SCIENTIFIC AMERICAN

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

Vol. XXVI.—No. 13. [NEW SERIES.] NEW YORK, MARCH 23, 1872. $3 per Annum [IN ADVANCE.]

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.

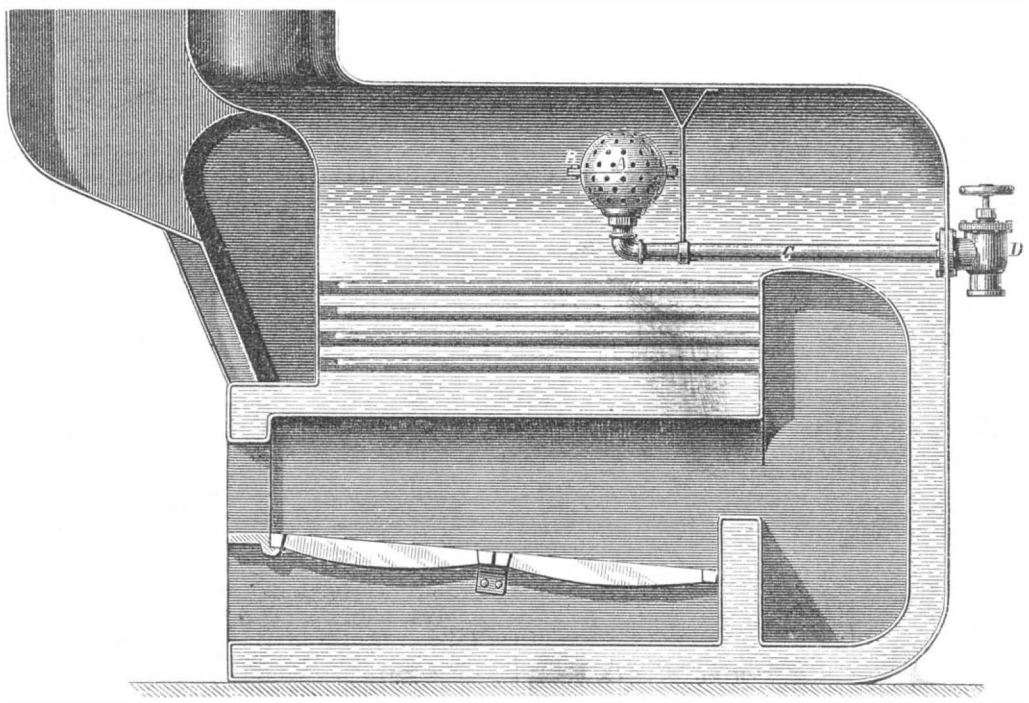
This is claimed to be the action of this surface blower, the parts of which are as follows:

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 & Calverley, 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.

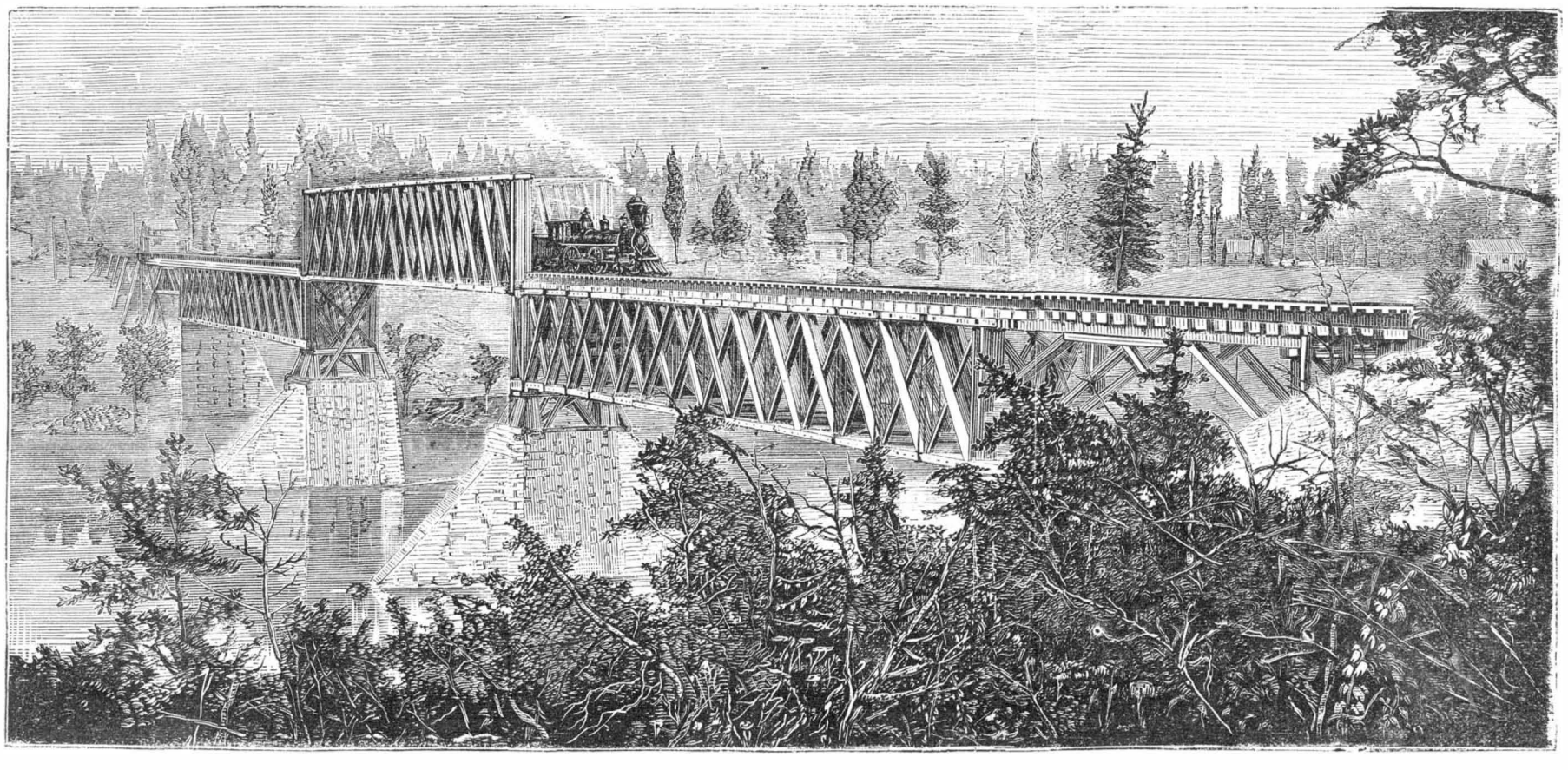
The road follows a natural line of commerce, which must, in time, develop into something enormous. It penetrates a region remarkably productive, into which civilization is crowding even in advance of the construction of the railway. This country has been appropriately called the "Garden Region" of the 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	8.419	
Number of revolutions of screw per minute to obtain a speed of 5 miles per 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 6⅛ 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 Ruhla, 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.

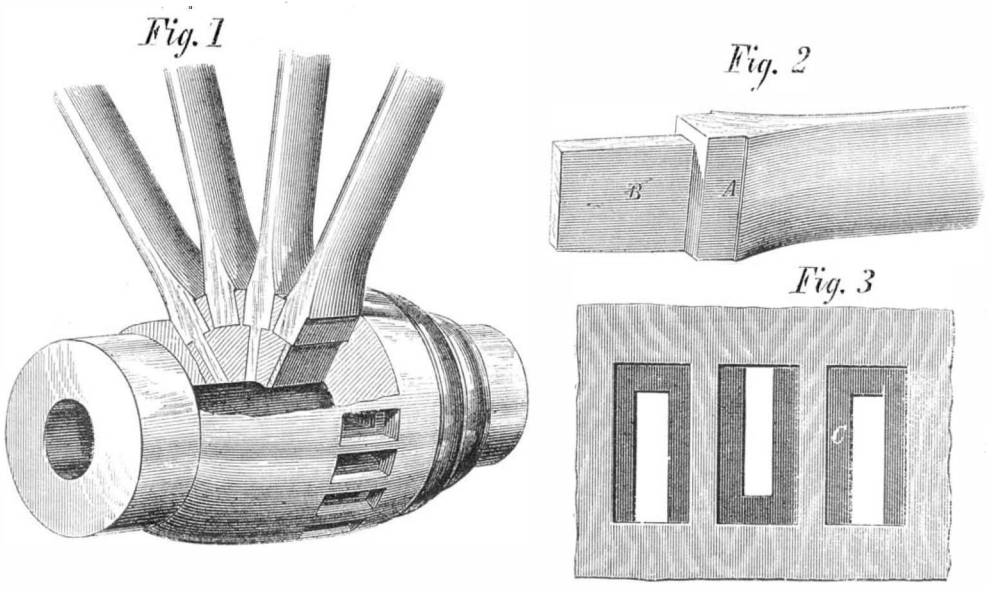
By referring to Fig. 2, it will be seen that a partition of the tenon, marked A, is cut as on ordinary spokes. Below this the wood is further cut away, as shown at B, making a smaller tenon, and leaving a shoulder on three sides of the tenon, which, when the spoke is driven home, rests upon the ledge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

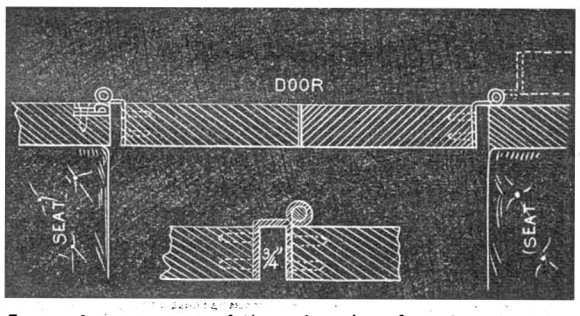
Patented through the Scientific American Patent Agency, January 2, 1872, by Christian Anderegg, of Lawrenceburgh, Ind., whom address for further information.



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.*

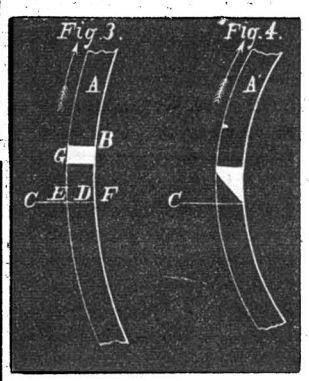
An Asiatic Railroad.

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.

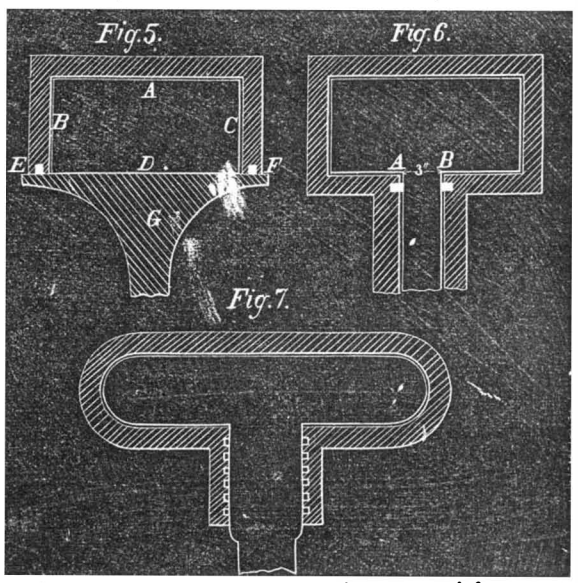
In figure 3, A is a portion of the annulus, B is the piston with sides nearly in the plane of the radius of the annulus; C is the abutment. The abutment begins to close at the moment the back edge of the piston passes the point E; but while the abutment is moving from E to F, the piston has advanced 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 10 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

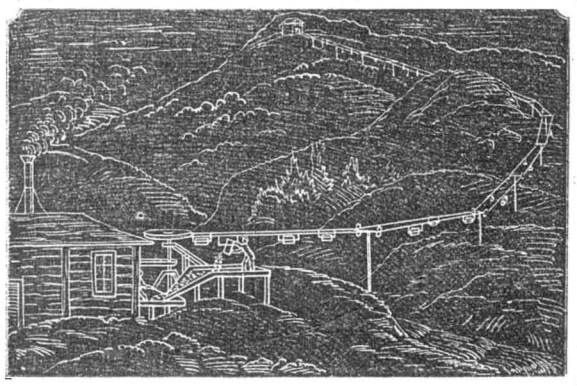


do not believe it to be possible to arrive at a satisfactory result if any attempt is made to pack the joints between the disk and the annulus in the ordinary way. The solution of the problem probably lies in making the disk for a considerable portion of its breadth, say at least a foot from the edge, 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 fly-wheel, 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.

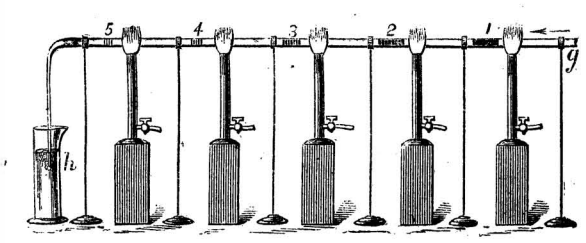
'This apparatus should not be confounded with the ropeway of Hodgson's patent, which is now in operation at the Eberhardt and Aurora Company's mines in White Pine, as it is totally different in its construction."

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.

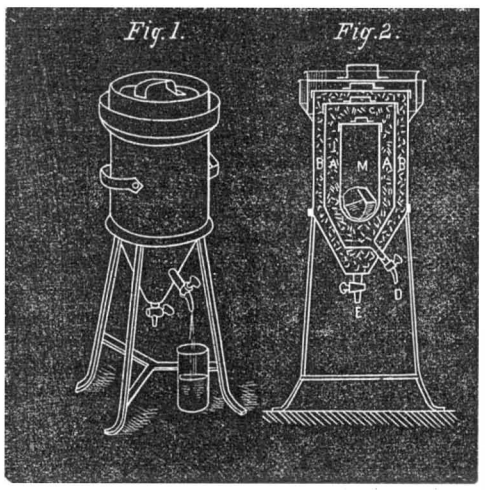
In an examination of the liver or other organ, in cases of arsenical poisoning, the solution generally obtained by the process of Fresenius and Babo is moderately strong when arsenic is present; it is therefore necessary to secure under these conditions the precipitation of the whole of the arsenic at 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° Fab.

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.

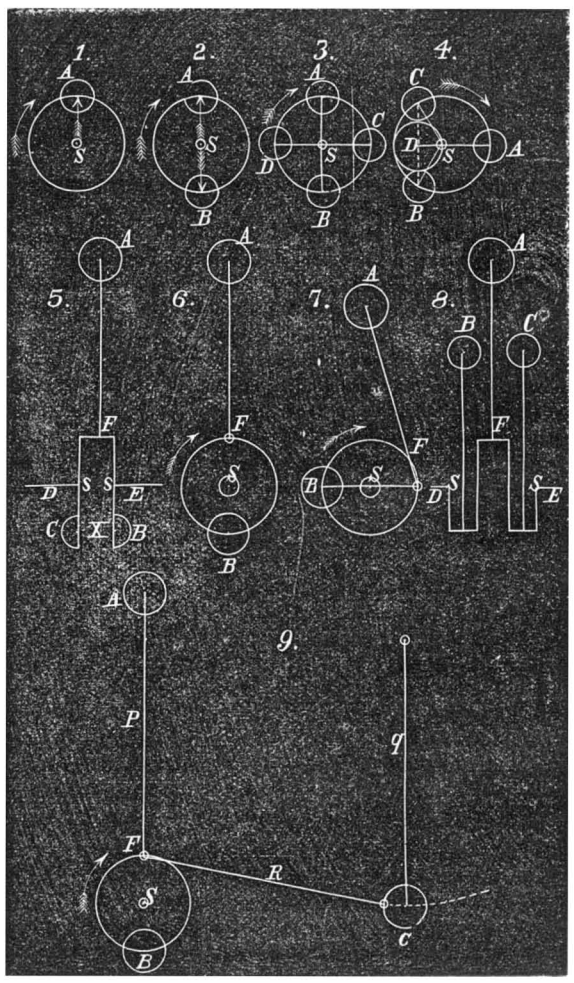
Correspondence.

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 mitttens 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 washboard. 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, Johnstown, 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.

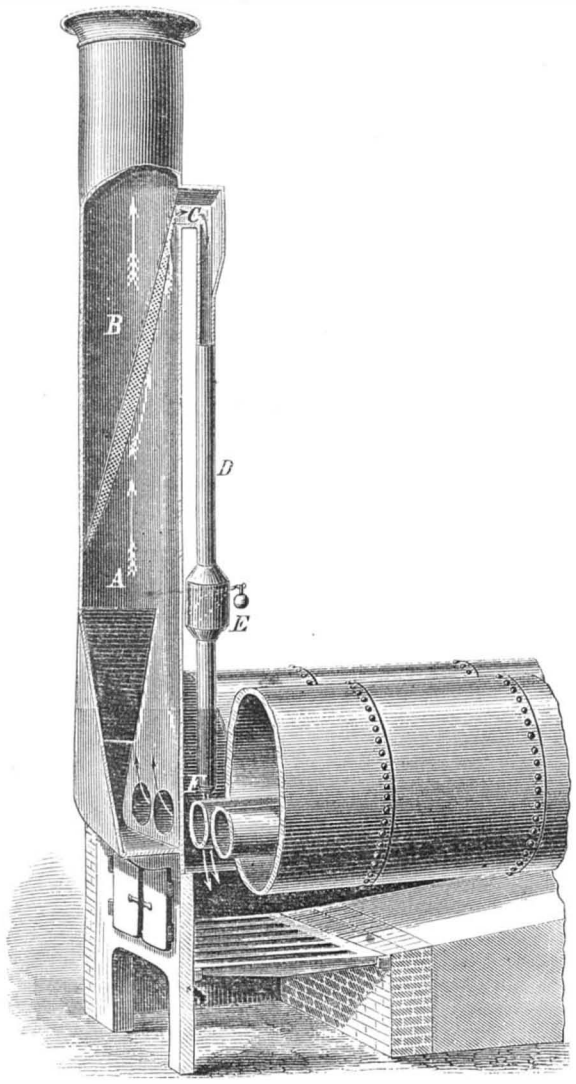
NITRO-GLYCERIN can be analyzed by means of an eudiometer, which is an instrument for ascertaining the quantities of certain gases in any given bulk of elastic fluid. Hydrogen and oxygen are introduced within the instrument after having first been carefully weighed, and a small quantity of nitro-glycerin 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.

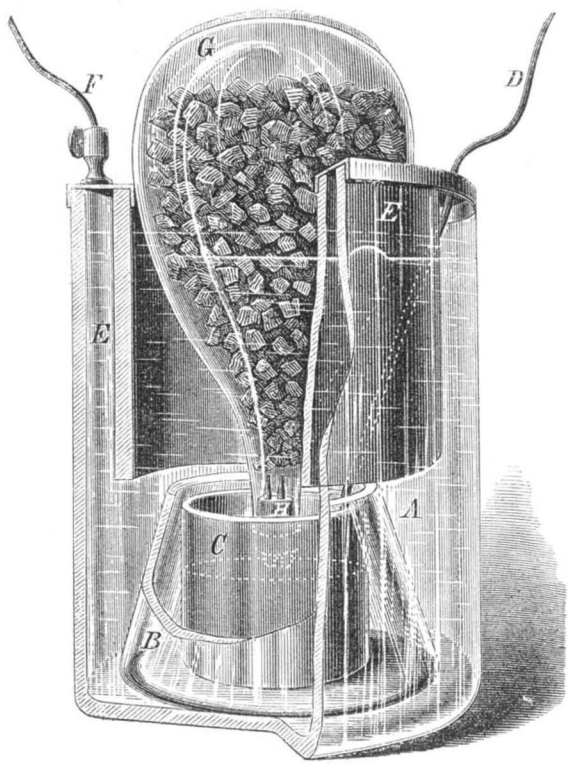
Objections have been raised, by some corporations, to the establishment of metallic connection between lightning conductors and gas mains, on the ground that damage might arise from ignition and explosion. These objections are most irrational, as gas will not ignite and explode unless mixed with atmospheric 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.

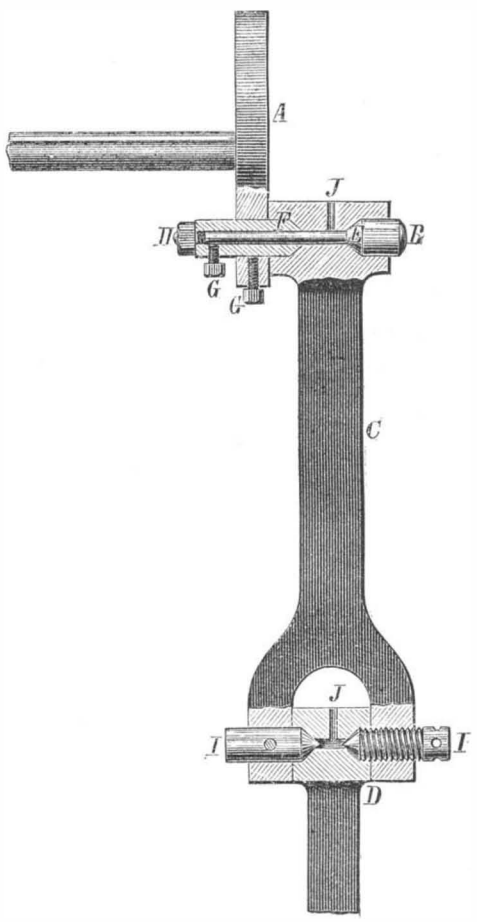
If, just previous to this period, the flask be removed and supplied with sulphate of copper crystals, enough of the solution of the latter will remain in the cup, B, to maintain the action of the battery during the process of filling, so that the duration of the action is practically limited only by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

OVER three thousand five hundred new books appeared in England last year.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING) NEW YORK.

O. D. MUNN. A. E. BEACH.

☞ "The American News Co.," Agents, 121 Nassau street, New York.
☞ "The New York News Co.," 8 Spruce street, New York.
☞ A. Asher & Co., 20 Unter den Linden, Berlin Prussia, are Agents for the German States.
☞ Messrs. Sampson Low, Son & Marston, Crown Building, 185 Fleet street, Trubner & Co., 60 Paternoster Row, and Gordon & Gotch, 121 Holborn Hill, London, are the Agents to receive European subscriptions. Orders sent to them will be promptly attended to.

VOL. XXVI., No. 13. [NEW SERIES.] *Twenty-seventh Year.*

NEW YORK, SATURDAY, MARCH 23, 1872.

Contents:

(Illustrated articles are marked with an asterisk.)

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 away 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 ransacked 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 allignment 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.

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 Kan.

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.—B. 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 1862. 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.

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. Stratten, 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 seagoing 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, shait 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 last 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. Baily, 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 bail 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 further 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	124,588
Baggage check, M. N. Coe	124,418
Batting or wadding for upholstery, elastic, Lindsley and Mackintosh	124,598
Bed bottom, spring, S. M. Guest	124,486
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	124,688
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	124,588
Brick machine, P. H. Kells	124,590
Broom holder, H. B. McCool	124,445
Brush, dust, A. Shelling	124,634
Buckle, R. F. Russel	124,514
Building, fire proof, Sisson and Wetmore	124,453
Burner, hydrocarbon vapor, Dopp and Stark	124,425
Cages, manufacture of bird, J. Hepp	124,576
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	124,490
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	124,508
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	124,520
Engine, rotary, W. Hall	124,572
Engine, traction, W. W. Hanscom	124,574
Engine, ammonia gas, E. Lamm	124,495
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. Wafers	124,464
Fuel, artificial, H. Cutler	124,553
Furnace, smelting, P. M. Wilson	124,467
Furniture button . H. Howcroft	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	124,660
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. Bussey	124,540
Locomotives, throttle valve lever for, J. Mills	124,606
Looms, shuttle mechanism for, T. Martin	124,501
Looms, let off meshanism 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, Elliot 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	124,687
Millstones, manufacture of, Elliott and Wood	124,559
Millstones, process of preparing, Elliott and Wood	124,559
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' use, holder for, S. J. Newell	124,610
Painting wire cloth, machine for, S. Graves	124,569
Pan, dust, R. S. Jennings	124,584
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 hoists, 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 Wurfflein	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	124,583
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	124,638
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. Sweat	124,517
Toy, J. M. Hartz	124,575
Traces, attachment for, P. 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	124,500
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. Mabie	124,499
Wood, preserving, S. L. Cole	124,419, 124,420
Writing machine, type, B. Halstead	124,437
Yoke, horse, G. P. Cole	124,54

DESIGNS PATENTED.

5,639 to 5,645.—CARPETS.—A. J. Bouet, 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.

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.
20,492.—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.
20,658.—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. Seibert, Philadelphia, Pa.

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 or 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.

Reissues.

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.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co. 37 Park Row, for full particulars.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row New York.

Design Patents.

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, altorelievo, 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.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York

Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate Address MUNN & Co., stating particulars.

European Patents.

MUNN & Co. have solicited a larger number of European Patents than any other agency. They have agents located at London, Paris, Brussels Berlin, and other chief cities. A pamphlet pertaining to foreign patents and the cost of procuring patents in all countries, sent free.

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an *honest opinion*. For such consultations, opinion, and advice, *no charge is made*. Write plain do not use pencil, nor pale ink; be brief.

All business committed to our care, and all consultations, are kept *secret and strictly confidential*.

In all matters pertaining to patents, such as conducting interferences procuring extensions, drawing assignments, examinations into the validity of patents, etc., special care and attention is given. For information, and for pamphlets of instruction and advice,

Address

MUNN & CO.,
PUBLISHERS SCIENTIFIC AMERICAN,
37 Park Row, New York.

OFFICE IN WASHINGTON—**Corner F and 7th streets,** opposit Patent Office.

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 1 61 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

MUNN & CO., 37 Park Row.

DETROIT AND MILWAUKEE RAILROAD COMPANY.
DETROIT, 1st March, 1872.

THOMAS BELL, Esq., General Superintendent of this road, having signified his desire to be relieved of his duties about May 1st, the Directors will receive applications for the position of General Superintendent, accompanied by suitable credentials, during the month of March. C. C. TROWBRIDGE, President.

Advertisements.

Advertisements will be admitted on this page at the rate of **$1·00** *per line for each insertion. Engravings may head advertisements at the same rate per line, by measurement, as the letter-press.*

VULCANIZED RUBBER

Adapted to Mechanical Purposes. New York Belting and Packing Co., 37 & 38 Park Row.

ASPHALTE ROOFING FELT.

A WELL tested article of good thickness and durability, suitable for steep or flat roofs; can be applied by an ordinary mechanic or handy laborer. Send for circular and samples to E. H. MARTIN, 70 Maiden Lane, and 9 Liberty Street, N. Y.

FIRST GRAND
Industrial Exposition
OF LOUISIANA.

THE SOUTHWESTERN EXPOSITION ASSOCIATION OF NEW ORLEANS, LA.,

Will inaugurate the enterprise for which their Immense New Building has been erected in the business portion of the city, by

A GRAND INDUSTRIAL EXPOSITION

—OF—

MANUFACTURES, PRODUCTS AND ARTS,

Commencing Wednesday, May 1st, 1872, and continuing until Wednesday, May 22d, 1872, every day, (Sundays excepted) from 9 o'clock A.M., to 10 o'clock, P.M.

OPEN TO RECEIVE GOODS APRIL 15, 1872. OPEN TO THE PUBLIC, MAY 1 TO MAY 22, 1872.

Ample preparations have been made for the exhibition of machinery in operation; for the display of Manufactures, Products and Works of Art, and for the convenience of Exhibitors. No effort or expense will be spared to make this the LARGEST AND MOST SATISFACTORY EXHIBITION EVER HELD IN THE SOUTH.

Our Building is located in the center of the city; it is of immense size; it fronts on two of the principal business streets of the city (St. Charles and Carondelet) and is perfect in its arrangements for the purpose. The Exposition will be held in the most delightful and healthful season of the year in this section. It will be open both day and night, and is certain to attract a large attendance.

At the close of the Exposition, the Building will be closed for ten days (until June 3d), when it will be again opened as a Permanent Exposition and Salesroom for all Manufactured Articles and Works of Art and Ingenuity. For space in the Permanent Exposition arrangement will be made independent of the First Grand Industrial Exposition above announced.

Circulars, will full information, Blank Forms, &c., may be obtained by addressing

THE SOUTHWESTERN EXPOSITION ASSOCIATION, New Orleans, La.

Diamonds and Carbon

DIAMONDS and CARBON, shaped or crude, furnished and set for boring rocks, dressing mill burs, emery wheels, grind stones, hardened steel and paper calender rollers, and for sawing, turning or working stone. Also, GLAZIERS' DIAMONDS.

JOHN DICKINSON, 64 Nassau Street, New York.

A STEAM FLOURING MILL WANTED, in one of the finest grain growing sections of the West. For particulars, address HONEK TOWN COMPANY, Honek, Saline Co., Kas.

A GOOD COMPOUND
Microscope,

Of 35 diameters or 1200 area, will be sent by mail, on receipt of Three Dollars and Seventy-five Cents.

W. Y. McALLISTER, 728 Chestnut St., Philadelphia, Pa.

STEEL TAPE MEASURES,

Mathematical Drawing Instruments,

SPY GLASSES, SPECTACLES,

MICROSCOPES, &c., &c.,

For Sale by W. Y. McALLISTER, 728 Chestnut Street, Philadelphia, Pa.

☞ Catalogues sent without charge.

THE ROCHESTER TURBINE.

OUR WHEEL is the strongest, simplest, and best in the market. It is a Van DeWater, with new and important improvements. One of Van DeWaters's wheels, tested by James Emerson, of Lowell, gave 84·60 per cent. Send for circular.

ROCHESTER TURBINE WATERWHEEL MANF'G COMPANY, Rochester, N. Y.

FIRST CLASS TRAVELERS, engaged in selling Machinists' Supplies and Mechanical Goods, can obtain a liberal commission by adding to their lists the goods of an established and well known Manufacturing Co. Address MORGAN, P. O. Box 2,874, New York.

RISDON'S IMPROVED
Turbine Water Wheel.

There are now several hundreds of these in successful operation. Their simple and tight gate, and their economical use of water at all stages of the gate makes them every where liked. One of these was tested by James Emerson, of Lowell, and gave

EIGHTY-FOUR AND SIX ONE-HUNDREDTHS PER CENT.

Send for a circular.

T. H. RISDON & CO., Mount Holly, New Jersey.

Manufacturers of all kinds of Mill Machinery, and Circular Saw Mills

Diamond-Pointed STEAM DRILLS.

THE adoption of new and improved applications to the celebrated Leschot's patent, have made these drills more fully adaptable to every variety of ROCK DRILLING. Their unequalled efficiency and economy are acknowledged, both in this country and Europe. The Drills are built of various sizes and patterns; WITH AND WITHOUT BOILERS, and bore at a uniform rate, of THREE TO FIVE INCHES PER MINUTE in hard rock. They are adapted to CHANNELLING GADDING, SHAFTING, TUNNELLING, and open cut work; also, to DEEP BORING FOR TESTING THE VALUE OF MINES AND QUARRIES. TEST CORES taken out, showing the character of mines at any depth. Used either with steam or compressed air. Simple and durable in construction. Never need sharpening. Manufactured by

THE AMERICAN DIAMOND DRILL CO., No. 61 Liberty St., New York

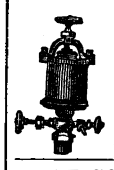
WIRE ROPE.

JOHN A. ROEBLING'S SONS, MANUFACTURERS, TRENTON, N. J.

FOR Inclined Planes, Standing Ship Rigging, Bridges, Ferries, Stays, or Guys on Derricks & Cranes, Tiller Ropes, Sash Cords of Copper and Iron, Lightning Conductors of Copper. Special attention given to hoisting rope of all kinds for Mines and Elevators. Apply for circular, giving price and other information. Send for pamphlet on Transmission of Power by Wire Ropes. A large stock constantly on hand at New York Warehouse No. 117 Liberty street.

SCHLENKER'S PATENT
BOLT CUTTER

NEW INVENTION. ADDRESS, HOWARD IRON WORKS, BUFFALO, N. Y.



LUBRICATORS.

DREYFUS' celebrated Self-acting Oilers, for all sorts of Machinery and Shafting, are reliable in all seasons, saving 75—95 per cent. The Self-acting Lubricator for Cylinders is now adopted by over 80 R. R. in the U. S., and by hundreds of stationary engines. Send for a circular to NATHAN & DREYFUS, 108 Liberty St., N. Y

PAT. SOLID EMERY WHEELS AND OIL STONES, for Brass and Iron Work, Saw Mills, and Edge Tools. Northampton Emery Wheel Co. Leeds, Mass.

Working Models

And Experimental Machinery, Metal, or Wood, made to order by J. F. WERNER, 62 Center st. N. Y.

MACHINERY, Safes, and Mechanical Supplies,

A. S. & J. GEAR & CO.,

56 to 62 SUDBURY STREET, BOSTON, MASS.,

Foundry and Machine Shop for Sale,

IN CHARLESTON, S. C.

I will sell, at private sale, on reasonable terms, the Establishment belonging to the late William S. Henery, situated on Meeting Street, near the Rail Road Depot, the lot of land, 180 feet front by 140 feet deep, upon which there is a Machine Shop of Wood, 80x36, two stories—Foundry of Brick, 52x44—a Boiler and Blacksmith Shop, on brick pillars, 104x25—Engine of 20 horse power—Lathes, Planers, Drilling Machines—Tools of all kinds for Machine and Pattern Shop—Cupola, Crane, and Iron Flasks for Foundry—a large number of Patterns, both Iron and Wood, Smiths' and Boiler Makers' Tools, &c &c. All the buildings are covered with slate. For further information, apply, by letter or in person, to WILLIAM SEBLEY, West Point Mills, Charleston, S. C.

C. J. Bandman. L. Jaffe.

Portland CEMENT,

For making **Artificial Stone.** EXTRA QUALITY, imported by the NEW YORK STONE WORKS. Send for circular. 1193 BROADWAY, New York.

IRON STEAMSHIP BUILDERS.

NEAFIE & LEVY,
PENN WORKS,

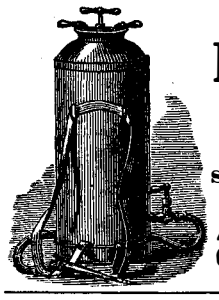
MARINE ENGINES, BOILERS, AND BUILDERS OF COMPOUND ENGINES,

PHILADELPHIA, PA.

GEORGE PAGE & CO., Manufacturers of Portable and Stationary *STEAM ENGINES AND BOILERS;* Patent Circular, Gang, Mulay, and Sash *SAW MILLS, with OUTFITS COMPLETE,* combining all reliable improvements—Grist Mills; Shingle Machines; Wood Working and General Machinery. Send for Descriptive Catalogues. Address No. 5 W. Schroeder Street, Baltimore, Md.

SIBLEY'S
Leveling Instrument,

For Builders, Farmers and Miners. Price only $12. Circular free. A. J. BICKNELL & CO., 27 Warren St., N. Y.



BABCOCK Fire Extinguisher

"ABSOLUTELY THE BEST PROTECTION AGAINST FIRE!"

Send for "It's Record."

F. W. FARWELL, Secretary.

407 BROADWAY, N. Y.
656 WABASH AVENUE, CHICAGO.

Small Watches for the South.

LARGE WATCHES for the WEST.

ALL KINDS ARE DESCRIBED IN

HOWARD & CO.'S

DESCRIPTIVE PRICE LIST OF

Waltham Watches.

Watches sent anywhere by Express, with privilege to examine before paying. Write for Price List (which is sent free), and mention the SCIENTIFIC AMERICAN.

Address

HOWARD & CO.,
No. 865 Broadway, New York.

PORTLAND CEMENT,

OF the well known manufacture of John Bazley White & Brothers, London, for sale by JAMES BRAND, 54 Cliff St., N. Y.

Wood Workers' Tools,

All the most approved brands, such as Bailey's Planes, Wilkinson's Unequaled Bench Planes, King Miter Box, Addis' Carving Tools, Carriage Tools, Bliss' Hand Screws, Wright's Floor Clamps, &c. &c. A. J. WILKINSON & CO.'S Tool Store, 2 Washington St., Boston, Mass.

IRON PLANERS, ENGINE LATHES, Drills, and other Machinists' Tools, of superior quality, on hand, and finishing. For sale low. For Description and Price address NEW HAVEN MANUFACTURING CO., New Haven, Conn.

Canadian Inventors,

Under the new Patent Law can obtain patents on the same terms as citizens.

For full particulars address

MUNN & CO., 37 Park Row, New York.

PATENT COLD ROLLED SHAFTING.

The fact that this Shafting has 75 per cent greater strength, a finer finish, and is truer to gage, than any other in use, renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price lists mailed on application to JONES & LAUGHLINS, 120 Water street, Pittsburgh, Pa.

☞ Stocks of this Shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass. GEO. PLACE & CO., 126 Chambers street, N. Y.

Damper Regulators. Pat. Gage Cocks. Boiler Feeders.

Send for circulars. MURRILL & KEIZER, Balt., Md.

FIRST PREMIUM (MEDAL) AWARDED IN 1870 AND IN 1871. Endorsed by Certificate from AMERICAN INSTITUTE as **"The Best Article in the Market."**

Also, manufacturer of **Asbestos Boiler Felting,** Roofing and Sheathing Felts, Acid, Water and Fire Proof Compositions, Boiler Scale Preventive, and dealer in ASBESTOS, ASPHALTUM and GENERAL ROOFING MATERIALS.

☞ Descriptive Pamphlets, Price Lists, &c., by mail.

{ *Established in* 1858. } **H. W. JOHNS, 78 William St., New York.**

FOR SALE,

THE PROPERTY OF THE

Chelsea Machine Works

Norwich, Conn., corner of Broadway and Willow Street, 191 feet front, by 102 feet deep, embracing the substantial brick building, 40 by 60, four floors, fitted with the necessary lines of shafting, steam, gas and water pipes, with adjacent buildings for blacksmith shop, engine room and coal house, together with steam engine and boiler, and a great variety of machinist's tools, consisting of engine lathes, hand lathes, planers, upright drills, gear cutters, and a very large and complete assortment of small tools, cutters, drills, taps, dies, jigs, etc., suitable for the manufacture of any kind of machinery. The steam engine is thirty-five horse power, low pressure, manufactured by Hewes & Phillips, of Newark, tubular boiler, and costing in fuel for the necessary power of running the full shop, about one dollar per day. The convenient proximity of the property to the steamboat wharf and railroad depots, make the location for manufacturing purposes far more desirable than can be found in inland towns, reducing expenses of transportation, in both material and manufactured product. The real estate, with tools and machinery, will be sold together or separately, as may be desired by the purchaser.

Apply to **CHARLES OSGOOD & CO., Norwich, Conn.**

Machinists' Tools

OF EVERY DESCRIPTION.

WE WOULD CALL THE ATTENTION of Railroad Companies and Car Builders to the superior excellence of our

CAR AXLE LATHES (GRAY'S PATENT),
CAR WHEEL BORERS,
HYDROSTATIC WHEEL PRESSES, ETC.
NILES TOOL WORKS,

Office 131 West Second Street, Cincinnati, O.

Brass & Copper
SEAMLESS TUBING

FOR LOCOMOTIVE, MARINE, AND STATIONARY BOILERS.

Merchant & Co.,

507 Market Street, Philadelphia.

Swain Turbine.

"Our Low-Water Wheel from this on"

WILL DO TEN PER CENT MORE WORK on small streams, in a dry season, than any wheel ever invented. Gave the best results, in every respect, the Lowell Tests.

For Report of tests at Lowell, with Diagrams and Rules of Power address

THE SWAIN TURBINE CO., North Chelmsford, Mass.

TODD & RAFFERTY, Manufacturers of Steam Engines, Boilers, Flax, Hemp, Tow Bagging, Rope and Oakum Machinery. Steam Pumps and Governors always on hand. Also Agents for the New Haven Manufacturing Co.'s Machinists' Tools. ☞ We invite especial attention to our new, improved, Portable Steam Engines. Warerooms, 10 Barclay st. Works Paterson, N. J.

REYNOLDS & CO.

MANUFACTURE

Screws & Bolts

For Machinery of every variety.

ALSO

Bridge and Roof Bolts.

STEEL & IRON SET SCREWS

A specialty. Also, Small Articles for Patentees, in great numbers, at No. 145 East st., New Haven Conn

KIDDER'S PASTILES—A Sure Relief for Asthma. STOWELL & CO., Charlestown Mass.

THE BAND SAW!

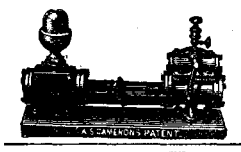
Its ORIGIN and

HISTORY, with Engravings of the OLDEST MACHINE, sent gratis. Address RICHARDS, LONDON & KELLEY, 22d st (above Arch), Philadelphia.

COLT'S ARMORY TESTING MACHINE—Strength of Materials.—The Colt's Arms Company, of Hartford, Conn., is prepared to measure the strength of all materials by its testing machine, which is capable of determining strains from 1 oz. to 100,000 lbs., in specimens from 7 inches to 8 feet in length, and with cross-sections up to 1 square inch in area. The price of testing half a dozen specimens of the same material, $25. See Scientific American, March 16, 1872. For further information, apply direct to the Company.

A. S. CAMERON & CO.,

ENGINEERS,



Works, foot of East 23d street, New York city.

Steam Pumps,

Adapted to every possible duty.

Send for a Price List.

TRADE MARK.

Union Stone Co.,

Patentees and Manufacturers of

ARTIFICIAL STONE & EMERY WHEELS,

and Artificial Stone and Emery Wheel Machinery and Tools. Send for circular. **29 Kilby Street. BOSTON, MASS.**

L. W. Pond---New Tools.

EXTRA HEAVY AND IMPROVED PATTERNS.

LATHES, PLANERS, DRILLS, of all sizes; Vertical Boring Mills, ten feet swing, and under. Milling Machines, Gear and Bolt Cutters; Hand Punches and Shears for Iron.

Office and Warerooms, 98 Liberty st., New York; Works at Worcester, Mass.

A. C. STEBBINS, New York, Agent.

VENEERS,
HARDWOOD BOARDS,

Large and choice assortment of

FRENCH BLACK WALNUT, AMBOINE, THUYA HUNGARIAN ASH;

Together with a complete stock of DOMESTIC FINE FIGURED VENEERS, BOARDS AND PLANK.

☞ Send for catalogue and price list.

G. W. READ & CO., 170 & 172 Center St., N. Y.

Factory, 186 to 200 Lewis st., between 5th and 6th sts.

American Saw Co., Manufacturers of

And Perforated Circular and Long Saws. Also Solid Saws of all kinds. No. 1 Ferry st., corner Gold street New York. Branch Office for Pacific Coast, No. 606 Front street, San Francisco, Cal.

BUILDING PAPER

FOR SHEATHING, PLASTERING, ROOFING, DEAFENING, AND CARPET LINING.

Samples & circulars sent free, by ROCK RIVER PAPER CO., Chicago; or,

B. E. HALE & CO., 22 & 24 Frankfort St., N. Y.

Sole Agents for Eastern States.

$20,000 IN PREMIUMS.—SIXTH Grand State Fair of the Mechanics' and Agricultural Fair Association of Louisiana, will be held on the Fair Ground, in the City of New Orleans, April 24, 25, 26, 27, 28, 29, and 30, 1872. Exhibitors are invited from every section of America. Those visiting the Fair by railway or steamer should procure their return tickets at the point of departure. Premium Catalogues will be sent to any address, free of charge, by application to LUTHER HOMES, Secretary and Treasurer, Office Mechanics' Institute, New Orleans, La.

Agents Wanted **$75 to $250 per month,** everywhere, male and female, to introduce the GENUINE IMPROVED COMMON SENSE FAMILY SEWING MACHINE. This Machine will stitch, hem, fell, tuck, quilt, cord, bind, braid and embroider in a most superior manner. Price only $15. Fully licensed and warranted for five years. We will pay $1000 for any machine that will sew a stronger, more beautiful, or more elastic seam than ours. It makes the "Elastic Lock Stitch." Every second stitch can be cut, and still the cloth cannot be pulled apart without tearing it. We pay Agents from $75 to $250 per month and expenses, or a commission from which twice that amount can be made. Address SECOMB & CO., *Boston, Mass.; Pittsburgh, Pa.; Chicago, Ill.; or St. Louis, Mo.*

THE NEW VOLUME OF

SCIENTIFIC AMERICAN

commenced JANUARY FIRST; therefore, now is the time to organize Clubs and to forward subscriptions. Clubs may be made up from different post offices.

TERMS FOR 1872.

One copy, one year		$3.00
One copy, six months		1.50
One copy four months		1.00
CLUB RATES	Ten copies, one year, each $2.50	25.00
	Over ten copies, same rate, each	2.50
One copy of Scientific American for one year, and one copy of engraving, "Men of Progress,"		10.00
One copy of Scientific American for one year, and one copy of "Science Record,"		4.00
Ten copies of "Science Record," and ten copies of the Scientific American for one year		35.00

CLUB PREMIUMS.

Any person who sends us a yearly club of ten or more copies, at the foregoing club rates, will be entitled to one copy, gratis, of the large steel plate engraving, "Men of Progress."

Remit by postal order, draft or express.

The postage on the Scientific American is five cents per quarter, payable at the office where received. Canada subscribers must remit, with subscription, 25 cents extra to pay postage.

Address all letters and make all Post Office orders or drafts payable, to

MUNN & CO., 37 PARK ROW, NEW YORK.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard sts. Philadelphia, and 59 Gold st., New York.