frog, dobule, carp, barbel, bream, rudd, perch, herring, flounder, pike, garpike, earthworm, and nephelis. The spectrum of blood-coloring matter when oxidized, with its two absorption *striæ* between D and E of Fraunhofer's lines or in the yellow part of the ordinary spectrum, and the single band of deoxidized hæmoglobin, are now well known. Preyer states he has not been able to obtain a spectrum from a single blood corpuscle, but that the characteristic bands are visible where certainly only a very few are present.

FASTENINGS FOR NECK TIES, SCARFS, ETC.

Much annoyance is often experienced through the inefficiency and unsatisfactory character of the fastening used for attaching these to the button or stud of the neck band. If at first they answer the purpose, they soon get out of order so as to need constant adjustment, which soils the ties and, in addition to the inconvenience caused by it, renders these articles much less serviceable than they would be with a more positive and reliable fastening which it is the object of the present invention to provide.



A, Fig. 1, is a fastening for all that class of neck wear known as bows, ties, etc., and consists of the sheet metal hook, A, securely fixed to the shield, B, by clinching. To provide a suitable hold for the hook, and at the same time prevent the metal from soiling the linen, a stud, Fig. 2, is provided, having a slot or dovetailed slit passing through or across the head, at right angles to the shank, as shown at D The hook, fitting the slot neatly, forms a durable, cheap, and easily adjusted fastening. E, Fig. 3, is a fastening for all that class of neck wear that furnishes a hiding place for the clasp, and tape, as shown in Fig. 4. The clasp, E, Fig. 3, is firmly fixed inside the shell of the scarf. The tape, F, Figs. 2 and 3, with button hole in one end, passes through the clasp, E, Fig. 3, in such manner that when the spring, concealed within said clasp, is allowed to assert its force, the sharp points, G, penetrate the tape and hold it fast. By pressing open the clasp, as shown in Fig. 3, the scarf may be passed freely up and down the tape, and stopped and retained at any desired point thereon. In use the tape is pulled out)Fig. 4) and fixed to the shirt collar button. Then, by pressing open the clasp with one hand and grasping the lower end of the tape with the other, the scarf is passed to its place; the clasp being then released, the spring forces the points into the tape and holds it fast. In use this arrangement has been found to answer the purpose admirably. Patented December 13, 1870.

For further information address the patentee, Wm. A. Wicks, 129 Jefferson street, Baltimore, Md.

Dyeing Leather.

Picric acid gives a good yellow without any mordant; it must be used in very dilute solution, and not warmer than 70° Fah. so as not to penetrate the leather. Anilin blue modifies this color to a fine green. In dyeing the leather, the temperature of 85° Fah. must never be exceeded.

Anilin green is well adapted to dyeing leather, and its application is quite simple. Whether used in paste or as powder, we must make a concentrated aqueous solution.

The leather is brushed over with a solution of sulphate of ammonia, mixed with water, the dye solution applied at 95° Fah., and it must be endeavored, by rapid manipulation, to prevent the dye from penetrating through the leather. By the addition of picric acid, the blueish shade of this dye stuff is modified to leaf green, and it becomes faster; but the picric acid must not be added to the color solution; it must be applied to the leather before or after the dyeing with anilin green.—*F. Springmuhl.*

MEASURING THE VELOCITY OF ROTATION.

Professor A. E. Dolbear suggests, in the *American Journal of Science*, a simple and effective method of determining the velocity of rotation of wheels and shafts. Upon the face or upon the periphery of the rotating object, he fastens smoked paper, and this he touches with a point of rubber which is attaehed to one branch of a vibrating tuning fork, having a known rate of vibration. The fork is to be so held that the direction of its vibrations will be at right angles to the line of motion of the shaft. By counting the number of undulalations made on a given extent of the smoked paper the speed of rotation is at once indicated. Thus if the fork makes 100 vibrations in a second and one vibration is recorded on the smoked paper in a space covering one half the circumference of the wheel or shaft, or two vibrations within the entire circumference, it is evident that the rate of rotation is 50 revolutions per second. By this simple and easy method, the velocity of rotation of gyroscope disks and of all kinds of shafts and wheels may be readily ascertained.

CHIMNEY MOVING.—The Cabot Company, of Brunswick, Maine, in order to enlarge their cotton mill, moved their large smoke stack chimney—78 feet high, 7 feet 9 inches square at base, and 5 feet square at top—containing more than 40,000 bricks and weighing more than 100 tuns—twenty feet, without rollers or balls, or guys or braces to steady it—one of the greatest feats ever performed in the State. It was planned and carried out by Superintendent Benjamin Greenes, not one of those engaged having ever witnessed the moving of such a body. It was accomplished by building such ways as are used in launching ships, surfaces planed, and greased, chimney wedged up, and moved by two jack screws in four and a half hours. The flues were disconnected from the boiler at 1 o'clock P. M., and at 9½ o'clock the same evening the flues were again connected, fires going, and steam up.

BEES are exceedingly susceptible of atmospheric changes; even the passage of a heavy cloud over the sun will drive them home; and if an easterly wind prevails, however fine the weather may otherwise be, they have a sort of rheumatic abhorrence of its influence and abide at home.

OUR next eclipse of the sun will take place soon after sunrise on Wednesday, Sept. 29th, 1875. Visible north of North Carolina and east of the Mississippi.

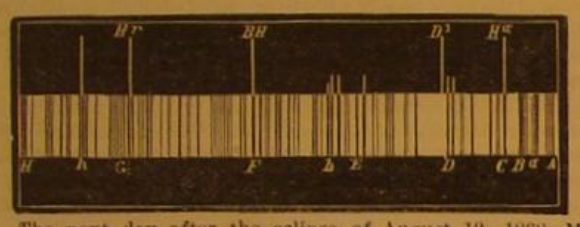
AT Denver, Colorado, on the 29th of July, 1878, at 3½ P. M. there will be a total eclipse of the sun lasting nearly three minutes.

[For the Scientific American.]

THE DISCOVERY AND HISTORY OF THE CHROMOSPHERE.

BY J. H. LEACH, OF DARTMOUTH COLLEGE.

Extensive preparations had been made to observe the chromosphere and prominences during the eclipse of 1868. The spectroscope, for the first time, was directed toward these mysterious flames about which there had been so much discussion. They were about to disclose the secret of their composition. The observers, stationed at different points along the path of the eclipse, met with general success. A spectrum of bright lines was found to be given by the chromosphere and prominences, although at this time the word chromosphere had not been invented, and that envelope which now bears the name had not, in reality, been distinguished as an envelope or atmosphere separate from the photosphere; yet a red light had been seen around the sun, and it was this which gave the bright lines. The spectrum of bright lines seen at once showed that this envelope must be gaseous and existing at a very high temperature. To M. Janssen, the well known astronomer, belongs the honor of succeeding in seeing the bright lines when the sun was shining in full splendor; Mr. Lockyer attempted, independently, to discern these lines, but failed, owing to defective instruments. The difficulty to be surmounted was this: the brightness of full sunlight eclipsed the comparatively feeble light given off by the prominences and chromosphere; how to get rid of this intense light was the problem. If a beam of sunlight be passed through a prism of glass, it will be dispersed, giving a spectrum of a certain length and brightness. Now if instead of one, two or more prisms be used, there will be an increase in the length of the spectrum and a corresponding diminution of its brightness. Now, as the spectrum of the chromosphere and its appendages is not a continuous spectrum but a spectrum of bright lines, the only effect which an increase in the number of prisms used could have would be that of more widely separating the lines, not to any great extent diminishing their brilliancy. Mr. Lockyer hoped, by using a sufficient number of prisms, to be able to see the prominences; for after toning down the glare of the solar spectrum, as given by one prism, he expected to see a monochromatic image, of the prominences he should examine, in each of the lines given by the prominences. As stated above, he failed, not because his theory was wrong, but because of the imperfection of the instruments he used.



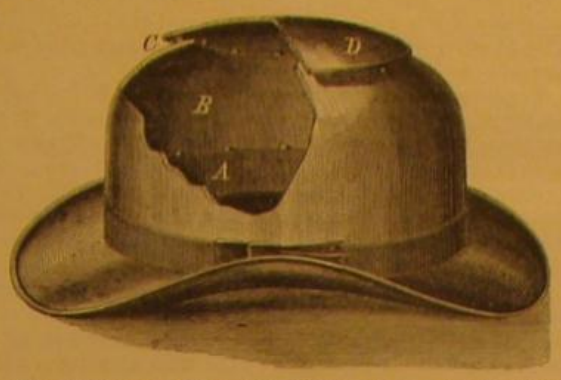
The next day after the eclipse of August 19, 1868, M Janssen tried the experiment and succeeded. There were the bright lines. Astronomers could now examine the prominences at their leisure. That which could be investigated heretofore only during an eclipse would now become a subject of daily study; in fact, M. Janssen had proved that it was possible to produce in effect a total eclipse whenever desired, providing the sun shone clear of clouds.

The next question which engaged astronomers was that of the coincidence of the lines seen with those given by some known gas or gases. Sodium and other metals had been proved to exist in the sun long before. Kirchoff had discovered the law that every body has the power of absorbing such light as it emits. The coincidence of the bright lines given by the vapor of sodium with the *D* lines in the solar spectrum had been announced. The coincidence of the chromospheric lines with certain dark lines in the solar spectrum was soon established. The line, marked *Ha* in the engraving, was found to coincide with the *C* line of Kirchoff's map. *BH* with *F*, and *Hy* with a line near *G*. These lines were coincident with those given by glowing hydrogen, and as they were the most prominent and the brightest, hydrogen was announced as being the chief constituent of the prominences and chromosphere. Another line was seen in the orange part of the spectrum, which at first was thought to be the sodium line *D*; but this was a mistake, and the line was soon found to be more refrangible than D. This line has been called the *D3* line. What is the nature of the substance which produces it is still unknown; it is found whenever the prominences and chromosphere are examined. Other lines are sometimes seen, such as the sodium and magnesium lines. These are, however, generally found in the lower portions of the prominences and in the chromosphere proper, rarely being seen in the more elevated portions of the prominences, probably by reason of the greater gravity of the vapors of these metals over hydrogen gas. Continued observation showed that the sun was surrounded by immense masses of hydrogen, ejected from the chromosphere, which were continually changing their form, bursting out, now here, now there; and when we consider that only a small portion of the sun's surface can be examined on any one day, only the edge or limb, it is apparent that innumerable outbursts occur of which we have no knowledge.

Of the mighty forces which are at work in that orb, which has been justly termed the ruler, fire, light, and life of the planetary system, we can have no conception: of the forces which have the power of hurling immense masses of matter to the hight of hundreds of thousands of miles, and at a velocity with which we are entirely unacquainted. That the chromosphere is the abiding place of terrific cyclonic storms, and (if we may be allowed the expression) volcanic eruptions, is a fact beyond doubt; daily evidence meets our eyes attesting to the turmoil going on therein.

HEARD'S VENTILATING HAT.

Not only in tropical climates, but in the torrid temperature of midsummer, experienced in our latitude, will such an invention, as the one illustrated in our engraving, be found of great service and comfort. The overheating of the head has often resulted in total prostration and even death, while undoubtedly many lesser disturbances of the general health are indirectly caused by it, not to speak of the great discomfor, resulting from a heavy almost air-tight head covering, in hot weather. While it is requisite that the head should be protected from the direct rays of the sun, it is also desirable that the air should have free access to all parts of the scalp, thus keeping it cool, carrying off the perspiration, and obviating not only the greater evils above alluded to, but the minor one of baldness, which is greatly hastened by overheating.



The making of a few perforations at the top of the crown of a hat does not really make a ventilating hat. To ventilate an air space requires either very much larger openings than these, in proportion to the space to be ventilated, or else openings below as well as above, so that the currents of heated air rising may meet opposing descending currents, and may be freely replaced by cooler air entering at the bottom.

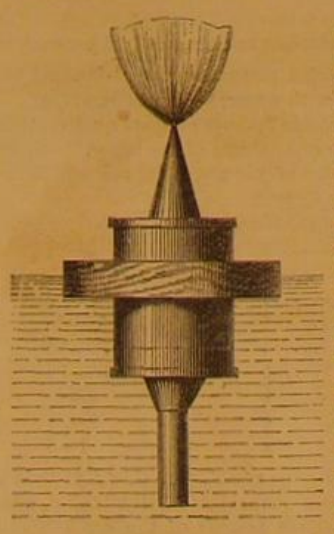
Now, in this hat, these principles are fully carried out. Air enters through an annular space formed between the sweat band, A, and the exterior, B. Rising equally about all parts of the head, it passes out of the opening, C, which extends entirely about the top of the crown, the part, D, overlapping the part, B, so as to exclude rain.

The hat may be made of any suitable material, and the ventilating device does not, as will be seen, interfere with conformability to reigning styles.

The invention was patented May 24, 1870, by Dr. Joseph M. Heard, then of Aberdeen, Miss., but now of West Point, Miss., whom those desirous of manufacturing on royalty may address for further particulars.

INEXTINGUISHABLE SIGNAL LIGHT.

In a Belgian exchange, the *Chronique de l'Industrie*, we find the description of an interesting little invention, which has found favor with the Grand Duke Constantine, of Russia, and has been adopted into the naval service of that country. It is a signal light of peculiar properties, being ignited by water, and, although unable to ignite other objects, not to be extinguished by wind or water. It is said to produce a very powerful and brilliant light, which can be observed at a great distance and retains its illuminating quality, though in small compass, for a considerable leng h of time.



The apparatus, an invention of N.T. Holmes, consists of a sheet metal cylinder, having a conical top and a tube of about six inches in length projecting from its bottom. It is filled with phosphate of calcium, which is prepared in the following manner: Pieces of chalk are put into a crucible, together with a quantity of amorphous phosphorus, and then brought to a white heat. The chalk, becoming incandescent, absorbs the vapors of phosphorus, and thereby becomes phosphate of chalk. The apparatus, when filled with this substance, is hermetically closed and preserves it for an indefinite period.

When to be used, the top of the cone is cut off, and a hole bored through the end of the pendent tube. A float is connected with the cylinder in the manner shown in the engraving, and then launched. The water, entering the tube, causes the phosphate of calcium to decompose and to generate a quantity of gas, which, escaping at the top, is ignited by contact with the air, and remains so until the contents have been entirely consumed. It is stated that the London Board of Trade has recommended the adoption of these signals in place of the blue danger signals at present in use in the commercial navy, experiments having proved the superiority of this ingenious invention.

HOW TO PRESERVE SOAP GREASE.—Fill a cask half full of good strong lye and drop all refuse grease therein. Stir up the mixture once a week.

[For the Scientific American.]

COMBINED CAST IRON AND WROUGHT IRON ARCH GIRDERS.

A cast iron arch girder is considered as a long column subject to a certain amount of bending strain, and the resistance will be governed by the laws affecting the strength of beams, as well as those relating to the strength of columns. By reason of the slight curvilinear form of the cast iron arch girders, so much in general use, they will not compare as favorably with the laws governing columns as with those governing beams.

The metallic arch in one piece differs materially from a stone or brick arch. In the latter, by the use of separate blocks, the capacity of the material to resist compression only is exerted; while, with the use of an arch of any material in one piece, both extension and compression are brought into play.

A stone or brick arch is an arrangement of blocks (*voussoirs*) set in a curvilinear form, each block separate from the other, and subject only to compression. The greater the weight placed upon the arch, the more compressed and compact these *voussoirs* become. Their resultant pressure, or the thrust of the arch, is received by piers or abutments at the extremities; and, should a slight yield of the abutment take place, it would only cause a further setting of the *voussoirs*, and not affect the strength of the arch in the same degree that would be caused by the elongation of the wrought iron tie rod in a cast iron arch girder, as the deflection of the latter is not great before rupture takes place, and a slight elongation of the rod causes considerable deflection.

Most materials used in the construction of arches have a much greater capacity to resist compression than to resist extension; and it is obvious that this system of *voussoirs*, when made of a material whose resistance to compression is greater than to extension, has an advantage over those in which the material is used in one piece. As wrought iron possesses the property of greater resistance to extension than to compression, its use is analogous that of a tie rod.

In the cast iron arch girder, both extension and compression are exerted, as on a straight beam, and these are the greatest at those points which are most distant from the neutral axis of cross section; hence the point of rupture will occur at one of these two extremes.

In cast iron, the resistance of compression is to that of extension in the ratio of six and a half to one; and, being a rigid, crystalline, unmalleable substance, weak in its resistance to extension as compared to that to compression, it becomes a matter of calculation, which should be based upon



experiment, to adjust the malleable wrought iron tie, which has a certain degree of extensibility, coming into play in proportion as the girder is loaded. These girders, as ordinarily constructed, have the arch or casting in one piece, with grooves at the ends to receive the wrought iron tie rods; the latter, being a little shorter, are expanded by heat and then placed in position in the casting, and allowed to contract in cooling, to tie the bottom of the casting, thus acting as an abutment to receive the horizontal thrust of the arch. If the tie rod should be too long, it does not receive the full proportion of the strain until the cast iron has so far deflected that its lower edge is subject to a severe tensile strain which cast iron is feeble to resist.

If, as is more frequently the case, the tie rod is made too short, it is subject to severe initial strain, which is added, to the strain proper induced by the load, to produce rupture. Wrought iron is extended about a one thousandth part of its length by every ten tuns of direct strain per square inch of cross section, which is the limit of elasticity of the best iron, as eight tuns per square inch is for ordinary iron. Therefore, a cast iron arch girder, with wrought iron tension rod, cannot be considered as an elastic arch confined between fixed abutments.

The usual careless manner in which these wrought iron tie rods are adjusted to the cast iron arches, ordinarily one quarter of an inch and occasionally three eighths of an inch less in length than the recess made in the casting for their reception, thus detracting from their capacity to resist strain and causing the cast iron arch to camber or the rod to elongate—usually both—with want of knowledge of the proper proportion of the cast iron arch to the tie rod, imperfect castings, bad welds, and great atmospheric changes, are the causes of the several failures of these girders in this city during the past few years. The last case of this kind occurred in a building on the southeast corner of 56th street and Sixth avenue, New York, on the 28th of last November. The thermometer had fallen 22° in a few hours, and the three inch rod of the girder parted at the weld. This girder, whose distance between the supports was about 25 feet, was marked to sustain 125 tuns, and broke with a load of about 60 tuns. It was set up in the building just before the enforcement of the law requiring it to be tested.

In view of these facts and the observations I have made in testing about 270 of these girders, I conclude that, as ordinarily made, in proportioning the wrought iron tie to the cast iron arch, one square inch of cross section of tie rod should be allowed for every ten net tuns of load imposed upon the span of the arch. Regarding the arch as flexible, or as possessing no inherent stiffness, and the tie rod as a chord without weight, the following formula is proper:

Let S equal span in feet; V the versed sine in feet; U the

uniform load per foot of span; H the horizontal thrust or strain; then $H = \frac{U S^2}{8V}$

P. H. JACKSON,
Inspector of Iron Construction, Department of Buildings, New York city.

[For the Scientific American.]

FRICTIONAL GEARING.

BY E. S. WICKLIN.

NUMBER II.

To select the best material, for driving pulleys in friction gearing, has required considerable experience; nor is it certain that this object has yet been attained. Few, if any, well arranged and careful experiments have been made with a view of determining the comparative value of different materials as a frictional medium for driving iron pulleys. The various theories and notions of builders have, however, caused the application to this use of several varieties of wood, and also of leather, india rubber, and paper; and thus an opportunity has been given to judge of their different degrees of efficiency. The materials most easily obtained, and most used, are the different varieties of wood, and of these several have given good results.

For driving light machinery, running at high speed, as in sash, door, and blind factories, basswood, the linden of the Southern and Middle States (*Tilia Americana*), has been found to possess good qualities, having considerable durability and being unsurpassed in the smoothness and softness of its movement. Cotton wood (*populus monilifera*) has been tried for small machinery with results somewhat similar to those of basswood, but is found to be more affected by atmospheric changes. And even white pine makes a driving surface which is, considering the softness of the wood, of astonishing efficiency and durability. But for all heavy work, where from twenty to sixty horse power is transmitted by a single contact, soft maple (*acer rubrum*) has, at present, no rival. Driving pulleys of this wood, if correctly proportioned and well built, will run for years with no perceptible wear.

For very small pulleys, leather is an excellent driver and is very durable; and rubber also possesses great adhesion as a driver; but a surface of soft rubber undoubtedly requires more power than one of a less elastic substance.

Recently paper has been introduced as a driver for small machinery, and has been applied in some situations where the test was most severe; and the remarkable manner in which it has thus far withstood the severity of these tests appears to point to it as the most efficient material yet tried.

The proportioning of friction pulleys to the work required and their substantial and accurate construction are matters of perhaps more importance than the selection of material. The mechanic who thinks he can put up frictional gearing temporarily and cheaply will make it a failure. Leather belts may be made to submit to all manner of abuse, but it is not so with friction pulleys. They must be most accurately and substantially made, and put up and kept in perfect line.

All large drivers, say from four to ten feet diameter and from twelve to thirty inch face, should have rims of soft maple six or seven inches deep. These should be made up of plank, one and a half or two inches thick, cut into "cants," one sixth, eighth, or tenth of the circle, so as to place the grain of the wood as nearly as practicable in the direction of the circumference. The cants should be closely fitted, and put together with white lead or glue, strongly nailed and bolted. The wooden rim, thus made up to within about three inches of the width required for the finished pulley, is mounted upon one or two heavy iron "spiders," with six or eight radial arms. If the pulley is above six feet in diameter, there should be eight arms, and two spiders when the width of face is more than eighteen inches.

Upon the ends of the arms are flat "pads," which should be of just sufficient width to extend across the inner face of the wooden rim, as described; that is, three inches less than the width of the finished pulley. These pads are gained into the inner side of the rim; the gains being cut large enough to admit keys under and beside the pads. When the keys are well driven, strong "lag" screws are put through the ends of the arm into the rim. This done, an additional "round" is put upon each side of the rim to cover bolt heads and secure the keys from ever working out. The pulley is now put to its place on the shaft and keyed, the edges trued up, and the face turned off with the utmost exactness.

For small drivers, the best construction is to make an iron pulley of about eight inches less diameter and three inches less face than the pulley required. Have four lugs, about an inch square, cast across the face of this pulley. Make a wooden rim, four inches deep, with face equal to that of the iron pulley, and the inside diameter equal to the outer diameter of the iron. Drive this rim snugly on over the rim of the iron pulley having cut gains to receive the lugs, together with a hard wood key beside each. Now add a *round* of cants upon each side, with their inner diameter less than the first, so as to cover the iron rim. If the pulley is designed for heavy work, the wood should be maple, and should be well fastened by lag screws put through the iron rim; but for light work, it may be of basswood or pine, and the lag screws omitted. But in all cases, the wood should be thoroughly seasoned.

In the early use of friction gearing, when it was used only as backing gear in saw mills, and for hoisting in grist mills, the pulleys were made so as to present the end of the wood to the surface; and we occasionally yet meet with an instance where they are so made. But such pulleys never run so smoothly nor drive so well as those made with the fiber more nearly in a line with the work. Besides, it is much more difficult to make up a pulley with the grain placed radially, and to secure it so that the blocks will not split when put to heavy work, than it is to make it up as above described.

As to the width of face required in friction gearing: When the drivers are of maple, a width of face equal to that required for a good leather belt (single) to do the same work is sufficient. Or, to speak more definitely, when the travel of the surface is equal to twelve hundred feet per minute, the width of face should be at least one inch for each horse power to be transmitted, and for drivers of basswood or pine, one and a half to two inches.

The driven pulleys, as before stated, are wholly of iron. They are similar to belt pulleys but much heavier, having more arms and stronger rim. The arm should be straight rather than curved, and there should be two sets of arms when the face of the pulley is above sixteen inches. For the proportion of these pulleys, a very good rule is to make the thickness of rim two and a half per cent of the diameter, that is, when the pulley is forty inches diameter, the rim should be an inch thick.

To secure perfect accuracy, these pulleys must be fitted and turned upon the shaft; and when large, should rest in journal boxes in the latter while being turned. If simply swung upon the lathe centers, they are liable to vary while the work is being done. When turned exactly true, round and smooth, these pulleys must be carefully and accurately balanced. The neglect of this last essential point has worked the destruction of otherwise well made friction pulleys.

When thus constructed, there is a beauty about the movement of this gearing, which at once enlists the favor of all who can appreciate the "music of motion," and gives character to its builder. Its efficiency and peculiar advantages will be more fully shown in a future article.

Sea Weed as a Fertilizer.

The sea weeds that are thrown up on the shores of salt water have long been prized in this country, as in Europe, for their fertilizing action when applied to the soil. The annals of Scotch and Irish husbandry contain ample testimony to their value, and it has been asserted that the recent great advance in the cost of iodine largely depends upon the fact that much of the seaweed, which was formerly burned for the iodine makers, is now employed for agricultural purposes.

I have recently examined a sample of a commercial article brought into the trade by the Quinnipiac Fertilizer Company, of New Haven, under the name of "Kelp Fertilizer." This is simply sea weed dried and reduced to such pulverization that it readily passes a sieve with one fourth inch meshes. Professor D. C. Eaton pronounced the sample I analysed to be chiefly *Fucus nodusus* or rock weed.

Its composition, as taken from a bag of 100 lbs. weight, was:

Moisture	11·01
Organic matter (by difference)	69·10
Sand	1·59
Sulphuric acid (SO_3)	6·82
Phosphoric acid (P_2O_5)	0·28
Lime	1·10
Magnesia	1·19
Oxide of iron (Fe_2O_3)	0·37
Potash	2·18
Soda	2·22
Chloride (and iodide) of sodium	4·14
	100·00

The crude ash = 21·13 per cent.

Nitrogen = 1·20, equivalent to ammonia 1·46 per cent.

In this analysis, the dried substance was carbonized at a low heat, and extracted with water, before incinerating.

On comparison with stable manure of good quality, using the average of a number of analyses of the latter, it appears that the relative quantities of the active ingredients are expressed by the following figures:

	Stable Manure.	Kelp Fertilizer.
Organic matter	1	5—6½
Nitrogen	1	2—3
Phosphoric acid	1	1—2½
Sulphuric acid	1	23—25
Common salt	1	37—54
Soda	1	23—32
Potash	1	3—4
Lime	1	2—2½
Magnesia	1	1—6

It thus appears that, by the addition of thirty pounds of fish guano (containing two pounds each of nitrogen, phosphoric acid and lime) to 1,970 pounds of the dry kelp, the ton of mixture would be worth, as far as can be judged from the quantity of the several solid ingredients, five times as much as the best stable manure. This consideration is one of high importance where, as in the Connecticut valley, stable manure sells for $10 to $15 per cord and often cannot be got at any price. The mixture named makes a pretty close imitation of stable manure in a dry and therefore concentrated form.

When used fresh from the sea shore, as thrown up by the tide, sea weed speedily suffers decomposition, and disappears in a short time; its saline ingredients become a part of the soil, but its organic matter would seem to be of little permanence.

Once dried, however, it becomes a rather slow acting fertilizer, and in various instances, where it was used in field trials last year, it gave the best results when applied very early to as to become fully swollen with the spring rains. It is deemed advisable to use with it a small quantity of some active nitrogenous manure.—*S. W. Johnson, in the American Chemist.*

Patent Suit on Car Wheels.

In the Supreme Court of the United States, Mowry *vs.* Whitney—appeal from the Circuit Court for the Southern District of Ohio.

This suit was brought by Whitney to restrain Mowry from an alleged infringement of a patent, granted to Whitney in 1848 and extended in 1862, for a process prolonging the time of cooling, in connection with annealing cast iron car wheels.

The defence was that the process was not new, and that the appellant had not adopted it in his mode of cooling cast iron wheels. The decree was for the complainant, and the case being referred to a Master for an account, the sum reported in favor of Whitney by that officer was about one hundred and twenty thousand dollars. It is here insisted that the Court erred in holding that Whitney's patent is protected against prior annealing processes, because former processes were confined to "unchilled articles," and also in deciding that the appellant's process was an infringement of the patent, when they were, in point of fact, essentially different. One cools by placing the wheel in a cooler and the other in a net chamber. The patent of Whitney is invalid because there is no novelty in it. It is simply the application, of a process well known, to a purpose analogous to purposes to which it had been applied long anterior to the alleged invention. It is also urged that it is void because what is claimed is not useful, as the process would destroy the hardness of the rim (or chill) of the wheels, and thus detract from their durability. It is further contended that the Court erred in apportioning the profit of Mowry by the alleged infringement, and in overruling the exception taken to the report of the Master. C. B. Collier and A. G. Thurman for applicant; H. Baldwin, Jr., E. W. Stoughton and B. R. Curtis for appellee.

Bailey's Paper Barrels.

Mr. William H. Bailey has recently patented, through the Scientific American Patent Agency, an improved paper barrel, intended as a means for protecting non-liquid contents of barrels from loss, adulteration, and change of trade mark. The paper barrel is to be used within a wooden barrel and properly printed, to show the mark of the manufacturer, even if the same should have been erased from the wooden barrel. In the sale of flour, sugar, paints, etc., it often occurs that dishonest dealers will remove the barrel heads of inferior brands and substitute therefor those marked with the names and devices of superior qualities, thereby seriously injuring the public and the most conscientious manufacturers. This will be made impossible by the application of the inner paper barrel, which is printed at both ends, and marked with the firm name and device, and which cannot be removed without being destroyed and having the contents of the barrel entirely displaced. The paper barrel also prevents the adulteration of the contents of the barrel and the escape of the contents through crevices between the staves, which at present occasions serious losses to dealers and consumers.

The paper barrel is made to fit exactly within the wooden barrel and with heads at the ends. These heads are also cut out of paper, and gummed or otherwise fastened to the sides either by having lips or ears on the latter overlap the heads, or by having lips or a flange on the head gummed to the sides, or otherwise. In place of paper, equivalent simple or compound fabrics may be employed. The bulging body of the paper barrel is made in sections properly gummed together or in one piece.

In using the invention, the paper barrel fitted with one head is firmly gummed or held in place within the wooden barrel, and then filled as far as required. The other head is then gummed or fastened to the body. The wooden barrel head is finally put on.

Roebling's Rubber Fillings for the Grooves of Transmission Wheels.

This is a rubber filling for lining the grooves of cast iron wheels, which run at a great velocity and are principally used for the purpose of transmitting power to distant points by means of wire ropes. The same filling may, however, be used for other grooved wheels running at a slower speed, and for different purposes.

It is composed of a core of hard rubber, surrounded by a skin of soft rubber, about one eighth of an inch thick, more or less. This coat of soft rubber extends along the two sides and the bottom, and is omitted on top, where the rope rests. By means of this combination two difficulties are overcome. One is the difficulty of inserting the filling into the dovetailed groove and yet having it large enough to fill the groove completely and not be thrown out by the centrifugal force, which is very great, owing to the high velocity of the wheels. The other difficulty is to find a material hard enough on top to resist the wear of a rapidly running rope, and at the same time have the necessary velocity. This is accomplished by surrounding a core of hard rubber by a skin of soft rubber, which has elasticity enough to allow of its being driven into the groove and of expanding sufficiently afterward to hold it there, and yet is hard enough to resist the wear of the rope.

This improvement is calculated to remove one of the chief drawbacks incident to the telodynamic system of transmitting power through long distances. It was patented through the Scientific American Patent Agency, March 19, 1872, by Mr. A. Roebling, of Trenton, N. J.

IT is a miserable economy to save time by robbing yourself of necessary sleep.

SCIENTIFIC AND PRACTICAL INFORMATION.

SURFACE ELECTRICITY.

M. Terquem has recently made some experiments for further elucidating the fact that the exterior surface of a hollow body is alone affected by electricity. Faraday showed that a small animal, placed inside a cylinder of wire gauze, was not incommoded when the cylinder was so highly electrified that sparks were freely given off by it. He also constructed a room, 12 feet in each dimension, of metallic wire, and suspended it by ropes of silk; and he found that, occupying this room, with electroscopes and electrometers at hand, there was not the slightest indication of electrical action inside the chamber, even when sparks of considerable length were given off by the metal of which it was made. M. Terquem verifies these results by taking a metal birdcage and suspending it to an insulated conductor of an electrical machine. While sparks sufficient to indicate a highly charged electrical condition were obtained from the exterior, pitch balls, feathers, and even a gold leaf electroscope remained unmoved inside. Two bundles of linen yarn were hung, one outside and one in; the inside one was unaffected, while the outside was excited, the threads diverging from each other and giving out sparks.

SULPHIDE OF SODIUM.

This salt has lately been used in blowpipe analysis as a reagent, in the following manner: The mineral under examination is fused with borax under the reduction flame. A small quantity of sulphide of sodium is then added, and the substance again submitted to the flame. Iron, silver, copper, lead, nickel, cobalt, bismuth, palladium, thallium, and uranium give opaque masses of a brown or black color. Zinc gives a white mass; the product with cadmium varies from red to yellow as it cools; that of gold and platinum give a bright light brown, and that of tin, a translucent yellow brown.

DETECTION OF MALIC ACID.

The adulteration of wines with cider can easily be detected by filtering and adding ammonia in excess. The apple juice will immediately deposit crystals on the side of the test tube. Genuine wine sheds a pulverulent deposit which does not adhere to the glass, and is devoid of a crystalline structure. Acetic acid will dissolve either of these precipitates. The deposit from the cider consists of flat crystals with parallel sides; that from wine shows star shaped formations. The treatment with acetic acid shows the presence of lime and phosphoric acid in both cases, the quantity of lime in the wine being minute.

SCARLATINA.

Mr. W. M. Searcy suggests the frequent examination of the tonsils of all persons living in a house where scarlatina is present, as the redness and enlargement of these organs are premonitory symptoms of the disease. Nitrate of silver in solution—one dram to one ounce distilled water—is a good local application, and if the case be severe, aperient medicine is used in conjunction therewith.

THE AGASSIZ EXPEDITION.

Professor Agassiz's party have visited Rio di Janeiro, and have explored the whole neighborhood of that beautifully situated port. The distinguished naturalist has forwarded a large number of specimens to the Cambridge Museum, Massachusetts. A cotemporary is responsible for the following:

During a trip to the Southern Parahyba river, the Professor obtained specimens of a number of species of fishes, some of them entirely unknown to science, which he very very carefully placed in alcohol for preservation. On his way back to Rio di Janeiro, he passed the night at a gentleman's residence, and his host's cook, naturally looking upon the party merely as gentlemen sportsmen, poured off the alcohol and served up the valuable specimens nicely fried for breakfast. It was an appropriate repast for a scientific party; but it is hardly to be supposed that the worthy professor would have enjoyed it if he had known at the time the source from which the supplies had been drawn.

THE DEAD SEA.

Being without an outlet, evaporation is the only escape of the water pouring into it by the river Jordan and some other streams. Each brings into that extraordinary reservoir, which is a depression in the earth's crust thirteen hundred feet below the water level of the Mediterranean, an immense mass of materials which must at last fill it up, when the Jordan will then run on beyond and find an outlet to the sea, if the world remains in its present physical form long enough.

The Jordan wafts down ninety cubic yards of water every second. Each day it carries in six and a half bushels of salt, liberated from rocks on its passage, in each ninety cubic yards. Therefore that dreadfully salt, bitter reservoir has nearly reached the point of saturation.

When no more salt can be dissolved, then it will accumulate on the irregular bottom till it reaches quite near the present surface. Its future will have quite as much interest for coming ages as its past history.

POROUS FILTERS.—In the course of an examination of filters, at the instance of the *British Medical Journal*, Professor Wanklyn has had proof that filtration through beds of porous materials includes very powerful chemical action, albuminoid matter being instantly resolved into ammonia and other products by the action of the filter, which, indeed, behaves in this respect like a boiling solution of permanganate of potash. A good filter is a sanitary engine of great power.

THE best and most durable insulation for electric wires is to tin them and cover with pure rubber.

UMBRELLA FRAMES.

The following are the processes which are required to make the frame of an umbrella, as seen in the manufactory of Messrs. Cox, Brothers, and Holland.

Nearly one hundred pairs of hands have their part in the preparation of the frame alone of this little article.

The covers were, till within sixty years, made of oiled silk, the frames of whalebone or bamboo cane. Steel was introduced about 20 years ago, the change being induced partly by the increasing cost of the whalebone, and partly through the great improvements accomplished in the manufacture of elastic steel.

No less than 2,500,000 sets are issued in one year from the manufactory of this firm alone.

The frame or furniture—as it is technically called—of an umbrella or parasol is composed of six parts. 1. The rib, the ends of which are named respectively the tip and the notch ends. 2. The stretcher, having the fork end and the last end. 3. The runner, which glides up or down the stick on opening or shutting the umbrella. 4. The notch or wheel, forming the apex or bottom of the umbrella, which is riveted to the stick. 5. The open cap, which fits outside the cover over the notch, and forms a finish. 6. The ferule, which is placed at the bottom of the stick and protects it when used in walking. In certain cases, there is also a seventh part—the stick—which is made of taper metal tube.

The wire of which the furniture is made is received into the manufactory in coiled bundles, and cut into the required lengths by a machine. Four or five gross of these lengths, now called "ribs," tightly confined within three or four iron rings, are placed in a furnace, and brought to a red heat: when the heat has uniformly penetrated the whole bundle—care being specially taken not to oxidize the metal—it is laid on an iron plate having a number of grooves corresponding to the number of rings clasping the ribs, the rings being fixed at such intervals as to fit into the grooves. A heavy iron bar is now laid upon the ribs and kept moving backwards and forwards, causing the ribs to rotate on their own own axes, thus not only straightening them by the friction, but softening the steel and preparing it for subsequent manipulations. The ribs are now taken to "the heading shop," where, by means of presses and press tools, the heads or "tips" of the ribs are made. The indentation to receive the hole for sewing on the cover is next impressed. These and a great number of other operations are carried on in separate departments or "shops," minute subdivision of labor being found essential for commercial success. In the piercing shop, the hole is punched and the rib is completed at the "tip" end. In another shop, the eye is punched at the tip end, the eye is put on a steel peg, and the notch end of the rib is formed in a pair of dies similar to those in which a needle eye is made. The ragged or superfluous portion is now removed and the end of the rib made smooth and round. The hole is then pierced to receive a threading wire, which forms the axis for opening and shutting the umbrella. The ribs now receive an impression in the middle, and they are sent to be hardened and tempered by the usual process of heating in a muffle and immersion, while hot, in a bath of oil. They are then again confined within rings and revolved as before in the straightening operation. They are next gradually heated till the steel attains a blue color, after which every rib is tested singly, to see that the proper degree of elasticity has been obtained. This is an important consideration, and requires a very nice proportion of tempering; as, if the heat in the tempering muffle has been too high, the steel becomes too soft, while on the other hand, if not carried far enough, the articles become brittle and useless. The rib is now ready to receive the stretcher joint, which is made as follows: Brass wire is drawn, with a groove down the center, and is cut into lengths suitable for joints; the rib is placed within the groove of one of these bits of wire, the horns of the bit are elongated to enable it, in an after operation, to surround the rib at the place where it has been marked to receive it, otherwise the joint would slip on the smooth surface of the rib; the rib, with the joint, is now placed between a pair of engraved dies in a press, and the pressure applied by this means is sufficient to make the joint fast, as well as round and smooth all over. This is a most ingenious process, only recently perfected. This joint is drilled, and the rib is complete and ready for japanning.

The stretcher is made as follows: The wire in coils is placed upon a reel, drawn through rollers to straighten it, and cut into suitable lengths. One end of the stretcher is split by means of press tools, about half an inch down it. In another pair of tools this split is opened by a wedge shaped punch, which widens into the shape of the stretcher fork, descending into the die in a uniform shape. The fork in another pair of tools is then flattened on each side at one operation, and pierced so as to be attached to the stretcher joint on the rib. The hole is now put upon a peg, and the other end of the stretcher is formed in the same way as described above in the case of the top end of the ribs.

The ribs and stretchers are now japanned, when they are taken to the riveting shop, where a large number of girls are employed in riveting them together.

In addition to the above kind of ribs and stretchers, there are several others, known as the Paragon, the Premier, and Hollow ribs, which are cut out of sheet steel, and curved round until they nearly become tubes. These improved makes are considered to be both lighter and stronger, and as the extra cost is but a few pence per frame, this construction is adopted for all the best silk umbrellas. These better qualities have also enamelled tips to the ribs, which are fixed by fusion, with the aid of a blow pipe.

Runners are made of brass and iron. They are constructed as follows: The "blank" for the barrel is cut by circular shears into oblong pieces, knocked round on a mandril, and soldered at the joint. A ring of metal is cast and rimered to the size of the barrel, where it is now soldered at one end, and a ring of brass at the other. They are next turned on a lathe, and a groove turned in at the end which is afterwards to be notched to receive what is called "the threading wire," which is the axis on which the stretcher works.

They are next taken to a notching machine, the exclusive invention of this firm, which, as a most important advance upon the methods hitherto in existence, demands special notice. Until this machine was invented, all notches were cut by hand, and, however skillful the workman, they were necessarily, in some measure, cut at irregular intervals. This was not of vast importance while the "gores" of the covers were cut out by hand, but after the introduction of sewing machines and machines for cutting out the gores also, this irregularity became a serious difficulty, which this firm has now, by an ingenious arrangement of levers, happily surmounted, and the notches are cut with mathematical accuracy that confers upon their frames a well merited distinction.

The runners are now smoothed at the bottom, minutely examined by the foreman and sent to be japanned or silvered as required. The top notch or wheel is made from a brass casting, turned and notched by the machine just described. The open cap is cut from a round "blank," when it is raised by dies in a stamp, three or four times successively, being stamped deeper at every operation. The bottom is punched out, taken to a lathe and turned, and afterwards subjected to a bronzing process, peculiar to this house, or, if for common caps, japanned. The ferules are also cut out of round blanks by machinery, and repeatedly drawn in presses until the required depth is obtained, being annealed and cleaned between each drawing. The bottom of each ferule is then cut out, and an iron blank inserted and soldered into its place. As this iron bottom is twice as thick as a penny, it is capable of enduring a vast amount of wear when the umbrella is used, as it is almost universally the case, as a walking stick.

The whole of the ordinary umbrella furniture is sent away in parts, to be fitted, covered, and finished by other manufacturers. There is another class of frames, furnished with tubular metal sticks, which are fitted as complete frames before they leave the manufactory; these are particularly adapted to hot climates, which are found seriously to warp the wooden sticks.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the month of February, 1872:

During the month 745 visits were made, and 1,534 boilers examined—1,443 externally, and 370 internally—while 194 were tested by hydraulic pressure. The number of defects in all discovered was 794, of which 198 were regarded as dangerous. The defects, in detail, were as follows:

Furnaces out of shape, 34—4 dangerous; fractures, 79—39 dangerous; burned plates, 53—29 dangerous; blistered plates, 96—12 dangerous; sediment and deposit, 111—9 dangerous; incrustation and scale, 130—4 dangerous; external corrosion, 54—16 dangerous; internal corrosion, 20—6 dangerous; internal grooving, 23—3 dangerous; water gages defective, 29—12 dangerous; blow out defective, 13—4 dangerous; safety valves overloaded or out of order, 24—12 dangerous; pressure gages defective, 104—19 dangerous, varying from —6 to +12; boilers without gages, 3—2 dangerous; deficiency of water, 9—9 dangerous; braces and stays loose and broken, 24—15 dangerous; boilers condemned, 7. There are many cases of glaring neglect reported, showing not only a great want of attention on the part of those having charge of boilers, but on the part of owners and users as well. If some responsible person would give a few moments' attention each day to the boilers and boiler connections, many disasters would no doubt be prevented. Among the instances of carelessness met with, are the following: A safety valve leaking badly, instead of being repaired, was found with a plank laid across the lever, loaded down with bricks—300 pounds pressure would probably not have been sufficient to raise this valve. In another case, where the boiler was in a building with a flat roof, the safety valve lever was found wedged under one of the rafters; this was regarded as an economical arrangement, "because it saved steam!" We might fill a page with similar instances, but enough has been said to show that destructive accidents need not be attributed to mysterious agencies.

WE are informed that the French and Austrian governments have succeeded in the propagation and cultivation of sponge, and the experiment is likely to be made elsewhere, as the result is commercially valuable.

AN obdurate screw may be drawn by applying a piece of red hot iron to the head for a minute or two, and immediately using the screw driver.

IF you are caught in a drenching rain, or fall into the water, by all means keep in motion sufficiently vigorous to prevent the slightest chilly sensation until you reach the house; then change your clothing with great rapidity before a blazing fire, and drink instantly a pint of some hot liquid

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BOOKS introduce us into the best society; they bring us into the presence of the greatest minds that ever lived.

PROPOSED CITY RAILROAD.

Among the recent projects for rapid transit in New York is that of Mr. R. H. Gilbert, for an elevated railway, on the plan so tastefully represented in the accompanying engraving.

The plan is to place along the street, at distances of from fifty to one hundred feet, compound Gothic iron arches, which shall span the street from curb to curb, at such an elevation as shall not interfere with the ordinary uses of the street. On these arches, a double line of atmospheric tubes, eight or nine feet in diameter, are to be secured. The arches are strongly connected with each other by means of a vertical, latticed or trussed girder running between the tubular ways, which are to be firmly joined to it on either side by ties of suitable construction. Through the tubes, supported as described, cars, carrying passengers, are to be propelled by atmospheric power. There is also provision in the same set of arches for two or more sets of tubes for the transportation of mails and packages. The stations will be situated at distances of about one mile apart along the line, and will be provided with pneumatic elevators to raise passengers to and from the place of transit with perfect safety, thus obviating the necessity of going up and down stairs for transit. The movement of the cars or trains along the line, as well as their arrival and departure from stations, is made known at all points by a telegraphic device which is automatically operated by the cars in passing.

A bill is now before the New York Legislature to authorize the construction of this work, which, it is alleged, can be economically and expeditiously executed. The bill has been favorably considered and reported by the Senate Committee, and meets with no opposition except on the part of the property owners and occupants of buildings on the streets which are intended to be occupied by the works. These people object to the erection of this ornamental structure or big bridge, as they term it, in front of their doors, and claim that the presence of the tubes would be equivalent to the roofing over of the street. They will consent to nothing that cuts off their light and air.

Everybody in New York wants rapid transit, but, strange to say, the moment that any body sets to work with a definite plan for its realization, they are vigorously opposed and the work prevented.

A New Anemometer.

A new form of anemometer has just been constructed in Europe, and seems likely to prove of material service to all who desire to notice and record the direction and velocity of the wind. The anemometer consists of an ordinary pair of Beckley fans and a set of revolving cups, fixed in any convenient situation, and connected by insulated wires with a galvanic battery and with a recording apparatus. There is no limit to the length of the connecting wires, so that, for example, recording instruments at Lloyd's might be connected with fans or cups at any part of the coast. The recording instrument itself consists of a clock, a wind dial, a reel of paper, and an endless band carrying a carbon paste for printing. The dial indicates the direction of the wind, and the printing band prints this direction every half hour. The same band records every quarter of an hour of time and every completed mile that the wind has traversed. The slip of paper issued by the machine is about an inch broad, and it receives the time on its left hand margin, the direction of the wind on its right hand margin, and a dot for each mile on a central line, so arranged as to be comparable with the time record. The number of dots marked on the paper between 10 and 11, for example, indicate the velocity of the wind during that period of time, and the dots become crowded as the velocity increases, and stand farther apart as it decreases. The battery is composed of zinc and carbon elements with dilute sulphuric acid, and will work for six months without attention. The reel of recording paper holds a supply for three months, and the clock can be made to run this length of time without winding; so that the whole apparatus would be as nearly as possible self acting. Ordinarily, however, it would be desirable for the attendant in charge of it to date the recording slip every twenty-four hours, and an eight day clock would be sufficient for the requirements of most observers. The great advantage of the instrument, says the *British Trade Journal*, is in the character of its record, and in the fact that the electrical communication does away with the use of cranks and shafting, which are not only costly and heavy and far less delicate, but which also render it necessary that the recording instrument should be in the immediate neighborhood of the fans.



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Contents:

(Illustrated articles are marked with an asterisk.)

*Adjustable Spring Bed Bottom.. 242
A New Anemometer..... 246
Answers to Correspondents..... 249
A Trades Union Trade..... 248
Australian Locomotives..... 240
Bailey's Paper Barrels..... 241
Blood Crystals..... 242
Bones and Bone Meal..... 241
Bromine Water as a Test for Phenol..... 240
Business and Personal..... 249
Chimney Moving..... 242
*Combined Cast and Wrought Iron Arch Girders..... 243
Death of Samuel F. B. Morse..... 247
Diamond Cutting in New York... 241
Dyeing Leather..... 242
*Fastening for Neck Ties, etc..... 242
Fastening Loose Window Sashes. 241
Frictional Gearing—No 2..... 241
*Heard's Ventilating Hat..... 243
*Improved Method of Propelling Canal Boats..... 239
*Inextinguishable Signal Light.... 243
Inventions Patented in England by Americans..... 248
Lightning Rods..... 248
Measuring the Velocity of Rotation..... 242
New Books and Publications..... 248
Notes and Queries..... 249
Official List of Patents, Extensions, Designs, etc..... 251
Patent Suit on Car Wheels..... 244
Porous Filters..... 245
*Proposed City Railroad..... 246
Recent American and Foreign Patents..... 250
Roebling's Rubber Fillings for Transmission Wheels..... 244
Scientific and Practical Information..... 245
Sea Weed as a Fertilizer..... 244
Sewing Machines and their Effect upon Health..... 247
Spiritualism Answered by Science 248
Stopping Pinholes in Lead Pipes 241
The Baltimore Boiler Inspection Law..... 242
*The Discovery and History of the Chromosphere—No. 2..... 243
The Great Sewing Machine Job before Congress..... 247
The Hartford Steam Boiler Inspection and Insurance Company..... 245
The Remington Works, Ilion, N.Y. 240
Umbrella Frames..... 245
Walking..... 241

THE GREAT SEWING MACHINE JOB BEFORE CONGRESS.

We recently alluded to the application now pending before Congress for the extension of the Wilson sewing machine patent which covers the feeding device, a feature which all sewing machines must have. The existence of this patent is a bar to the introduction of a variety of improved machines, which will be brought out next year if the Wilson patent is not extended, for it expires in 1873. The owners of improvements are not allowed by the parties who control the Wilson patent to put their goods in the market.

The Sewing Machine Ring, consisting of the Wheeler & Wilson Company, the Singer Company, the Grover & Baker Company, and the Howe Company have had the almost exclusive monopoly of the sewing machine business for the past quarter of a century. This is long enough in all conscience.

Under the shadow of these patents, Wilson's patent being a chief one, they have wrung from our people many millions of dollars in profits, and to-day they charge American citizens sixty-five dollars for the same machines that they sell on the other side of the Atlantic for half the money. It would be a wicked thing for Congress to do to extend this monopoly. It has lasted long enough, and ought now to die a natural death.

In the memorial of W. L. Groot and others, we find the following interesting particulars:—

The corporations above named "are now selling machines in England, Ireland, Scotland, France, Belgium, Holland, Austria, Russia, Prussia, Norway, Denmark, Sweden, Spain, and other countries of Europe, at one half the price they offer the same sewing machines to our own people, and cheaper than they can be produced by the poorly paid labor of Europe, where the manufacturer, who has no patents to dread and no 'combination' to interfere, realizes, even at the price of one half what we must pay, a profit of 100 per cent. This unjust discrimination carries its own strong logic why no further extension shall be granted to enable a few to oppress thousands.

NUMBER AND PRICE OF SEWING MACHINES.

Not counting the great number of sewing machines made and sold since the origin of the business, the chief patent of which has expired and is now sought to be renewed by Congressional legislation, your memorialists annex the number made in 1870 only by the companies forming this 'combination,' the statement being made under oath:

Singer Manufacturing Company sold	127,833
Wheeler & Wilson Manufacturing Company sold	83,208
Grover & Baker Sewing Machine Company sold	57,402
The Howe Sewing Machine Company sold	75,156
Total	343,599

These were retailed at an average price of $65 each, making in the aggregate $22,333,935. The same number of sewing machines would have retailed in Europe at half the price charged here, and our people must pay for this number sold them $11,166,967.50 more than the people of Europe are charged. This great product is only of four companies, not counting many others, all of whom have paid a tribute to this 'combination.' Their aggregate wealth is more than $50,000,000, and all of it is clear gain, the small amounts which were originally invested being too insignificant for comparison at this day. This is easily apparent when the incontrovertible fact is made known that the cost of each sewing machine sold at $65 is less than $12. If this patent is not extended, the price of all sewing machines now selling at $65 must be reduced to $32.50, and there will be no difference between our people and those in Europe, as there is an abundance of capital anxious to produce better sewing machines at $35 than are now sold at $65, and to have liberal, legitimate reward for both labor and capital.

Your memorialists will be ready at any time to appear before Congress, both in person and by attorney, to give such additional proofs, and to propound such questions, to the applicants or their attorney, as it is impossible to present in the limits of this memorial.

SEWING MACHINES AND THEIR EFFECT UPON HEALTH.

It is one of the accompaniments of almost every change in human habits, brought about by advances in civilization, that the health of the public is influenced in some way. Often new complaints are engendered, or old ones are complicated, so that medical science is kept constantly on the alert to combat attacks from unexpected quarters. It has been charged against that most valuable of modern labor saving inventions, the sewing machine, that the act of impelling it by foot power, as almost universally practiced, has resulted in injury to female health. At first these charges were hardly more than surmises, but they were finally made direct and positive, with how much reason it is the object of this article to enquire. Fortunately for our purpose, we find in the report of the Massachusetts State Board of Health an extended discussion of the subject, from the pen of Arthur Nichols, M. D., which contains many facts and statistics drawn from various sources. Of these facts we shall freely avail ourselves, and shall thereby further the object of the publication of all such reports, the general enlightenment of the public.

In 1860, Dr. A. K. Gardner expressed, in the *American Medical Times*, his opinion that the exercise of propelling sewing machines with the feet, so far from being injurious, is really beneficial inasmuch as it gives exercise, which, though it affects only part of the body, is still better than no exercise at all.

Dr. Vernois stated, in 1862, in the *Annales d'Hygiéne Publique*, that, both in males and females, the motion produced cramps, partial paralysis, and, in females just begin ing to operate, a peculiar and injurious nervous excitement.

Dr. William Ord, in a report on the sanitary condition of dressmakers and needlewomen in London, 1863, states that, while in general the exercise is beneficial and tends to improve the health of females, the cramped position sometimes causes pain in the chest and indigestion, and that delicate women are greatly exhausted by this particular work.

This testimony was followed by something far different in 1866, from M. Guibout, physician to the Hôpital Saint Louis, in Paris, who, in a paper read before the Société Médicale des Hôpitaux, made such strong statements, in regard to the effect of sewing machines upon female health, that general apprehension resulted. Shortly after the reading of this paper, Dr. Feurnier attributed a case of paralysis of sensation in bottom of the foot, occurring in a girl admitted to the same hospital, to the use of the sewing machine; and the publication of this case increased the general alarm.

The opinions of Dr. Espagne, Professor at the Montpellier University in France, were published in 1869, in which he denies that any injuries result, from the use of the feet on sewing machines, other than general fatigue and muscular pain.

Next follow the published opinions of the celebrated Dr. Decaisne, who has done so much toward enlightening the world upon the effects, of various trades, professions, and callings, upon the health of those engaged in them. He examined and questioned a large number of women, searched hospital records, and came to the conclusions which are thus summarized:

"The effects of this work upon the muscular system differ in no respect from those of any other kind of excessive labor involving the use of certain portions of the body to the exclusion of others. The affections most commonly complained of are muscular pains, pain in the region of the kidneys, and cramps in the lower extremities; none of which, however, are developed among those working three or four hours daily. These pains, cramps, etc., are most commonly found among beginners, and usually diminish after one has become accustomed to the motion of the machine.

The use of the sewing machine, when employed within moderate limits, without overworking, as is too often done, is attended with no greater inconvenience to health than working with the needle, as was shown by the examination of 28 women between the ages of 18 and 40, employed from three to four hours daily."

We now come to the investigations of the Massachusetts State Board of Health. The Board circulated widely this printed question, "Have you observed any injury to health from the use of sewing machines moved by foot power? If so, please to send us all the information you may have on the subject." To this question, 138 replies were received, representing 120 different towns. Of this number, 80 report one or more instances of injury, and 58 return negative or doubtful answers.

We cannot give place to even a synopsis of the various replies. They however establish the fact that, among operatives on sewing machines, certain complaints do exist in greater proportion than with other females, while they as plainly show that this results not from the exercise itself but from is excess. It is avowed by Dr. Nichols that these complaints are not inseparable from the propulsion of the sewing machine by the feet, but that excessive work of this kind is very likely to be followed by injury, if not by total prostration.

Now what is excessive work with one kind of a machine might be far from excessive with another. The number of hours per day these operators work would not injure them were the machines driven by steam power. Anything more than from five to ten minutes labor, without rest, on the brakes of the old style fire engine would be excessive for most men. But because this labor is too much, it does not follow that an engine cannot be made upon which a man might work six hours without over fatigue.

Operators at sewing machines are obliged to sit with backs entirely unsupported and the knees elevated, thus keeping the spinal muscles constantly on the stretch, inducing the pain in the small of the back which is the most constant effect of work of this kind. This irritation is reflected by sympathy to other parts, and general debility finally results. We have never seen any satisfactory reason why the tables of sewing machines which are operated by foot power should not be brought up over the lap, so that the operator might sit leaning slightly backward, with the spine thoroughly supported and the limbs extended. We proposed this once to a leading manufacturer, and were told that the notion that women were injured by working on sewing machines had no foundation in fact. We argued that those who had investigated the subject, though claiming that moderate exercise of this sort would not injure, almost unanimously insisted that excess would injure, and added that profitable employment with such machines implied an extent of labor which these authorities claimed to be excessive on machines as at present constructed. We failed, however, to convince him that any improvement in form was either desirable or practicable. Notwithstanding this discouragement, we put our idea to the test of actual trial, and found that all who had been accustomed to work on the old machine, who tried the modified position above described, were unanimous in testifying to the superior comfort and ease secured by it. There may be improvements made in treadles, as suggested by Dr. Nichols, but these do not reach the root of the evil. It is the position, not the mere labor of propelling the machines, that fatigues the operator.

Those who tried our plan of raising and bringing the table up nearer the person, and placing the treadles farther away, found no difficulty, in handling the work or in keeping it properly placed on the table, as the manufacturer above alluded to seemed to apprehend. The whole body was placed in an easy unconstrained position, and so supported as to rest rather than fatigue the back. We look to see some such change made in the construction of sewing machines. They are so valuable in many departments of industry that invention will not rest till their full utility is developed. The value of an improvement that would enable an operator to work even one hour per day longer than at present, without injurious fatigue, can scarcely be over estimated.

DEATH OF SAMUEL F. B. MORSE.

After a few days' illness which, with his great age, led to anticipation of a fatal result, Professor Morse died at ten minutes before eight o'clock in the evening of Tuesday, the 2d of April. His long and varied life, and his universal renown, will give interest to the following particulars:

He was born at Charlestown, Mass., on April 27, 1791. His early education was acquired at Yale College, and his career would have been through life that of a painter, had not circumstances directed his attention to scientific pursuits. With a view of following the first named vocation, he left the United States in 1811, in company with Washington Allston, to study his art under the tuition of the well known Benjamin West. The Society of Arts, of London, recognized the merits of the young artist, and awarded him a medal for a piece of sculpture, a "Dying Hercules." After four years' absence, he returned to his native country and subsequently established an association which, after many changes and against much opposition, became, in 1826, the National Academy of Design. He again visited Europe in 1829, and, while on that continent, was elected to the Professorship of Literature of the Arts of Design, in the city of New York University.

In the year 1826 or 1827, his attention had reverted to electro-magnetism and cognate subjects, of which his education at Yale had given him a sound practical knowledge; and he had an additional incentive to this pursuit in his close and intimate acquaintance with John Freeman Dana, then a co laborer with Morse in the lecture theater of the New York Athenæum. He returned from his second visit to Europe in 1832, and in conversation with his fellow passengers on the ship (the *Sully*) concerning the recent obtaining of an electric spark from a magnet, mentioned the idea of an electro-magnetic and chemical recording telegraph. The more zealous and indiscreet of his admirers claim for this conversation the credit due to an original idea, whereas the desirability and possibility of telegraphing by means of electricity had already occupied the attention of Mr. Ronald, who had erected eight miles of insulated wire in his garden and dispatched signals through it, and who published an account of his method in the year 1823. Other inventors in England and France, in the latter part of the eighteenth century, had been working towards a similar object, and it is impossible and unnecessary to decide to whom the thought first came. Certain it is that it had been largely canvassed long before Professor Morse's labors commenced. But it is to Morse that the credit of long and enduring perseverance in introducing a practical and efficient telegraph is due; and he was enabled to do this great service to mankind by the invention of the electro-magnet by Joseph Henry, to whom all users of electro-magnetism, for whatever purpose, must confess themselves indebted.

It is hardly necessary, just now, to describe the difficulties against which Morse fought so courageously. Recent events

in this city and considerable newspaper discussion have called public attention to all the facts, and full justice has been done to Morse, not only by his admiring and grateful countrymen, but by scientists and public men, by crowned heads and peoples in all parts of the world. He had to struggle for years against the prejudices and timidity of capitalists; he went to England in 1838 with his invention, only to find that an electric telegraph—in which the signals were conveyed by the pointing of a needle on a dial—had been already patented and introduced to the public by Messrs. Cooke and Wheatstone; but persistency at last met its reward, and success and fame, honors and wealth fell to his share; and he has left us after the enjoyment of a long life, crowned with an unusual meed of all those things for which men ordinarily toil and worry away their existences.

He was liberal and charitable in all his transactions, and took a paternal interest in all that belongs to the great invention he gave to the world. Living alternately in New York city and at his country residence on the Hudson, near Poughkeepsie, N. Y., his face was well known to all classes of his countrymen; and the latter part of his life was unclouded by trouble, and his end was peaceful.

SPIRITUALISM ANSWERED BY SCIENCE.

Mr. H. L. Hinton, 744 Broadway, N. Y., has issued the pamphlet entitled as above, by the celebrated London barrister, Mr. Edward W. Cox, in which he gives expression to his views concerning spiritualism, or spirit manifestations, as deduced from the series of scientific experiments made last year in London, under the auspices of Dr. Crookes, Dr. Huggins, and others, Mr. Cox being one of the examining party. A description of some of these experiments, with drawings of the testing apparatus employed by Dr. Crookes, will be found in our back numbers.

In the present work Mr. Cox describes the various forms of spirit manifestations that he has witnessed, from which it is evident that he has been a careful and extensive observer. He has become fully satisfied that intelligent noises or rappings are actually produced, that chairs, tables, or other objects are undoubtedly moved, and that the proofs of the reality of these demonstrations are just as absolute as are the proofs of any other fact in nature. The force by which these demonstrations are made, he calls psychic force. It may be indicative, he thinks, of the existence of a soul within man, and it is this soul which he thinks may exercise psychic force beyond the body. He rejects the idea that the manifestations are produced by the agency of disembodied spirits. They are purely and wholly the result of forces residing in the human organism, and neither our departed friends, angels, or devils have to do with them. The medium is never able to communicate anything that is not already known to some person present.

This psychic force, Mr. Cox thinks, operates by a vibratory or wave like action, is opposed to and capable of overcoming the attraction of gravitation. Tables and other objects that are moved are first filled, so to speak, with the psychic emanation, which renders them buoyant in the air, when they float, swing, and sway about as if supported by an invisible balloon.

One of the explanations of these phenomena, and upon which Mr. Cox lays much stress, is *the unconscious cerebral action of the mind of the medium*, which action is manifested through the psychic force. Now as this unconscious cerebral action can be induced and made to set men's bodies in motion, without their knowing it, it becomes a question whether Mr. Cox himself and his friends did not have their cerebrums unconsciously excited so that they could hear noises and see sights that in reality never took place; or so that they could not see the person who pushed the piano, lifted the table, or forced down the balance.

What Mr. Cox and Dr. Crookes now need, in order further to verify their published conclusions and observations, is a scientific apparatus so made as to indicate the true condition of their own cerebrums. An instrument, that shall be capable of indicating the unconscious excitement or action of the mind, would be of great value in pathology. In addition to its uses in unraveling these "spirit" mysteries, it would doubtless be of inestimable importance to physicians in the diagnosis and treatment of mental disorders and diseases that react upon the brain.

There are various forms of unconscious cerebral action to which persons have been subject. To some individuals, visions and spectral personages have appeared when they have been wide awake and in the full possession of their ordinary senses. Sir David Brewster mentions several examples of this kind of cerebral action.

The latest phases of these psychic demonstrations, as brought out in this country, to wit, the visible production of the forms of departed friends, standing out clear and positive in the presence of the members of the psychic circle, have never been witnessed by Mr. Cox; at least he makes no mention thereof; nor does he allude to the spirit flames and lights now produced here. Mr. Cox should come over and visit Mrs. Mary Andrews, at Moravia, N. Y., who will show him things in this line that will probably make his hair stand on end. One visitor has assured us that the sight of these things brought on a cold perspiration, and he felt as if the gates of the eternal world had been actually thrown open. Until Mr. Cox goes to Moravia, it is evident that spiritualism will not be fully answered by science.

REPEATED spectroscopic measurements made last year by Professors Zöllner and Vogel, in Germany, show that the velocity of rotation of the sun on its own axis is at the rate of six hundred and sixty miles an hour.

A TRADES UNION TIRADE.

To appeal to the passions and prejudices of men rather than their reason, to distort and misrepresent facts, statements and motives, to misconstrue the slightest and most friendly criticism into an abusive attack, and to reply to it by real and undisguised scurrility and abuse has ever been the method of discussion and the characteristic manner of men who, through the false pretence of regard to the interests of the working classes, seek only the furtherance of their own private interests and purposes. We are sorry to say that in this spirit the editor of the *Machinists' and Blacksmiths' Monthly Journal*, an International Union organ, published at Cleveland, Ohio, comments upon some remarks of ours relative to the action of trades' unions in regard to apprentices.

The immediate cause of offence, to our brother editor, is the clause in one of our recent editorials which follows:

"The refusal of mechanics' unions to reconsider their unreasonable restriction, whereby their own sons are denied the privilege of learning the trades of *their fathers*, is one of the mysteries of the age. We have before alluded to this, for we feel that the prosperity of the country, the interest of humanity, and the welfare of coming generations, all demand that the shutting out of boys from learning trades ought to cease, so that they may be trained up to become good workmen, and able to learn an honorable mode of living."

Upon this we are charged by the editor with being very abusive, with departing from the truth, with being "opposed to trades unions, not from principle," with being destitute of virtue, with shamming interest in the welfare of the mechanic, with giving nothing tangible for their benefit, and with picturing a state of affairs that does not exist. We are sarcastically complimented for our learning and directly called feeble minded, both of which are equally flattering from such a source.

Perhaps we shall again be called abusive when we say that such a tirade can avail nothing against the truth of the paragraph which has provoked this uncalled for attack. We might add that a contrast, between the tone of our offending paragraph and the charges based upon it, might lead candid minds to throw back the charges of abuse upon the accuser, and inspire some doubt as to his respect for the truth and candor he professes to revere.

LIGHTNING RODS.

"We have a company in our town putting lightning rods on our houses. They use a copper rod, corrugated or fluted, and they fasten the rod to the shingles with zinc, allowing the rod to rest on the shingles and against the sides of the houses. My idea *of* putting up rods is to insulate the rod by means of glass tubes. But when questioned on the subject, the company's agent produced a paragraph, from an essay by Sir David Brewster, in which that eminent philosopher is made to say that the old theory of insulation is exploded, and that the conducting rod should be placed as near as possible to the object to be protected, in other words, should touch the wood and shingles of the building.

Now, I am a constant reader of the SCIENTIFIC AMERICAN, and many of our engineers and builders read your paper. We wish to know from you what we shall do with the rod that is not only not insulated from the house but put in as close contact with it as possible. A reply through your paper will be read and acknowledged with gratitude by many of your readers in this place and surrounding country.

W. C. MCDOUGAL."

Meridian, Miss., March, 1872.

Answer.—The method of attaching the rod which you describe is correct; it should not be insulated. The golden rule in regard to the erection of lightning rods is to *place the lower end of the rod in communication with an extensive conducting surface underground;* the electricity is thereby dissipated without injury to the building should the rod be struck.

If the area of this conducting surface equals that of the roof of the building, the rods being of proper size, perfect protection may be expected, not otherwise.

You will invariably find, in the examples of rodded buildings that have been damaged by lightning, that the lower extremities of the rods were not arranged in accordance with the above rule. The general practice is simply to stick the extremity of the rod into the ground for a short distance and there leave it, no provision for underground conducting surface being made. This is a very defective and unsafe practice.

A good way to provide the necessary conducting surface is to connect the rod with an iron pipe, laid down specially for the purpose and extended several hundred feet under ground away from the building, burying the pipe for the whole distance in charcoal or in moist earth. Another plan is to make a trench leading from the building and fill in with old iron or iron ore, the lower end of the rod being made to communicate with such conducting material. Leader pipes, metal roofs and chimneys should also be connected with this conducting material. In towns where there are water and gas mains, the lightning rods should connect with them, as the metals of such pipes present large conducting surfaces.

You will perceive from the foregoing that an essential part of the lightning rod is *an extensive conducting surface underground.* If your rod lacks this, it is of little value, your house is not protected, and in the very next thunder storm you may suffer damage.

COLONEL C. W. JENKS has traced into the Blue Ridge several fine veins of corundum, some of them four feet wide, in Franklin, N. C.

Examples for the Ladies.

Mrs. T. M. Scullin, Troy, N. Y., has used her "dear friend," a Wheeler & Wilson Machine, since 1858, in dress and cloak making. The last six months she earned $332, and the year before, $117.

Mrs. Mary Hacher, Muscatine, Iowa, has used her Wheeler & Wilson Machine since September, 1857, and earned from $10 to $20 a week, making dresses and cloaks, from the finest to the heaviest, and her machine is now in as good order as when she bought it.

Mrs. C. D. Goodman, Cleveland, Ohio, has used her Wheeler & Wilson Machine 4½ years with the same No. 2 needle that came in it without breaking or blunting it.

Watch No. 2755—bearing Trade Mark "Fayette Stratton, Marion, N. J."—manufactured by United States Watch Co. (Giles, Wales & Co.), has been carried by me two months; its total variation from mean time being one second.—JAMES B. WEAVER, with A. S. Barnes & Co., 111 and 113 William Street, New York.

Burnett's Kalliston will impart a *clear, soft,* and *beautiful* hue to the skin.

NEW BOOKS AND PUBLICATIONS.

THE AMATEUR MICROSCOPIST; or, Views of the Microscopic World. A Handbook of Microscopic Manipulation and Microscopic Objects. By John Brocklesby, A.M., Professor of Mathematics and Natural Philosophy, Trinity College, Hartford, Conn. New York: William Wood & Co.

This is a very convenient and useful little work, full of practical instruction upon the uses of the microscope. It is profusely illustrated with engravings which show the construction and various powers of the instrument, together with views of many remarkable objects that may be easily obtained and prepared for observation. A most interesting chapter is that devoted to crystallizations, in which the author presents us with many new drawings, and gives directions for preparing the slides so that the process of crystal formations may be readily witnessed under the microscope. This part of the work will be especially welcomed by amateurs. The examination of crystals is always attended with peculiar interest. The beholder revels for the time being amid sights of gorgeous beauty, and gazes upon gems seemingly most rare, exquisite, and precious. This book is a valuable addition to our stock of scientific literature.

BARRY'S FRUIT GARDEN. New Edition. New York: Orange Judd & Co., 254 Broadway.

This volume of 490 pages, as its title implies, is devoted to the culture of fruits of every variety in orchards and gardens. It also contains hints on the kind of soils best adapted for the different varieties, best modes of propagation, pruning, training, etc. It describes the diseases incident to the various fruit trees, the kinds of insects that prey upon them, and the remedies for ridding trees of the evil. The book is illustrated with numerous engravings of green houses, propagating beds, grafting, pruning, and garden implements, and the mode of training trees into beautiful and grotesque shapes. It also contains directions for the management of strawberry plants and other like fruits, with a chapter on nutting trees, etc. It is a work important to every agriculturist, and will find ready sale.

POCKET BOOK OF MECHANICS AND ENGINEERING. By John W. Nystrom, C. E. Philadelphia and New York: J. B. Lippincott & Co. New edition, revised and enlarged.

This book is already extensively known, this being the eleventh edition. In the present revision and enlargement, much valuable matter has been added. For example: Logarithms of numbers and of trigonometrical functions for every minute of a degree, or for every four seconds of time, are given; also the eight natural trigonometrical functions for angles, expressed either in degrees or time, as may be required. In regard to dynamical terms, the author proposes to abolish a great number of them, including "moment of inertia," which is a well established term in the philosophy of dynamics. A list is also given of proper dynamical terms, limited to force, motion, time, power, space, work, static and dynamic momentums, which the author maintains are all the terms necessary in dynamics. Examples are given for the dynamics of fly wheels, in which the term "moment of inertia" ought to perform an important function, but does not appear in the formulas and calculations. However right or wrong the author might be in the philosophy of dynamics, his reasoning is well worthy of attention. Barometrical tables, for the measurement of hights, are new and very complete, in English and French measures which have been arranged by the author from actual practice among the Andes; also, original formulas for the flow of water in bends of pipes; the evaporation on the surface of water, under the atmosphere; the harmonical and geometrical scales of vibration in music or acoustics; illustrations of the expansion of bodies by heat, at and near the temperature of fusion. The article on air and heat, and the specific heat of gases, contains simple and valuable formulas with original examples. The properties of inflamed gunpowder and its dynamics in heavy ordnance are given; also the properties of water and steam, with formulas and tables; also an original rule for determining a standard nominal horse power of steam boilers. On the parabolic construction of ships, the author gives a formula by which any form of a ship can be recorded, and by which any ship builder familiar with the parabolic method can construct a ship of a definite form. The formulas and tables for the parabolic method are very simple and complete.

NEW AND COMPLETE CLOCK AND WATCHMAKER'S MANUAL: Comprising Descriptions of the Various Gearings, Escapements, and Compensations now in Use in French, Swiss, and English Clocks and Watches, Patents, Tools, etc., with Directions for Cleaning and Repairing. With Numerous Engravings. Compiled from the French—with an Appendix containing a History of Watchmaking in America. By Mary L. Booth, Translator of the Marble Worker's Manual, etc. New York: John Wiley & Son, Publishers, 2 Clinton Hall, Astor Place.

This will, we should opine, be a valuable book for the watchmaker's and jeweler's craft, although there is not much in it regarding American improvements in watchmaking. The brief sketch of the history of watchmaking in this country is not of much importance. There is much in the book, however, useful for instruction and reference. The printing and binding are not of the highest order, and we suppose that the publishers sought rather to place the work before the public in cheap form than to limit its sale by a more expensive style of execution.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From March 8 to March 14, 1872, inclusive.

BATTERY GUN.—W. A. Mills, Salisbury, Conn.

BILGE WATER INDICATOR.—A. Harris, New York city.

BOAT LOWERING APPARATUS.—C. C. Quarillius, Canaan, N. Y.

BOOT HEEL.—F. Richardson, F. Hacker, Providence, R. I.

COTTON CLEANING MACHINE.—N. B. Hall, Providence, R. I.

DIAL PLATE.—J. C. Dana, E. C. Lewis, L. Atwood, D. W. Marshall, W. B. Musey, B. M. Baily, C. E. Kilby, D. B. Channell, Rutland, Vt.

ELECTRIC TORCH.—W. W. Batchelder, New York city.

GOVERNOR.—J. B. Duff, Patchogue, N. Y.

HEALD, ETC.—D. C. Brown, Lowell, Mass.

LEATHER MAKING MACHINERY.—E. Fitzhenry, Somerville, Mass.

PREVENTION OF RAILWAY ACCIDENTS.—S. W. Emery, E. P. Doyen, W. Sparrow, Portland, Me.

PROPELLING VESSELS, ETC.—A. Mot, G. E. Weaver, Providence, R. I.

ROLL FOR SPINNING MACHINE.—W. A. Caswell, Providence, R. I.

ROLLING MACHINE.—A. Johnson, New York city.

ROTARY ENGINE, ETC.—C. Avery, Tunkhannock, Pa.

SEWING MACHINE.—J. A. House, Bridgeport, Conn.

TRIMMING BOOT SOLES, ETC.—S. H. Hodges, Boston, Mass.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Dickinson's Patent Shaped Diamond Carbon Points and Adjustable Holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24 and Nov. 20, 1869. 61 Nassau st., New York.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4 00 a year. Advertisements 75c. a line.

Over 800 different style Pumps for Tanners, Paper Makers, Fire Purposes, etc. Send for Catalogue. Rumsey & Co., Seneca Falls, N. Y.

Portable Mulsy Saw Mill, that may be run profitably by the power of a Thrashing Engine. Manufactured by Chandler & Taylor, Indianapolis, Ind. Send for circular.

A. N. Fox & Co., Buffalo, N. Y., are operating Vacuum on Sugar Pan, of 26½ to 28 inches mercury. Produced by Ransom Syphon Condenser—no air pump. See advertisement.

Croquet Wickets, made and pointed by machinery, of number four Black, Galvanized, or Tinned Wire, supplied to the trade by Langhland & Co., No. 212 Franklin Street, New York.

For Diamond Turning Tools for Truеing Emery Wheels and Grindstones, address Sullivan Machine Co., Claremont, N. Hamp.

Grindstones for File Cutters. Worthington & Sons, North Amherst, Ohio.

Mill Wrights' Grindstones, for picks, J.E.Mitchell, Phila., Pa.

Ship Carpenters' Grindstones, for adzes, J.E.Mitchell, Phila., Pa.

Billiard Cushions—Manufacturers of Billiard Tables, use Murphy's Patent Cushions. The finest made. Send for sample set. Gutta Percha and Rubber Manufacturing Company, 9 & 11 Park Place, New York.

H.R.Russell, Woodbury, N.J., wants Catalogue of School Desks.

H. E. Shelley, Austin, Texas, wishes price and description of best hand Brick Presses.

We will Remove and Prevent Scale in any Steam Boiler or make no charge. Geo. W. Lord, 232 Arch Street, Philadelphia, Pa.

For Sale—A Steam Boiler, 44 inches by 13 feet, with 43 three inch Flues—about 30 Horse Power. Not long used. Address A. & E. H. Sedgwick, Poughkeepsie, N. Y.

Painters, attention—New Pat. Quick, Clean, Easy, and Cheap Way of Graining, first class Imitations of Oak, Walnut, Rosewood, etc. Send Stamp for Circular. J. J. Callow, Cleveland, Ohio.

Patent Self-acting Horse Holder for Sale—State Rights. Very simple. Can be attached to all kinds of vehicles, will give them a vast preference. A great want never before supplied for saving life, property, &c. Address Abm. Quinn, 230 Marcy Avenue, Brooklyn, L. I.

Astronomical calculations for almanacs a specialty. Address Richard H. Buel, 7 Warren Street, New York.

Right, for Sale, of a valuable improvement in Sad Irons. Address, H. W. Seaman, Millport, N. Y.

Williamson's Road Steamer and Steam Plow, with Rubber Tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1809.

Something New. Shaping Machine Attachment for Lathes. Wm. E. Cass, 61 & 63 Hamilton Street, Newark, N. J.

Improved Foot Lathes, Hand Planers, etc. Many a reader of this paper has one of them. Selling in all parts of the country, Canada, Europe, etc. Catalogue free. N. H. Baldwin, Laconia, N. H.

Drawings and tracings made of Machinery, Models, etc. C. Delafield, C. E., 26 Broad Street, New York.

The Baxter Steam Engine is safe, and pays no extra Insurance.

For the best and cheapest Water Wheel Regulator "in all creation," address Sullivan Machine Co., Claremont, N. H.

The most economical Engine, from 2 to 10 H.P., is the Baxter

Our Home Physician. By Dr. Beard and other eminent Physicians. Is the latest and best Family Guide. 1067 pages. $3. E. B. Treat, Pub., 805 Broadway, New York. Agents wanted.

If you want to know all about the Baxter Engine, address Wm. D. Russell, office of the Baxter Steam Engine Co., 18 Park Place, N.Y.

If you want a perfect motor, buy the Baxter Steam Engine.

Shive's Patent Watchman's Clock and Time Detector—the best ever made. Price $15. Shive Governor Company, Philadelphia, Pa.

Save your Boilers and Save Fuel—Use Thomas's Scale Dissolver, pr. 5c. per lb., in bbls. and ½ bbls. N. Spencer Thomas, Elmira, N.Y.

Enameled and Tinned Hollow-Ware and job work of all kinds. Warranted to give satisfaction, by A. G. Patton, Troy, N.Y.

Best and Cheapest—The Jones Scale Works, Binghamton, N.Y.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

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

Belting as is Belting—Best Philadelphia Oak Tanned. C.W. Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

Boynton's Lightning Saws. The genuine $500 challenge. Will cut five times as fast as an ax. A 6 foot cross cut and buck saw, $6. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

Over 1,000 Tanners, Paper-makers, Contractors, &c., use the Pumps of Heald, Sisco & Co. See advertisement.

Opium Eaters—If you wish to be cured of the habit, address T. E. Clarke, M. D., Mount Vernon, Ohio.

Boiler and Pipe Covering manufactured by the Chalmers Spence Non-Conductor Co. In use in the principal mills and factories. Claims—Economy, Safety, and Durability. Offices and Manufactories, foot E. 9th street, New York, and 1202 N. 3d street, St. Louis, Mo.

L. & J. W. Feuchtwanger, 55 Cedar St., New York, Manufacturers of Silicates, Soda and Potash, Soluble Glass, Importers of Chemicals and Drugs for Manufacturers' use.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W.D.Andrews & Bro., 414 Water st., N.Y.

Presses, Dies, and Tinners' Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N.Y.

In the Wakefield Earth Closet are combined Health, Cleanliness and Comfort. Send to 36 Dey St., New York, for descriptive pamphlet.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms $4.00 a year.

Presses, Dies & all can tools. Ferracute Mch Wks, Bridgeton, N.J.

Seeds and Fertilizers. R. H. Allen & Co., New York.

Vertical Engines—Simple, Durable, Compact. Excel in economy of fuel and repair. All sizes made by the Greenleaf Machine Works Indianapolis, Ind. Send for cuts and price list.

For 2 & 4 Horse Engines, address Twiss Bros., New Haven, Ct.

Peck's Patent Drop Press. Milo Peck & Co., New Haven, Ct.

Hydraulic Jacks and Presses, New or Second Hand, Bought and sold, send for circular to E. Lyon, 470 Grand Street, New York.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

Get your steam boilers and pipes covered with the best non-conductor in the world. Call for Circular. Asbestos Felting Company, 78 Jay Street, New York City.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—COLORING CASTOR OIL.—How can I impart a yellow color to castor oil, without injuring its medicinal value?—S. W. O.

2.—SOLVENT FOR ANILIN GREEN.—Can any one inform me of a volatile non-acid solvent for anilin green?—A. G., Jr.

3.—SEASONING HICKORY.—Can any one inform us, through the columns of your paper, the best way to season second growth hickory for stone cutters' mallets, so that they will not check?—G. W. B. & Co.

4.—KILN FOR DRYING CORN.—I am in pursuit of the best method of kiln drying corn, but cannot find anything that suits me. Can your readers make some suggestions on this point?—J. M. P.

5.—DYEING.—How are anilin colors used in dyeing, and what are the proper recipes for preparation? How can I color fabrics with chrome green and yellow, and with Prussian blue; and what is used as a "set" or mordant for each?—S. W. O.

6.—CEMENT FOR VARNISHED WORK.—Can you inform me how to make a glue or cement to fasten wood to painted or varnished work, so that it will adhere as well as on unpainted work?—PAINTER.

7.—STRENGTH OF WOODEN VAT.—Can any one inform me what pressure a wooden vat, 16 feet deep and 10 feet wide, of staves five inches thick, hooped with ¾ iron, 19 inches apart, will bear, and what should be the limit of pressure of steam therein? The vat is used in preparing straw.—L. A. S.

8.—TIMBER FOR WATER PIPES.—What kind of timber will make the best and most durable piping for conveying water under ground, and should the bark be left on or taken off?—C. H.

9.—NICKEL PLATING LEAD PIPE.—Can any one inform me what, if any, are the advantages of nickel plating the supply or induction pipes of pumps? Will such plating prevent the deleterious effects which are said to be caused by the placing of lead pump pipes in wells?—B.

10.—EXPANSION OF MERCURY BY HEAT.—Will some one of your readers inform me how much per cent mercury will expand when heated from 0° to 100° Fahr.? Which metal comes nearest to mercury in its degree of expansion?—S.

11.—STAINING POPLAR A WALNUT COLOR.—I would like to know how to stain poplar or other light colored woods a walnut color, so that I can rub it down smooth after staining. I can stain a very nice walnut with permanganate of potash, but it does not go deep enough in the wood, and any attempt to rub smooth rubs off the stain.—J. R. H.

12.—NICKEL IN SOLUTION.—Nickel, held in solution so that it can be applied with a brush, is much needed. It must be chemically prepared with such ingredients as not to discolor polished steel, and should evaporate at a low temperature of heat, leaving the articles plated with nickel. The discoverer of such an article would find an immense sale for it, and would confer a lasting benefit on manufacturers of, dealers in and users of polished tools.—J. E. E.

13.—PITCH OF SCREW PROPELLERS.—Can any of your readers give a simple method of computing the correct pitch of screw propellers from the dimensions of the wheel?—G. R.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

LARGEST ENGINE IN THE WORLD.—W. N. G. is informed that we used the figures given by our informant regarding this engine. It was probably the crank that weighed one ton, and not the crank pin.

A. B. S., of La., sends a black mineral specimen and says: Will you kindly let me know the cost of having the enclosed specimen of plumbago analyzed? I would also like to be informed of the number of graphite mines now worked or known to exist in North America, the value of said mines, etc.—Answer: Your specimen is not "plumbago," but is simply a soft bituminous shale. If you will compare the traces on paper made by it and by a good lead pencil, you will see the difference. The best graphite (plumbago) mines in the United States are at Sturbridge, Mass., Ticonderoga, N. Y., Brandon, Vt., and Wake, N. C.

FAST COLORS.—Query 8, March 16.—If the material to be dyed black is woolen, be sure, in the first place, to have it thoroughly free from grease, and clean. Boil in your logwood (half weight of material) liquor for an hour, and add the copperas, in solution, gradually, and continually stirring; after boiling awhile, the addition of a little muriate of tin in solution will give a brilliancy of tone. Now take out the goods, drain, and expose to the action of the air for an hour or two, after which give a thorough washing in water, and eventually with warm soapsuds.—E. H. H., of Mass.

TEST FOR LEAD IN WATER.—Query 24, March 9.—To F. C. The best test is sulphuretted hydrogen. Precautions to be observed: Evaporate in a porcelain vessel or a porcelain lined preserving kettle. Lead is usually present in water, as carbonate or some other insoluble compound, hence most or all of it remains on the filter and should be tested for there. The sulphuretted hydrogen may be prepared from black sulphuret of iron and either oil of vitriol or muriatic acid, no heat being required. The gas should be washed by passing through water. F. C. may prepare the gas quite as well, if not better, by heating together a little flowers of sulphur and some paraffin.—E. J. H., of—

MELTING ASPHALTUM.—No. 1, March 23.—To H. E. W.—This can easily be done in a pot over the fire.—E. H. H., of Mass.

TEMPERING TRAP AND OTHER SPRINGS.—W. R. H. should take good cast steel, work at a low heat, and forge evenly; temper in salt water, and then heat gradually and evenly until it will burn tallow when some is rubbed on. Continue the heating till the blue flame ceases to appear and the flame is white. This is, I believe, the best mode for trap or other large springs; who knows of one better adapted for small springs?—W. H. R., of Pa.

PAINTING BATH TUB.—If C. A. H. will have his bath tub painted with dead flat colors, and then varnish it, it will not scale.—W. C. R., of W. Va.

TEST FOR IRON AND STEEL.—Tell J. H. that if he let fall a drop of nitric acid on steel, it will cause a black spot upon it, but if upon wrought iron, it will not have this effect. He will find this a simple and easy method of distinguishing the two.—H. S., of R. I.

DEMAGNETIZING STEEL.—Let J. B. W., page 200, scour his tools with fine emery, and he will remove the magnetism from them, as it only affects the surface of iron and steel.—C. T., of Vt.

FROSTING GLASS.—G. P. may make a saturated solution of Epsom salts, and cover his glass with it by means of a piece of raz. In crystallizing, the salt will present a pretty appearance.—E. H. H., of Mass.

MAKING RULES.—J. E. M., may dissolve shellac in alcohol, and add a little gum elemi to give increased toughness. To blacken the figures, mix a little lampblack with the above.—E. H. H., of Mass.

PREPARING SKELETON.—G. L. F., after cutting off as much flesh and cartilage from the bones as possible, should then boil them in water till the remainder easily separates. The French still further prepare their skeletons, by bleaching for a short time in a weak solution of chloride of lime. This is no disadvantage whatever.—E. H. H., of Mass.

DISINFECTING WELL.—The most feasible plan for cleansing the well would, I think, be putting in an abundance of chloride of lime. The quantity I can't suggest, not knowing the depth of water. Mix the powder to a smooth cream with water and pour in. Give the sides a thorough washing over, and allow to remain some days in order to effectually destroy the putrid matter; constant agitation of the water will tend to wash the stuff out of the crevices. Afterwards pump all out, and again allow the water to accumulate and again pump out. After a while, I think the well will be found perfectly clean and pure. I would like to know of the success of the plan.—E. H. H., of Mass.

SHELLAC VARNISH WITH LINSEED OIL.—J. C. may dissolve the lac in either a strong solution of ammonia or a saturated solution of borax, and then add the oil and thoroughly agitate, to form an emulsion. The ammonia will be found the best, as in use it will evaporate and leave the coat of lac and oil.—E. H. H., of Mass.

CLEANSING SOAPY FELTS.—W. H. P. will probably find that, after the soap is washed off as thoroughly as may be, the addition of stale urine or dilute ammonia will remove the remainder. These alkalies will be better than either caustic soda or potash, as less likely to affect the color of the material.—E. H. H., of Mass.

W. A. McD., of Pa.—The black "hairs" attached to the coke are pure carbon. If these is any appreciable difference in quality between the hairy coke and the hairless coke, it is in favor of the former. The white hairy substance that you send, resembling cotton wool, which you say is formed by passing a jet of steam through the slag that issues from the bottom of the furnace stacks in which the Fayette county coke has been used, is only the silica of the slag, blown into threads by the steam jet. It readily melts and is not like asbestos as you suppose.

A. H. M. & Co., Ala.—The mineral you send is a soft bituminous shale without any graphite. It may be (and is) used to adulterate graphite for stove polish and the like; but it can never take the place of true graphite in the manufacture of pencils and in the electrotype art.

WATER IN AQUARIA.—I have had an aquarium for fifteen months without changing the water, and C. D. can have similar success by taking some porous stone, broken into small pieces, and covering the bottom of the aquarium to a depth of two inches. In this place some myrtle, water lilies, or other plants that will thrive under water. Do not put in too many plants, and wash such as you use free from all dirt. Fill the aquarium with water, put in your fishes, place the vessel out of the sunshine, and let Nature do the rest. Study how to proportion the plants to the fish, as the plants yield oxygen to the fish and the fish carbon to the plants.—S. B. R.

DIVIDING CIRCLES.—Your correspondent R. C. W., query 19, Feb. 17, wishes a method of dividing circles. The best method is by calculating as follows: Let n equal the number of parts into which the circle is to be divided, d equal the diameter, and c equal the length to be spaced off, that is, the side of inscribed polygon; then will c divided by d is equal to (*sine* times 180 divided by n)°. A near approximation, when n is large, is c divided by d is equal to 3·141593 divided by n. Let n equal 63, then by the first formula: c divided by d is equal to 0·049846, and by the second c divided by d is equal to 0·049968; hence c equals d multiplied by 0·9816.—H. A., of Conn.

BRASS FOUNDING.—If D. G. will take a sand crucible, and allow it first to be well warmed up, he can heat it safely in a blacksmith's fire, although, at best, there is some liability to crack. He should have on a good supply of coal, so that the crucible is not too close to the sharp blast; then use a light blast, and heat slowly until the brass is melted. When hot, it will look white on the surface. If the brass, as he says, "will not run," let him add to the old brass a little good sheet copper, and a small quantity of block tin. Old brass will not run well, if remelted several times, unless thus treated. The white smoke of which he speaks is nothing uncommon.—W. H. R., of Pa.

PAINTING SHEET IRON.—Query 18, March 16.—Let J. C. mix together one pint good varnish, one pint boiled oil, and red lead sufficient to produce a proper consistency. Prepare it a few hours before wanted, and repeatedly stir while using. Use no turpentine or dryers. I have a stack thus painted which has stood the weather and heat for two years, and remains as when first done, but changing to a darker color. The expense is trifling. This is applicable to C. A. H.'s bath tub, and I would advise him to give it a trial.—J. K. W., of Mich.

WORCESTERSHIRE SAUCE.—White vinegar, 15 gallons; walnut catsup, 10 gallons; Madeira wine, 5 gallons; mushroom catsup, 10 gallons; table salt, 25 pounds; Canton soy, 4 gallons; powdered capsicums, 2 pounds; powdered allspice, 1 pound; powdered coriander seeds, 1 pound; cloves, mace, and cinnamon, of each, ½ pound; assafœtida, ½ pound, dissolved in brandy, 1 gallon. Boil 20 pounds of hog's liver in 10 gallons of water, for 12 hours, renewing the water from time to time. Take out the liver, chop it, mix with water, and work it through a sieve; mix with the sauce. *Imitation No. 1.*—White vinegar, 240 gallons; Canton soy, 36 gallons; sugar house strup, 30 gallons; walnut catsup, 30 gallons; mushroom catsup, 30 gallons; table salt, 120 pounds; powdered capsicum, 15 pounds; allspice, 7 pounds; coriander, 7 pounds; cloves, mace, and cinnamon, of each, 4 pounds; assafœtida, 2½ pounds, dissolved in St. Croix rum, 1 gallon. *Imitation No. 2.*—White vinegar, 1 gallon; Canton soy, 1 pint; molasses, 1 pint; walnut catsup, 1½ pints; table salt, 4 ounces; powdered capsicum, 1 ounce; allspice, 1 ounce; coriander, ½ ounce; cloves, ½ ounce; mace, ½ ounce, cinnamon, 6 drams; assafœtida, ½ ounce, in rum 4 ounces; mix. *Imitation No. 3.*—Take port wine and mushroom catsup, of each 1 quart; walnut pickle, 1 pint; soy, ½ pint; pounded anchovies, ½ pound; fresh lemon peel, minced shallots, and scraped horse radish, each 2 ounces; allspice and black pepper (bruised), each 1 ounce (or cayrie powder, ¼ ounce); digest for 14 days, strain, and bottle.—H. W. B., of N. J.

WORN COINS.—By heating these gradually, the inscription will, in almost all cases, make its appearance.—A. J. R., of N. Y.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

ICE CREAM HOLDER AND FILLER.—Henry R. Robbins, Baltimore, Md.—The invention consists of a base cup made of tin, a paper cylinder to receive the cream, and a tin foil cylinder on the outside. These can be furnished to the confectioner at less than one cent apiece. The patent also covers a filler, consisting of an elongated cup and plunger. The cup is principally intended for convenience on cars and in public places, where the vessel must necessarily be sold with its contents.

METHOD OF FORCING PLANTS.—Chas. Reese, Baltimore, Md.—The invention consists in fixing a sponge in the throat of a vessel so that a part of it shall come in contact with water in the body of said vessel, and then filling slits or apertures thereof with bulbous roots. The porous character of the sponge causes the absorption of water, and allows the roots to ramify therethrough. A rapid growth follows and a quick evolution of the flower. The latter is much larger and more brilliant in its colors than by any method heretofore known.

BOLT FASTENING FOR FISH PLATES.—Thos. W. Kirkwood, McKeesport, Pa.—The invention consists in combining a lock plate with fish plates, so that when nuts require tightening up, the rivets can be cut, removed, and replaced without removing the fish plates.

APPARATUS FOR TRACING DRAWINGS, PICTURES, ETC.—Casper Zweifel and Edward Stevens, Pomeroy, O.—This invention relates to an apparatus by which a mirror is made to reflect light through a glass plate and through a picture, drawing, or the like laid upon said plate, and through tracing muslin or other similar material laid upon the picture for the purpose of enabling an operator to accurately delineate upon the tracing muslin the outlines of the picture.

PROCESS AND APPARATUS FOR YELLOWING TOBACCO AND SUBSEQUENTLY RENDERING IT PLIABLE.—Chas. W. Flippen, Laurel Grove, Va.—The invention consists in a new process of yellowing tobacco by applying heat and steam simultaneously, previous to curing it, and in the means by which it may be thoroughly and effectively accomplished.

HOT BLAST OVEN.—Richard Long, Pittsburgh, Pa.—This invention relates to an oven for heating the blast of a furnace by means of the combustion, within the oven, of gases drawn from the furnace, the chief novelty of the invention consisting in an apparatus for burning the gases inside of flues passing vertically through the oven while the blast is passed through chambers enclosing said flues, the blast therefore flowing outside of the flues instead of inside of them, the latter having been, up to the date of this invention, the common mode of conducting the blast.

CAR ROOF.—John L. Burnham, Nashville, Tenn.—The invention consists in making a roof having arc-shaped and longitudinal undersheathing and cross pieces for outer cover, with intermediate longitudinal and continuous sheets of metal, which slightly overlap each other. It makes both a very cheap and durable car roof.

WATER WHEEL.—Vincent M. Baker, of Preston, Minn.—This invention relates to a new arrangement of gates and mechanism for adjusting the same in water wheels. It consists principally in connecting with each gate a vibrating chute plate, which will carry the water at the most advantageous angle to the wheel, whatever the position of the gate. The invention also consists in a new manner of hanging the gate, adjusting and connecting it with the several gates. The flanges of the cylinder and crown plate are curved, forming a flaring and convenient entrance for the water. The gate can swing independently of the chute plate, and *vice versa*. Each gate is pivoted at or near the middle, and with its inner part fully overlaps its chute plate, while its outer part more or less covers the inner part of the gate next behind. The gates can be adjusted according to the amount of power to be obtained. But the chute plates are self-adjusting, and will, it is claimed, always swing toward the wheel to carry whatever water is at disposal at the most advantageous angle.

PLASTIC COMPOSITION.—Thomas B. Gunnings, of New York city.—This invention relates to a new plastic composition claimed to be of great value when applied to the manufacture of boxes and other useful and ornamental articles, since it is strong, durable, sufficiently elastic, beautiful in appearance, susceptible of high polish and distinct ornamentation, and impervious, practically, to air, water, and fatty substances. The composition consists, principally, of finely powdered carbonate of lime and shellac so combined and treated as to produce the desired effect. To one part, by weight, of good shellac—preferably the kind known in market as "Camel's"—two parts, by weight, of finely pulverized marble are added. The ingredients should be finely powdered before mixture, then put into a suitable vessel, exposed to heat, and stirred constantly until melted into a homogeneous mass, which should then be rolled out to a suitable thickness. It can then be reheated, molded, and pressed or otherwise shaped into the desired form. When bleached shellac is used, it may be necessary to reduce the proportion of marble somewhat, as the fusibility of the shellac is generally diminished in the bleaching process. In some instances, where a light shade is desired, pure white chalk may be used in place of the marble, one part of bleached shellac being used to one and a half or to one and five eighths parts of chalk. Different colors may be obtained by adding suitable coloring matter to the materials when first mixed. Composition containing different colors can be mixed so that the articles made from it will present a marbled appearance. Alabaster, travertine, agaric mineral, all the various marbles, and also the calcareous spars, such as calc spar, Iceland spar, etc.; also the marble known as dolomite, containing carbonate of magnesia; also limestone, containing silicate of alumina or clay, or other matter, coral, etc., may be employed in this, their use being covered by the broad claims allowed in the patent, which are as follows: A new calcareous composition made as described, and the method described of preparing the ingredients and producing the calcareous composition. The composition in some of its lighter shades will resemble ivory somewhat in appearance, strength, and elasticity; but, owing to its plastic state when heated, and to its capacity for taking color, this composition can be more frequently applied than ivory.

RAILWAY SWITCH.—Patrick Carrigan, of Sturgeon, N. Y.—The construction of this railroad switch causes the rails to be securely held in place when adjusted, and enables the weight of the sliding or movable rails to bring them exactly in line with the stationary rails should they be moved by the switch rod a little too far or not quite far enough. The invention consists mainly in providing V shaped projections on the rail chair and switch rod, which, engaging V recesses formed in the bottom of the groove in the chair or block in which the switch rod works, holds the rail securely in place when adjusted, and, at the same time, the inclined sides of the projections cause the rails to slide into line with the stationary rails, should they be moved a little too far or not quite far enough by the switch lever. The invention thus differs materially from those in which the ends of the rails fit in sockets formed with straight sides, since, in the latter case, the rails will not enter the sockets unless a very perfect adjustment be first effected by the operation of the switch rod and lever.

SPRING FOR VEHICLES.—Alexander W. McKown, of Honesdale, Pa.—This invention consists in a combination of auxiliary springs with the ordinary springs of a wagon and connecting devices, whereby the auxiliary springs may be utilized to reinforce the ordinary springs according to the weight of the load, and thus avoid the present objectionable practice of using the same springs for light or heavy loads, for both of which they cannot be well adapted. The ordinary springs are provided with a cross bar or bars rigidly connected to them at the ends. These bars carry cranked, pivoted, or hooked devices, or any equivalent thereof, arranged to confine the auxiliary springs to the cross bars to reinforce the main springs or to disconnect them, as may be required by the conditions of the load.

SPARK ARRESTER.—Russell Hawkes and Henry J. Paine, of Providence, R. I., assignors to themselves and Joseph Kelley, of same place.—The upper end of the smoke stack is closed, except in the middle, from which a pipe of wire gauze or perforated sheet metal, projects downward and connects at the lower end with the steam exhaust pipe. All smoke that reaches the smoke chamber is by the force of the exhaust, as well as by the ordinary draught and by its own impetus, caused to enter a perforated pipe and ascend in the same to escape. Sparks and cinders, however, of larger size than the apertures of the pipe cannot escape into the same, but are, by the same stated forces, carried up around the pipe into an upper, outer, and closed part of the smoke stack. In this upper outer part are some inclined rings which deflect the ascending sparks or cinders, and cause them to enter an annular space, which is formed in the smoke stack by an upright tube. The lower end of the space is closed, except where it communicates with two, more or less, pipes, which communicate with as many horizontal or inclined tubes that lead back to the fireplace. Thus all the sparks, cinders, etc., that are carried to the chamber are conducted back to the fireplace for complete consumption. It may be necessary to create a draft in the inclined tubes in order to force the sparks and cinders backward therein. For this purpose, these pipes are carried through the front end of the engine, and open or perforated in front, so the air entering them during the forward motion of the locomotive may carry the cinders into the furnace, besides furnishing oxygen for a more complete combustion of the gases. Since the tubes are thus open at both ends, the light of the fire that shines through them is utilized by attaching to their front ends spherical reflectors with glass faces. These will constitute signals that can be used for suitable purposes, and will be displayed without the use of lamps or extra lights.

GAS APPARATUS.—Charles Seeger, of Quincy, Ill.—The invention consists in combining, constructing, and arranging the essential parts of a retort furnace, namely, the upper fire chamber, its ring grate, the retort passing through the grate, the doors of the furnace, the ash pit, and its doors provided with air inlets; with a second fire chamber, having a grate and an ash pit, provided with a drawer. The independent flues of the two fire chambers terminating in a common flue, a steam or gas outlet from the retort is provided, and also a perforated chamber to contain the article to be heated. The advantage of combining the two fires with retort chamber is claimed to be economy of time in heating and a comparative saving in the fuel.

EARTH CLOSET.—Anthony W. Davis, of Wilmington, Del.—A hopper or receptacle for the earth is placed behind the seat. The bottom of the hopper is formed by a fixed grate, under which there is a similar but movable grate. A spring or grate moves the movable grate forward under the openings of the grate to hold the bottom of the hopper closed. The hinged lid of the closet is provided at its sides with projecting arms or levers which reach down to and connect with a movable frame under the seat. The receiving vessel of the closet is placed upon the movable frame or case. By opening the lid, the movable frame is brought forward so as to place the vessel under the seat, the hopper meanwhile being closed. When the lid is closed, the frame with the vessel is moved back under the hopper, the frame striking an ear of the movable grate and pushing the latter back so as to open the bottom of the hopper. The earth can then freely flow into the vessel.

MACHINE FOR TURNING LOGS IN SAW MILLS.—Alexander Rodgers, of Muskegon, Mich.—This is an improvement in the construction of E. Tarrant's machine for turning logs in saw mills, patented August 25, 1868, which is claimed to render it more convenient in use, and more effective in operation, while requiring less power to operate it, and enabling a smaller chain to be used. It consists in a sheave, in combination with the arm of a toothed bar, to receive the chain, by which construction the strain upon the chain is distributed upon its two parts, so that the chain may be made lighter, and at the same time the friction pulley may be made smaller, thus giving greater speed to the device.

BARBER'S AND DENTISTS' CHAIR.—Anthony Abel, of New York city.—This invention relates to the construction of chairs with adjustable backs, for barbers' and dentists' use, having special reference to the raising and lowering the back of the chair. It consists in a screw and bevel gear wheels supported in a hinged yoke, and connected with the back and bottom of the chair, so that when the nut is revolved the screw will be raised or lowered as the bottom side or collar of the nut wheel rests upon the arm of the yoke. As the back of the chair is raised or lowered, the relative position of the screw thereto will change; but, as the screw is pivoted at its top end to the back, or is allowed to turn and passes through the hinged yoke, the parts work easily together and without undue friction.

OSCILLATING STEAM ENGINE.—George F. Lowry, of Lake Mississippi, Miss.—This invention relates to a new arrangement of oscillating steam engine, and more particularly to a new valve, new crank connection, and new link motion. The valve is made with two sets of apertures or steam passages, each set having three arms to connect with the inlet and exhaust in the requisite manner. The crank motion is peculiar, consisting, principally, in the arrangement of a disk with a series of projecting crank pins, which alternately connect with the oscillating slide that is attached to the end of the piston rod. The link motion, finally, is an inclined rail, on which the above mentioned slide travels, and which connects with the valve so as by its changed inclination to reverse the valves and the motion of the engine. The mere change of position of said rail is, therefore, sufficient to reverse or arrest the motion of the engine, and the same is, therefore, under very convenient control. Its several advantages make the improved engine peculiarly adaptable for use on steamboats, locomotives, and other moving devices, though it can also be profitably employed on stationary machinery. The improvements are covered by five claims upon which the patent was issued.

MACHINE FOR JOINTING STAVES.—Arza M. Benson, of Cleveland, Ohio.—The staves are jointed by two cutter heads, the shafts of which are set at an angle so the faces of the cutter are inclined to give the required convexity to the joint. A swinging table is provided with adjustable clamps for different lengths of staves. By shaping the cutter heads in a peculiar manner, the work can be done much faster than on the old plan, the projecting naked arms allow the knives to commence cutting on the stave with heavy shavings—or, in other words, to cut away the stave as fast as it is being fed ahead, until the ends of the staves are sufficiently cut away to come to a bearing on the round part of the cutter head, when light shavings only will be cut.

PRINTING PRESS.—Berthold Huber, of Williamsburgh, N. Y.—This invention is an improved movement for printing presses by which the cylinder will be made to move at the exact rate of speed with the bed plate, while in contact with the bed plate, and allowed to move at a different rate of speed during the rest of its revolution, to bring it again in contact with the bed plate at the proper time, thus allowing the cylinder to be made smaller than it can be made when the ordinary movement is used. The invention is only applicable to those presses in which the bed plate is driven by a crank movement. A variety of devices is employed to effect the desired object, embraced in two claims upon which the patent has been issued.

CORN PLANTER.—Samuel L. Donnell, of Humboldt, Tenn.—This invention consists in a combination of a hopper, bottom apertured board, wheel having pins and cups, and a corrugated and pivoted plate having inclines arranged in a new and peculiar manner by which, with other parts not new and therefore not comprised in the claim, a very neat, compact, and apparently effective machine for the purpose designed is secured.

ROAD PAVEMENT.—Matthew K. Couzens, of Yonkers, N. Y.—This invention relates to a new arrangement of constituents for a roadway, and has for its object to combine strength and antifrictional qualities with simplicity of construction, convenience of laying and of taking up. A difficulty with ordinary road beds for cities and towns is that the occasional taking up of portions makes the even replacement difficult, and often causes the subsequent sinking of the road at such places. This invention consists in the arrangement of prismatic blocks, made of concrete or artificial stone, and grooved on the surface, and in their combination with an asphaltum covering. The edges of the blocks are made with alternate ribs and grooves so that they will lock together when placed upon a road; but every tenth gutter block is made without such ribs or grooves to enable its convenient removal and that of the blocks adjoining. The surfaces of all the blocks are grooved or indented to become sufficiently roughened for the attachment of the asphaltum covering. Such covering, sufficiently thick, is subsequently spread over the blocks, and forms the actual road bed. By a heated tool, the asphaltum can at any time be cut to detach the blocks beneath and permit their removal. After replacement the joints are merely closed by the application of liquid asphaltum, so that hardly any material is wasted by such removal and replacement. In place of asphaltum, any equivalent bituminous covering may be used.

FASTENING KEY FOR COFFINS.—John Homrighous, of Royalton, Ohio.—The object of this invention is to provide a substitute for screws, used in fastening the lids of coffins, and for all similar purposes, whereby much time and annoyance may be saved. It consists in a key, ordinarily constructed so that it can be turned like a thumb screw. The shank of the key passes through the cover and enters the side or end of the coffin the same as a common wood screw. One or more spurs project from the side of the shank near its end. These spurs are preferably flat and sharp on one edge, and placed spirally on the shank, or like the thread of a screw, so that when the key is turned the spurs will draw the key down and tighten the cover to the side, the same as would be done by turning down a screw, a shoulder on the shank of the key giving the desired hold on the cover. To apply the key, a hole is bored through the top or cover and in the side or end, and then a channel is cut in one side of the hole of sufficient size to admit the spurs. With the hole thus prepared, the key may be dropped into it, and when it is turned, the spur or spurs will penetrate the wood and act the same as a screw thread to draw the parts of the coffin, box, or other article together. The lower edge of the obliquely placed spur is sharpened or made thin, so that it will readily penetrate the wood. Ordinarily, the spur or spurs will be placed so that the key would be turned to the right to fasten, and to the left to unfasten. One fourth of a revolution will do either. A great saving of time is thus effected, as compared with the time required for driving screws with a screw driver.

PADDLE MECHANISM FOR BOATS.—Charles Howard, of New York city.—This is an improved paddle mechanism for the propulsion of vessels and boats. A shaft is arranged across the boat and connected in a suitable manner with a steam or other engine, which is supported on said boat. At the outer ends of the shaft are cranks which work outside of the boat. On the outer end of each crank is a gudgeon, on which fits a suitable box provided in the paddle near the center of same. Another pair of shorter cranks is secured to the ends of a shaft, which is placed parallel to and over the other or main shaft. The outer end of each short crank is attached to an arm, which connects it with the upper end of the paddle. These shafts are geared so that they turn alike, and the two cranks at each end always point in the same direction. When they revolve, the long crank, which is attached near the middle of the paddle, carries that part of the paddle further forward and aft than the short crank, which is attached to the upper end of the paddle, carries that end. This difference in the length of the cranks causes the lower end of the paddle to move further than the upper end, and, therefore, it makes a longer stroke than if both cranks were of the same length. By varying the relative lengths of these cranks, the paddle is made to go into and come out of the water at any desirable angle. If the cranks were of the same length, the lower end of the paddle would move no further fore and aft than the circle of the cranks would measure, as the paddle would always remain upright, and the stroke would be too short. If, on the other hand, there were no upper crank, and if the arm attached to the short crank and upper end of the paddle were secured to a stationary pivot instead of to a short crank, it would give the paddle too much stroke, and cause it to strike the water at so great an angle as to waste its power by driving the water downward at the forward end of the stroke, and raising the water at the back end of the stroke. These paddles are designed for the stern, side, or bow of the boat. If they are placed at or near the bow, the blades of the paddle are set at an angle from the beam of the boat, the edge next to the boat being further aft than the outer edge. This angle of the blade throws the water diagonally from the bow, and prevents its piling up in front of the boat. The rapid motion of the paddle causes a partial lowering of the water at the bow, which accelerates the speed. If the paddle is placed at or near the stern, the outer edge of the paddle is placed further aft than the edge next to the boat. This is to prevent the paddle from lowering the water under the stern of the boat, and to facilitate the steering of the boat.

TRAY HOLDER.—Obed Fahnestock, of Indianapolis, Ind.—This invention consists of a small horizontal lattice frame of metal, with a handle at one side, and short legs on the bottom with screw threaded holes formed in them from the top, on which the tray is fastened by screws or, it may be, rivets entering said holes; and the handle is arranged so that it may be taken in the hand to hold the tray while resting on the arm behind, the hand grasping said handle to enable one to hold the loaded tray by one hand, and allow of using the other for other things.

POCKET FLASK.—Rogers George, of New York city.—This invention furnishes an improved pocket flask, so constructed that the operation of putting on the cup or cap will cork the flask, and the operation of taking off the cup or cap will uncork the flask; and it consists in the cork or stopper, permanently attached to the cap or cup of the flask, as hereinafter more fully described. A stopper, made of cork, rubber, or other suitable material, is permanently attached to a cap or cup which is placed on the top of the flask. This may be done by securing a small screw to said cup, upon which a cork or stopper is placed and secured by a nut. The cork or stopper may be attached to the cup or cap in any other substantial and convenient manner. The shape of the cups is immaterial. It is preferred that the cups should conform somewhat to the form of the glass flask, and their bottoms should be flat, so that they may stand steadily upon a table or other support when required.

INSTRUMENT FOR EXTRACTING AIR FROM FRUIT JARS.—John H. Parrish, of Talladega, Alabama.—This invention relates to and consists in a peculiar construction of a tubular perforator, which is passed through the cork of the fruit jar. There is an orifice through which the air enters, and one through which the air escapes. The perforator being passed through the cork, the cork is inserted into the neck of the jar. When the jar, with the cork and perforator inserted, is placed in the water, and the contents are brought to the boiling temperature, the steam generated will exclude the air which will be driven into the tube, and escape therefrom through the outlet. The cork should be soft and elastic, and tightly driven in. The perforator is so small and delicate that the orifice it has made through the cork will upon its withdrawal be instantly closed by the elasticity of the cork, so that air is excluded; but to render the top of the cork perfectly impervious, a cap of cement, gum, or any other suitable material is used. It is claimed that, with the use of this perforator, the fruit preserving jar is cheaply made. The process or operation of "putting up" fruit or vegetables is rendered very simple, and the result is equaled only where the best and most perfect fruit preserving vessels are used.

SOFA BEDSTEAD.—Joseph Schaier, of New York city, assignor to himself and George W. Smith, of same place.—This is an improved sofa bedstead, constructed so that it may be extended to serve as a bedstead, and, folded up, to serve as a sofa, and when folded up shall give no indication that it can be extended. The construction is strong, durable, not liable to get out of order, and conveniently extended and folded. It is moreover capable of being made highly ornamental, the construction admitting of elaborate as well as plain designs, so as to meet the various tastes and means of the general public.

WAGON BODY LIFTER.—Edward A. Chatfield, Waterloo, Iowa.—This is an improved apparatus for lifting wagon boxes, wood racks, hay racks, etc. from and lowering them upon the running gearing of wagons, enabling a single person, or even a boy, to readily remove and replace a wagon body or rack. The box is provided with staples at the side with which iron loops engage. A post sustains a pivoted lever bar, one end of which being lowered, engages the iron loop at one end of the box. When the opposite end of the lever bar is depressed, it raises one end of the box. The link now being attached at the depressed end, the box is so nearly balanced that a slight effort suspends it, at a level high enough to allow the running gear to be drawn from under it.

HUB FOR CARRIAGE WHEEL.—Joinville F. Fowler, Alliance, Ohio.—This is an improvement in the construction of wheels whose hubs are made of a wooden core encircled by metal bands. The hub is made of wood, and provided with projecting ribs in which mortises for receiving the spokes are arranged. The spokes are properly tenoned to fit the mortises. Two metal rings are fitted over the ends of the hub, and provided, respectively, with flanges, which bear against the sides of the rib. Each flange has a lip with which it overlaps the edge of the rib. By means of screws or bolts the flanges are secured to the rib, and the rings thereby held in place. By means of these flanged plates the use of metal between the spokes is dispensed with, the spokes being allowed to come close together.

[OFFICIAL.]

Index of Inventions

For which Letters Patent of the United States were granted

FOR THE WEEK ENDING APRIL 2, 1872, AND EACH

BEARING THAT DATE.

Alarm, burglar, I. and A. Herzberg 125,298
Alarm, burglar, T. N. Howell 125,296
Barrels, cleansing and purifying beer, W. Harvey 125,193
Bed, spring, I. E. Webster 125,357
Bed bottom, spring, S. B. Andrews 125,250
Bedstead fastening, J. Simpson 125,342
Bell, alarm, W. M. Preston 125,328
Belts, fastening for, H. Norfolk 125,213
Billiard register, Wood and Geer 125,242
Boats, propelling canal, W. P. More 125,207
Boats, device for propelling canal, T. K. McDonell 125,205
Boiler tubes in tube sheets, securing steam, W. Moorhouse 125,321
Boot and shoe heel, C. B. Norton 125,214
Boot strap, guard for, J. E. Curtis 125,274
Brake and starter, combined, J. A. Cody 125,119
Brick kiln, B. R. Hawley 125,292
Brick kiln, B. R. Hawley (reissue) 4,848
Brick machine, H. C. Bankerd 125,253
Brick machine, C. Clarke 125,272
Bricks, tiles, etc., manufacture of, J. M. Reid 125,144
Bridge, J. Zellweger 226,244
Bridge, J. H. Diedrichs 125,182
Bridge, wrought iron, A. P. Boller 125,117
Bridges, arch for, D. Foragne 125,128
Brush, etc., blacking, H. S. Kerr 125,200
Brushes, handle for, S. D. Foster 125,279
Buckle, H. Sanders 125,335
Buckle, Maxwell and Lindner 125,315
Building, fireproof, J. J. Bartlett 125,163
Burner, gas, S. W. Pingree 125,327
Cages, construction of bird, G. Günther 125,288
Camel, marine, M. Toulmin 125,352
Camera boxes, guide slide for, O. Loehr 125,202
Car coupling, F. M. Hunt 125,298
Car dumping, S. D. King 125,307
Car platform, R. A. Cowell (reissue) 4,846
Car roof, J. L. Burnham 126,266
Car seat, N. S. Whipple 125,364
Car buffers, spring for, J. Haldeman 125,191
Car, propelling street, Simms and Duvall 125,224
Carbureter, H. Holton 125,194
Carpets, machine for cleaning and finishing, J. Wilkinson, Jr 125,240
Carriage step, E. Wells 125,235
Carriage wheel, C. A. Miller 125,206
Carriage wheels, hub for, I. E. Bower 125,164
Carriage wheels, tire for, H. Silvester 125,341
Cartridge shell, S. W. Wood (reissue) 4,843
Casks, device for closing the mouths of, J. F. C. Rider 125,220
Cattle, device for removing obstacles from the throats of, C. Schule. 125,337
Chair, folding, H. James 125,337
Chair, swiveled, D. E. Teal 125,350
Clay, etc., machine for grinding, A. Alexander 125,159
Clipping machine, J. W. Moyer 125,209
Cloth, cord, and paper cutter, combined, I. B. Millner 125,319
Clothes pin, T. C. Ball 125,253
Clothes pin, S. B. Lucas 125,311
Clothes wringer, A. H. Goss 125,129
Clothes wringer, Bailey and Couch, (reissue) 4,844
Collar, breast, G. Van Wagenen 125,353
Cooking apparatus, steam, L. K. Williams 125,155
Cooler for liquids, J. W. Campbell, Sr 125,268
Coop, poultry, M. Potter 125,142
Corn sheller, A. H. Patch 125,217
Cracklings, cutting tool for the manufacture of, L. F. Lannay 125,137
Cultivator, I. H. Chappell 125,271
Cutter head, A. D. Shefar 125,340
Demijohn, G. W. and C. W. Foster 125,147
Digger, potato, M. Johnson 125,308
Ditching machine, H. Carter 125,167
Dough board, H. F. Morse 125,208
dovetails, device for molding, A. L. Finch 125,183
Dovetailing machine, Gear and Dunklee 125,282
Drawings, etc., apparatus for tracing, Zweifel and Stevens 125,372
Dredging machine, W. T. Thelin 125,351
Dryer, M. P. Smith 125,344
Dryer, clothes, A. C. Stowe 125,227
Drill, grain, Mast and Gardiner 125,314
Earth closet, R. S. Williams 125,156, 125,370
Electro-magnet, I. P. Tice 125,151
Elevators, stop motion for, H. E. Bathrick 125,256
Engine, gas, G. B. Brayton 125,166
Engine, rotary steam, S. Gibson ..... [illegible]
Engine valve, steam, S. J. Peet, (reissue) ..... [illegible]
Engines, constructing links for valve gear for steam, J. A. Wildman 125,154
Fare box, J. B. Slawson, (reissue) 4,850
Fats and oils from seeds, etc., separating, E. S. Hutchinson 125,300
Fence post, Freeman, Idell, and Vanderhoven 125,189
Fertilizers, treating animal matters for, W. L. Bradley 125,260
Fertilizers, apparatus for pulverizing animal matters for, A. Smith. 125,343
Fire extinguisher, J. Duffy 125,275
Fire arm, breech loading, J. F. Thomas 125,229
Fire arm, breech loading, W. H. Elliott 125,127
Fire arm, breech loading, S. W. Wood, (reissue) 4,842
Food, treating vegetables for, Adamson and Simonin 125,247
Fork, horse hay, Beam and Bush 125,330
Frictional brake, P. W. Yarrell 125,158
Fruit packing implement, C. C. Roberts 125,146
Furnace, boiler, B. F. Smith 125,148
Furnace, hot air, W. R. Bond 125,259
Furnace for melting iron, G. H. Sellers 125,147
Furnace for treating ores, J. M. Reid 124,143
Gaiter, W. E. Putnam 125,219
Glass mold, F. A. Weise 125,234
Glass blower's mold, S. R. Bowle 125,165
Grain binder, J. H. Whitney 125,366
Grain bin, L. S. Chichester 125,169
Grain for grinding, preparing, L. S. Chichester 125,170
Grain scourer and huller, L. S. Chichester 125,171
Grape crusher and stemmer, Johnston and Johnson 124,197
Hair for stuffing cushions, etc., W. Adamson 125,246
Hame for harness, D. Foreman 125,278
Harvester rake, W. A. Kirby 125,203
Harvester and husker, combined, J. McLeish 125,318
Harvesters, divider attachment for, Keller and Luse 125,196
Hay carrier, J. B. Drake 125,183
Heater for preventing the accumulation of snow, R. B. Miller 125,141
Hide and leather working machine, F. Fitzhenry 125,276
Hinge, W. Wakenshaw 125,354
Hinge for carriage doors, E. Wells 125,236
Hinge for table leaf, D. A. Garver 125,281
Horse power, J. H. Kleppinger, (reissue) 4,839
Hose, manufacture of waterproof, T. L. Reed 125,331
Hose and tubing, manufacture of, S. P. Cook 125,175
Ice cream holder and filler, H. R. Robbins 125,333
Ice machines, valve for, F. Windhausen 125,371
Implement, compound, J. C. Schlarbaum 125,336
Iron, metal coated sad, W. H. Howell 125,297
Iron, manufacture of, J. Absterdam 125,245
Iron from mill cinder, manufacture of, C. M. Nes 125,212
Ironing and polishing cloth, machine for, H. Hamill 125,289
Knapsack attachment, J. S. Foy 125,188
Knife scouring board, E. Deming 125,134
Lambrequin, wooden, H. Weber 125,356
Lamp, hunting, J. T. Staples 125,150
Lard, bleaching, O. J. Backus 125,162
Latch and lock for sliding doors, combined, C. W. Chappell 125,168
Lathe carrier, extension, W. A. Lorenz 125,203
Lead, manufacture of sulphate of H. A. Whiting 125,153
Line and strap holder, F. W. Jay 125,136
Lock, permutation, O. L. Damon 125,180
Lock for valises, etc., R. Schmitt 125,223
Locomotive, counting register for, E. P. Curtiss 125,179
Marbles, manufacture of imitation, G. Davey 125,122
Matches, machine for slitting, Smith and Jordan 125,149
Mattress stuffer, T. A. Watson 125,233
Medical compound, F. Goetsch 125,286
Medical compound or capsicum plaster, J. & I. Coddington 125,173
Metal, machine for bending sheet, R. B. McConnell 125,317
Meter, liquid, J. S. Barden 125,114
Meter, liquid, I. P. Tice 125,152
Mill, mortar, H. Hill 125,295
Millstone dress, P. W. Yarrell 125,157
Mill, hide and tulling, S. Hussey 125,135
Mortising machine, E. Dayton 125,123
Mowing machine, Burdick and Daggett 125,264
Muff, ear, C. Sedgwick 125,339
Music leaf turner, C. I. Adkins 125,113
Musical instrument keys, making pivot holes in, S. H. Wilder 125,239
Neck-tie holder, A. F. Bixby 125,116
Neck-tie or scarf, reversible, L. Kahn 125,305
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5,738.—BEER MUG.—C. Ballinger, Wilkins Township, Pa.
5,739 to 5,741.—TYPES.—H. Brehmer, Brooklyn, N. Y.
5,742.—GLASS WARE.—J. Bryce, Allegheny county, Pa.
5,743.—FENCE.—F. A. Fleming, Curwinsville, Pa.
5,744.—BEER MUG.—J. H. Hobbs, Wheeling, W. Va.
5,745.—LABEL.—T. K. Leslie, New York city.
5,746.—OIL CLOTH.—J. Meyer, Lansingburgh, N. Y.
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5,748.—CARPET.—F. Nowell, Milford, N. H.
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Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

20,728.—HAND DRILL.—H. H. Packer. June 12, 1872.
20,777.—RAILROAD CAR SEAT AND BERTH.—Z. Cobb. June 19, 1872.
21,059.—STEAM ENGINE.—H. and F. J. L. Blandy. July 17, 1872.
20,736.—FIRE AND BURGLAR PROOF SAFE.—T. Sharts. June 17, 1872.
20,920.—SPINNING FRAME.—A. Houghton. June 26, 1872.
20,960.—HEEL SHAVER.—V. Snell. July 3, 1872.
20,719.—HARVESTER.—W. F. Ketcham. June 12, 1872.

EXTENSIONS GRANTED.

19,696.—GRINDING ATTACHMENT.—D. H. Gage.
19,718.—TURNING AND SLIDING TABLE.—W. Sellers.
19,683.—HOT AIR FURNACE.—J. Child.
19,719.—STOP MOTION FOR LOOM.—R. J. Stafford.
19,733.—COMBINATION OF LEAD PENCIL AND ERASER.—H. L. Lipman.

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