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THE AUGSBURG WEB PRINTING PRESS.

We gave a brief account about a month ago of the celebrated Walter press, two of which machines are now in operation in the establishment of the New York *Times*. The apparatus illustrated in the present engraving is a modification of the Walter invention, and is manufactured by a German house, the *Maschinenfabrik Augsburg*. The principal point of difference between this press and its English prototype is that the paper is taken from the under side of the web instead of the top, and is carried to the lower cylinders first instead of passing to the upper portion of the machine and thence down. This enables the whole printing part of the press to be kept lower, and consequently a somewhat different position is given to the distributing apparatus for the lower cylinder. The speed of the machine is about the same as that of the Walter, namely, 12,000 sheets per hour, though we are informed that, in the New York *Times* office, that of the latter has been increased to 17,000 sheets. The size of sheet is 20·67 by 30·31 inches, and of the type forms, 19·09 by 28·54 inches.

According to *Engineering*, from which journal we extract our engraving, the action of the Augsburg machine is very simple. The paper first passes through damping rollers, which can be arranged to give it any required degree of wetness; and then it makes its way, through rollers which are adjustable to regulate its tension, to the first type cylinder. The two type cylinders and the two impression cylinders lie in the same vertical plane. Their position is seen in the illustration, the lowest and highest cylinders being the type cylinders and the two middle ones the impression cylinders.

The paper is printed from stereotypes cast in semicircular molds so as to fit round the type cylinders. This method is adopted in all web printing machines, and by using it the founts of type may last twenty years instead of two, while the actual printing is quite as clear and good as if it were done from the type direct. The paper first passes between the lowest pair of cylinders, and is there printed on the first side. It is carried upward and backward by the revolution of the lower impression cylinder, and passed from it forward again over the upper impression cylinder; and in passing between the latter and the upper type cylinder, it is printed on the second side. As these four cylinders are all exactly of the same diameter, and are placed close together, the printing on the second side must coincide exactly in its position on the sheet of paper with that on the first. The printing operation being now completed, the paper passes horizontally forward to the cutting cylinders. These are placed at the same level as the upper type and impression cylinders, and are necessarily of the same diameter, that diameter being such that their circumference is exactly equal to the length of the sheet which is to form one copy of the newspaper. On one of the rollers is an ingeniously arranged cutter, and on the other, at a corresponding point, a kind of groove or seat for the projecting knife. As the paper on leaving the cutting cylinder is not led upwards at a steep angle as in the Walter press, it is not necessary to leave a small width on each side uncut, but the sheet is cut right across. The tapes, it will be seen, slope slightly upwards from the cutters in order to give sufficient hight for the delivery apparatus. By an ingenious adjustment of their speed, the speed of each sheet is accelerated as it rises; so that by the time it reaches the delivery roller, there is a distance of several inches between it and the one next behind it. The delivery takes place downwards, and alternately to right and left on to the tables shown in the engraving, and the space between the sheets is necessary in order to allow time for the oscillation of the delivery frame. The apparatus for distributing the ink is very complete; that for the lower type cylinder will be seen behind and below it, and that for the upper type cylinder behind and above it. Just outside the frame which carries the cutting cylinders, there is an index, not shown in the illustration, which marks the number of copies printed as they are cut off. There are many interesting and ingenious details about the machine, but they are unfortunately of a nature which cannot well be made intelligible without the aid of detail drawings.

The Augsburg press was recently exhibited in the Vienna show, in company with two other types of web machines, the Victory and the Marinoni. The former is a folding as well as printing apparatus, and the latter has its special feature in a "divider" by the aid of which the sheets, after they are printed, are sent in four different directions.

Engineering states that since 1869 the London *Times* has been entirely printed from web paper, with a saving in working cost so great that the capital sunk in the displaced machinery was recouped in less than two years. The general catalogue of the Vienna exhibition, as well as several of the special catalogues, were printed on the Walter press in the office of the last named newspaper, and are noticeable, we believe, as being the first books printed from continuous paper.

The Walter press derives its name from Mr. Walter, M.P., the proprietor (the credit of its invention and construction being due to the manager and engineer) of the *Times*.

Small Swift Steam Propellers.

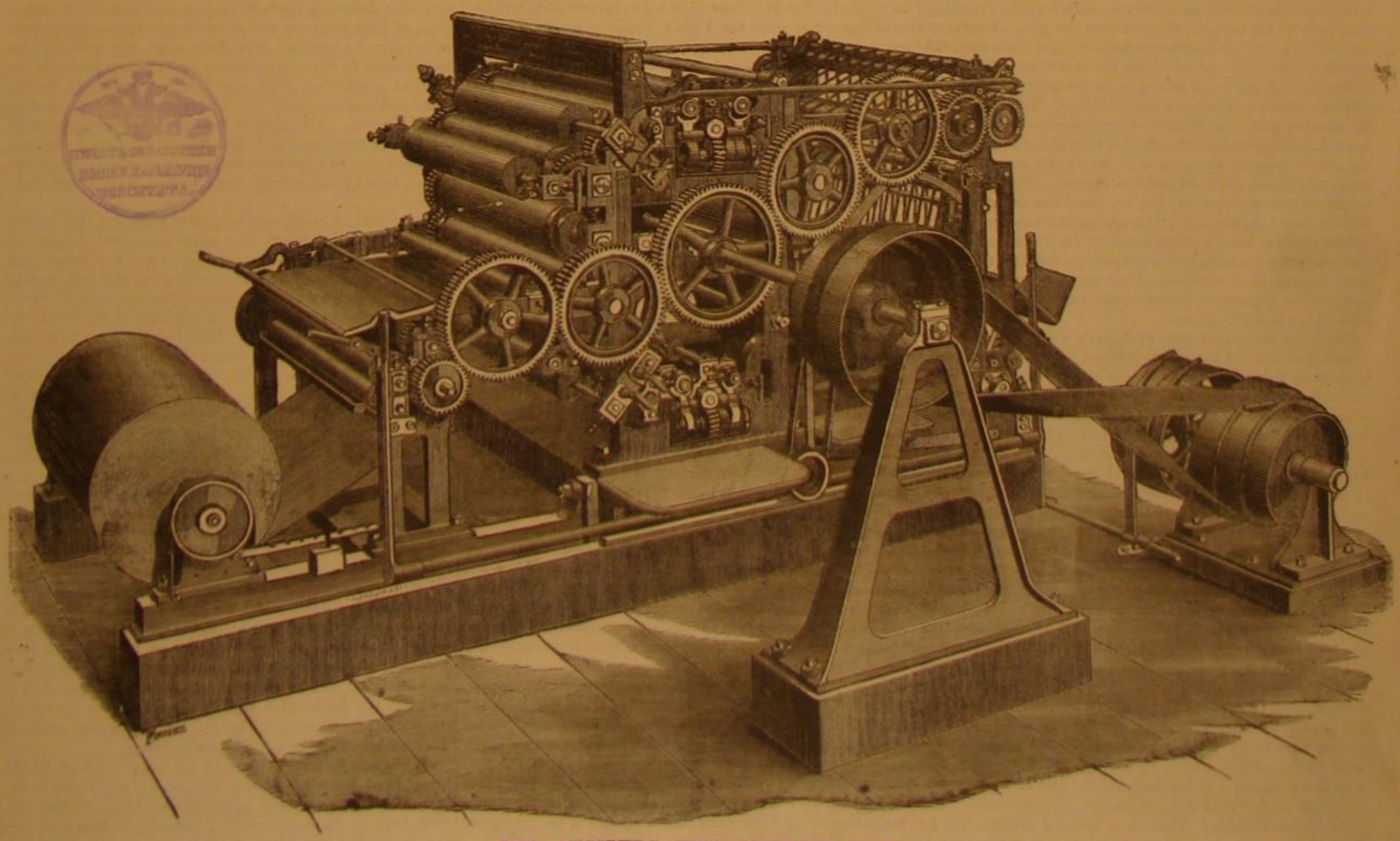
In our issue of July 6, 1872, there appeared a letter from Mr. A. Gray, of Burlington, Iowa, describing a small steam propeller built by him for the Chicago, Burlington, and Quincy Railroad, and used to cross the Mississippi river between the above named town and the stock yards of the company. The boat, named the Robert Harris, is fifty feet long, of 7 feet beam, and draws about 30 inches aft and 1 foot forward. She has a locomotive boiler 11 feet long, with fire box 2½ feet by 3½ feet, with 27 two inch flues 7 feet long.

There are two direct-acting vertical engine cylinders, 5 inches bore and 10 inches stroke. The screw is forward of the rudder, and is 4 feet in diameter and has a quarter pitch. The engines are fitted with circular slide valves.

At the outset it was found that the vessel would run a full mile with three shovelsful of coal, and that, with 55 lbs. of steam and 104 revolutions, carrying 16 passengers, she crossed the river, a distance of ⅝ mile, in 7 minutes; and returning, with 90 lbs. of steam and 140 revolutions, she made the same distance in 3½ minutes.

Mr. Gray has recently favored us with a second letter, in in which he says that the above details, as published in our columns, brought him letters of inquiry from all parts of the civilized world, and even from such out-of-the-way localities as China, and Finland, on the northwestern border of Russia. He informs us that the boat has been running nearly every day during the past two seasons, and was most severely tested in stormy weather, besides encountering stone heaps, log piles, sand bars, and all the obstructions to be found in shallow water.

A few days ago, a formal examination of the engines was made. Not a moment's time has been lost, or a dime spent for repairs, since this boat came out in the spring of 1872; nor have the steam chests been opened. The valves proved to be as tight as when first fitted, not the slightest sign of "blow," or wear, being perceptible. The tool marks were yet visible, and they were not even scoured bright. The engines made 133 revolutions to the minute, with 80 lbs. of steam, which constantly rose while they were in motion, with a 4 foot propeller one third out of water, which makes her uniform speed about 15 miles an hour down, and 10 to 12 up, stream. She has passed every boat that competed with her. The river has been repeatedly crossed with 8 to 12 lbs. of steam, showing a remarkable contrast, in economy of fuel and steam, with a much smaller boat formerly used, having engines built from the same patterns.



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LOUIS AGASSIZ.

Professor Agassiz is dead. Suddenly, unexpectedly, and apparently in the full vigor of his physical and mental power, the great master has been stricken down in the very midst of his labors, leaving to other hands the completion of his manifold enterprises, to other minds the development of the grand works to which his days have been so earnestly, so purely, devoted. Grief, sincere and deep, will everywhere greet these saddest of tidings, for the loss is not to the country but to the world; and wherever civilization extends her sway, there will his mourners be found.

It is but a melancholy duty of the journalist to pen the brief lines which constitute the last tribute to the memory of one distinguished in any walk of life, from whose lips and to whose actions the people have learned to look for counsel as from the oracles of old, or to indite the curt sentences which imprint *finis* on the work of which death has forbidden the continuance. Doubly sad is the task which now devolves upon us, in thus recording that the voice which so often, through these pages, has imparted to the world the great efforts of a master genius is for ever hushed, and that the indefatigable student and wise teacher, whose achievements have added so brilliant a luster to the works of American Science, is now but a thing of the memory, a reminiscence to be cherished, but buried in the irrevocable past.

We leave to others, who have been his immediate colaborers in the cause of education, the detailing the chronicle of his private life. To the outside world, however, we may justly say that it seemed as if he were every one's immediate friend; his personality was of that magnetic order which appeals directly to the heart, and it was the charming simplicity of his manner, coupled with the glow of enthusiasm which pervaded his every utterance, that made even the dullest units of his vast audiences feel that the subject under treatment, though never so dry, was invested with new attributes of rare and before unseen interest. It mattered little whether men were capable of grasping the thread of his consummate arguments, or whether they failed to appreciate the single hearted devotion with which he embraced the study of Science for itself and itself alone. When their intellects failed to respond to his, or, conscious of inferiority, shrank from the encounter, their sympathies were irresistibly drawn towards him; and the magic of his voice his winning smile and the sincerity of his purpose gained the trust and confidence of even those who condemned his opinions and opposed the donation of the necessary means for the furtherance of his favored projects.

There are many anecdotes of Agassiz which just now are invested with a sad but timely interest, and which, perhaps, more truly indicate the character of the man than the most carefully worded eulogy which we might produce. It was this overflowing cordiality of his nature which gained him his object even above the most stubborn of opposition, and to his qualities of heart, probably as largely as to those of brain, did he owe the completion of many of his most cherished schemes. His Cambridge Museum was built by private subscription, and his celebrated voyage up the Amazon was carried out through the munificence of a Boston millionaire. Did he need a State appropriation, he fairly charmed it out of the stingiest of legislatures; and indeed a Massachusetts law maker at one time opposed his being allowed to press his request in person, for the reason, as stated, that no opposition could stand before him. Penikese, with the princely sum accompanying, was the gift of one unskilled in Sciences. And the few enthusiastic *extempore* speeches made by him in San Francisco, after the Hassler voyage, brought forth the unexampled donation of Mr. James Lick, and gave Science on the Pacific coast an inestimable assistance. He gained friends by thousands simply by his smile. "We want you to come and beam upon us, that is all," said a friend who had arranged a social reception for him in Washington. "Agassiz came," said his entertainer, subsequently, "and merely shook hands. There was nothing formal, but he beamed on everybody with such a pleasant smile that it seemed as if he were diffusing happiness through the whole company." And yet, with all his success in the cause of education, it is even the more remarkable that he persistently refused to use his efforts for his private ends. "You would make any amount of money in the business," urged a wealthy capitalist who was desirous of securing Agassiz as a partner, and using his great technical knowledge for commercial enterprises. "I have no time to make money," replied the Professor. Similar to this was his answer to a publisher, who pressed him to write text books for schools. "I wrote them," said he, and his eyes sparkled with indignation, "that I was not the man to do this sort of work. And I told them, too, that the less of this work was done, the better. It is not school books that we want, but students. The book of Nature is always open. All that I can say or write shall be to make them study that book, and not pin their faith to any other." These were not the only brilliant offers, pointing to almost unlimited wealth, which he rejected, while his salary was only $1,500 a year. One more story and we pass to a brief review of his life. Agassiz detested "Science falsely so called" most cordially; and if in anything he manifested impatience or became actually incensed, it was when theories or ideas which he believed false or deceptive were submitted to his examination. In such cases, indeed, his wrath became mighty. It is related that some friends once invited him to a spiritualist exhibition to make a scientific investigation of the alleged manifestations. He turned his back upon them and motioned them to the open door in almost speechless rage, nor did he return to the subject except to express surprise at the insult which he considered had been offered him.

Louis John Rudolph Agassiz was born in Motiers, Switzerland, on May 28, 1807, his father and indeed his ancestors for six generations back being clergymen. Originally beginning the study of medicine, he entered the medical school at Zurich, thence he went to Heidelberg, and finally, at the age of twenty, began a course at the University of Munich. Here he commenced his studies in embryology, and received instructions from Wagler, Oken and Martins, and issued his first publications in the shape of brief treatises on special subjects. Subsequently becoming deeply interested in a work that he was selected to perform, namely, the classification of a variety of fishes, brought back by a Brazil exploring expedition, Agassiz gave up the practice of medicine, though not until after he had obtained his doctorate both in that art and in philosophy. His course, during the following years, was upward; for becoming a favored pupil of the great Cuvier and enjoying the association of such men as Owen, Milne-Edwards, and others of equal eminence, he laid the basis for his establishment of fossil ichthyology, and its translation to a cognate from a hitherto unknown science. Aided by Baron Von Humboldt, he was enabled to publish his great work, in which about 1,000 species are fully described and 700 more partially so, and thus to firmly establish his fame as a naturalist. Then came the enunciation of his glacial theory, the assertion of the existence of a vast sheet of ice which overspread existing continents, leaving its tracks behind. The view has been vehemently opposed, but it has triumphed, and is now an accepted scientific fact. Numerous other works were published by Agassiz in Europe, to which we need not stop to allude, except perhaps to say that they are standard volumes of reference, and invaluable to the naturalist. In 1846, he emigrated to this country, and became connected with the United States coast survey. It was not long, however, before he recognized the position of the United States in the scientific world. He saw that as a nation, we were far in the rear, and that, although in point of fertility of inventive genius, we were unsurpassed, yet Science for itself met with no fostering, and that we were content to depend upon the efforts of the learned men of the old world. Original thought was comparatively absent, and original research unknown to the masses. Seeing the need, he at once devoted his energies to its fulfilment. Accepting the chair of zöology and geology in Harvard College, he began the endeavors which have culminated in the establishment of the Cambridge museum (the most extensive of its kind in the world) and the education of scores of able and learned students of natural science. Of the more recent labors in which Professor Agassiz has been engaged, it is hardly necessary for us particularly to speak. Important expeditions have been made by him, years ago to Lake Superior, and Florida Reefs, and more lately up the Amazon and around Cape Horn.

As an opponent of the Darwinian theory, Agassiz has of late been drawn into the immediate attention of the entire world. His last writings were upon this subject; and in the *Atlantic Monthly* for January, we find an exhaustive and brilliant paper, beginning a series, in the course of which the writer designed to go over his entire ground, and clearly explain the arguments supporting his position. In his concluding lines he says: "The more I look at the great complex of the animal world, the more sure do I feel that we have not yet reached its hidden meaning, and the more do I regret that the young and ardent spirits of our day give themselves to speculation rather than to close and accurate investigation. I hope in future articles to show, first, that, however broken the geological record may be, there is a complete sequence in many parts of it, from which the character of the succession may be ascertained; secondly, that since the most exquisitely delicate structures, as well as embryonic phases of the most perishable nature, have been preserved from very early deposits, we have no right to infer the disappearance of types because their absence disproves some favorite theory; and lastly, that there is no evidence of a direct descent of later from earlier species in the geological succession of animals."

The place of a precentor, of an instructor whose grasp of the subjects of which he taught extended to their minutest ramifications, left by Agassiz, it will indeed be difficult to fill; and the cause of scientific education has sustained a bereavement, the magnitude of which time alone will suffer us to realize. The example of the master is, however, immortal, his renown is part of the history of his adopted country; and posterity, in striving to emulate the one, will have before it a constant beacon pointing to the attainment of the proud rewards of the other.

LOOK TO YOUR STOVES.

The noxious effects of carbonic acid and carbonic oxide gas were recently illustrated, in an alarming manner, at Oakland, Pa., at a school near the Susquehanna depot. The chool had been in session about two hours in the morning, when, to the astonishment of the teacher, one of her smaller pupils fell to the floor, apparently in a swoon; very soon three or four others were in a similar condition; then the number quickly increased to a dozen, all thrown down and unconscious. The teacher, greatly alarmed, dismissed the school, but only a portion of the scholars were able to move from their seats. The windows and doors were thrown open and assistance summoned. The teacher, with the aid of older scholars, dragged out the unconscious ones. A physician came; and after long effort, all were restored to consciousness and recovered, except a few who are still suffering.

It appeared, on examination, that the smoke pipe had been jammed too far into the chimney, causing a stoppage of the draft of the stove, throwing all the deadly gases of combustion into the school room. The escape of the children as well as they did is matter for congratulation.

The gases of combustion, chiefly carbonic oxide and carbonic acid, are, when taken into the lungs in comparatively small quantities, dangerous to life. One one-hundredth part of carbonic oxide gas in a given volume of air renders such air noxious.

Carbonic acid gas is not quite so bad. It may be taken into the stomach without injury. Soda water, as everybody knows, is water charged with carbonic acid gas. But when the gas is taken into the lungs, even in small quantities, its effects are injurious. One of the great causes of ill health is the accumulation and breathing of the deadly carbonic acid gas in the dwellings and apartments in which people live. Too little attention is paid to ventilation. Every one hundred volumes of air discharged from the lungs contain four volumes of carbonic acid gas. Now if air containing one two hundredth part of the gas is breathed, headache and languor are soon produced. Air that has been once breathed is therefore highly dangerous. The average amount of the gas thrown out by every person is seven cubic feet per hour. A single six foot gas light in a room gives off as much carbonic acid gas as a person in breathing.

THE REPORT OF THE CHIEF ENGINEER OF THE NAVY

Chief Engineer W. W. W. Wood, United States Navy, in charge of the Bureau of Steam Engineering, submits an annual report which contains a large amount of interesting and valuable information. Among other topics discussed, we note opinions upon compound engines, which may be taken as the result of a series of careful experiments and comparisons made by a board of prominent officers. The conclusion definitely reached is that the method of using steam of high pressure and expanding in separate cylinders (one or more in number, depending upon the power to be transmitted) is more economical and advantageous in its practical application than the former method, in simple cylindered engines, with the pressures heretofore used in such cylinders. This opinion is based upon comparisons of some forty non-compound and fifteen compound engines, though it may be considered as merely an official corroboration of facts already agreed upon by the majority of engineers.

The subject of machinery for steam vessels of war is next discussed, and the report of a board appointed to examine designs is embodied. Commenting upon the latter, the Chief of the Bureau says that no plan presented was considered as a whole superior to those emanating from the Government engineers, and hence the designs of the last mentioned officers were adopted. The following contracts for construction were awarded, work to be completed six months from their date: Atlantic Works, Boston, two engines of 800 H. P., cost $175,000 and $163,000. James Murphy, New York, one pair, 175,000. John Roach, New York, one pair, 560 H. P., for $120,000. Woodruff Iron Works, Hartford, one pair, 800 H. P., for $175,000, and Wm. Wright & Co., Newburgh, one pair, 800 H. P., for $175,000.

With reference to the internal corrosion of naval boilers, the report states that, by a careful analysis made at the Naval Laboratory in New York, this difficulty in vessels using surface condensers is found to be caused by oleate of copper, formed in the condenser, from which it passes to the boiler, where it is slowly transformed into oleate of iron, deriving the iron from the different parts of the boiler with which it comes in contact and precipitating its copper. The oleate of copper adhering to the iron under the condition of high pressures and temperatures, the deposition of copper and the absorption of iron begins. As a preventive, a method of arresting the destructive agents formed in the condenser, through a process patented by Mr. W. C. Selden of New York, is spoken of in quite favorable terms.

The most interesting part of the report relates to the question of screw propellers, and embodies the results obtained in certain changes made in the screws of vessels—from four to two blades—with a view of rendering such vessels more efficient while under sail alone. With equal propelling surfaces, it has been determined that no advantage

whatever can be derived from using a screw of two blades, instead of four, when sailing; because, when screws are uncoupled and revolving freely, those of four blades oppose no greater resistance to the vessel than those of two. When fixed and held stationary, in a vertical position behind the stern post, the loss of speed due to the resistance of the screw, expressed in percentage of speed, has been shown by careful experiment to be 18·29 per cent; while the four or two bladed screw, revolving freely by the pressure of the water, gives a resistance of only 9·96 per cent, being nearly two to one in favor of the revolving screw. The four bladed screw also produces less vibration in a ship than one of three, and the latter less than one of two blades. The propelling efficiency of a screw is entirely independent of the number of its blades, but is wholly dependent upon the area, the pitch, the fraction of the pitch used, and the area of the circle described by the blades.

To diminish the shocks and vibration, more or less incidental to the use of the screw propeller, the largest amount of clearance admissible for the screw between the stern and rudder post should be given. It is obvious, then, says the report before us, that a post, intended for a screw, the area of which is contained in four blades having the same surface, pitch, and fraction of pitch, for that screw must be just double the length of the former in the line of its axis. Consequently, the two bladed screws, which were substituted for those of four blades, were necessarily constructed of less propelling area, as the post openings of the vessels could not be enlarged: hence the inefficiency of the screws as reported.

THE MANUFACTURE OF EARTHENWARE.

The potter's art has long furnished Great Britainand other European countries with most important branches of commerce. It was first introduced into England by two foreigners, at a place called Bradawoods, which is now Longport, situated about two miles from Burslem, Staffordshire. These two men commenced in a small way and kept themselves very secluded. The ware which they made was of quality very inferior to that of the present day; the business was only in its infancy, and the only mode of glazing the ware was by simply throwing salt into the saggars or vessels in which the crockery was baked. It was reserved for the famous and ever noted Josiah Wedgewood to be the pioneer in introducing new glazes and bodies, and to improve and bring to perfection the manufacture of earthenware. This was during the commencement of the eighteenth century. He it was who laid the foundation of the famous Staffordshire potteries, which now extend some ten or twelve miles in length and two or three miles in width. The district contains the towns of Tunstall, Burslem, Longport, Dalehall, Hanley, Stoke upon Trent, Fenton, and Longton. The potteries are right amidst the clays that are used in the manufacture. The same clays are also found in abundance in Derbyshire, which is the next county, but the most important and valuable clay is found in Cornwall. It is called china clay, and is purely white. This clay is not found anywhere else in the United Kingdom. Another valuable acquisition to the potteries is the valuable coal beds which abound in North Staffordshire, and furnish very important material in the manufature of earthenware.

The clay is generally weathered for one or two years before being used, that is, it is exposed to the effects of the atmosphere, to make it of a better color and more pliable. After which, certain quantities of each kind are weighed out, put in large vats, and worked together until they are thoroughly mixed, and become of the consistency of thick milk. Other ingredients are then mixed with these clays. They are china clay, felspar, and a few other materials to give body and consistence to the ware. After the whole has been ground and mixed up together, it is put in a large press (a new invention which has been patented); and by means of heat, the materials become more solid, are pressed into large blocks, and are ready to be used. An earthenware manufactory is arranged in such a manner that each branch is kept separate to itself.

In making a water pitcher, for instance, the body of the pitcher is made in two equal parts, and the handle is made separately. The presser, as he is called, takes sufficient clay for the molds he is going to use; the mold is made of plaster of Paris. When both halves of the mold are filled, he puts them together, and straps them tightly; he then finishes the inside of the pitcher, by smoothing it by means of a wet sponge, to fill up the seams. He then takes off the strap, and places the mold with its contents in a small room which is kept at a high temperature. This is done to harden the clay, and evaporate the water. After being in a few hours, the clay appears white; and the mold is taken out and opened. The pitcher is then finished off and the handle is put on. This being done, it is ready for what is called the biscuit oven, where it undergoes its first baking. A similar process is gone through in making dishes, plates, cups and saucers, and other articles, except that the molds are of different shape. The ovens, or kilns as they are called, are built of brick and are of a conical shape, something like a sugar loaf.

After the ware is finished, it is placed in what are called saggars, vessels made of clay and baked before using; sand is sprinkled in these saggars and round the ware to prevent the whole from sticking together. When placed in the oven, it is exposed to a very severe heat for forty-eight hours; the fires are then allowed to go down and the ware to cool gradually. The oven and the ware are still very warm; and the men employed to take the pottery from the oven have to wear flannel over their hands and bodies to protect themselves from being scorched. They cannot remain many minutes at a time in the oven. The ware is then carried to what is called the biscuit warehouse, where it is sorted over by women and girls. In this state, it is called biscuit and is of a porous nature. The position of fireman of the biscuit oven is a very important post, and it requires a man of great experience and skill. If the ware be not fired or baked up to a certain point, it is very apt to craze, a phrase used amongst manufacturers to imply that it is liable to have those small cracks upon it which are sometimes seen upon earthenware or crockery. After being sorted over, it is prepared to go through a second firing.

The printing is done upon the biscuit ware before it receives the glaze. But figured earthenware has been largely superseded in this country by what is called white granite or white ironstone china, which is clear white. It looks much cleaner than the printed goods, and is much more easily matched. The ware, having been examined in the biscuit warehouse, is then taken to the dipping house. The dipping is a noxious process, owing to the white lead that is used in the glaze, in which the articles are dipped. The glaze is composed of borax, lead, flint, soda and other materials, which are ground together in a liquid state and put in large tubs, into which the ware is plunged and afterwards put on racks to dry. After this process, the ware is ready for the gloss oven, to give it the finishing touch. It is placed in saggars, the same as in the biscuit oven, some round and some oval, according to the size and description of the ware; but instead of sand being put in, the flat pieces, such as dishes, plates, saucers, etc., are kept separate by what are called cockspurs, small three pointed articles, made of clay and put between the wares. One may often see the marks of these cockspurs on the back of the ware. The time of firing the ware in the gloss oven is twenty-four hours, just half the time used in the biscuit oven. When the ware is drawn out of the gloss oven, it is taken to the gloss warehouse, where it is sorted over, and all the chipped, cracked, or damaged ware is put on one side. The good ware is packed in crates or casks by experienced packers, and shipped to its destination.

The importation of earthenware to the United States has been gradually increasing for many years. There were a few manufactories, established in this country, previous to the late war; and since its close many more have been started, and are doing a large business.

The duty upon earthenware is 40 per cent *ad valorem*; the freights are also high; and during the past year, the price of earthenware has been raised some 25 per cent in Staffordshire, owing to the high price of coal, labor, and materials, which have increased very much during the past two years. From these causes the importation has been much less in former years; and thus has been the means of giving more employment to the manufacturers on this side. There is no doubt but that all the materials used in the manufacture of both earthenware and china can be found in the United States; although many of our manufacturers are importing the china clay they use from Cornwall, at a great expense. This clay can be superseded by one which is found in large quantities in Alabama, and is being introduced generally. Missouri abounds with all the materials that are used in the manufacture of earthenware, and also is well supplied with extensive coal beds. There are also large earthenware manufactories at Trenton, N. J., East Liverpool and Cincinnati, Ohio, Geddes, N. Y., and St. Louis, Mo.

Considerable improvements have been made in the bodies and glazes of the ware during the past two years, and there are indications that this valuable business is firmly established in this country. Many gentlemen once connected with the manufacture of this class of ware in the Staffordshire potteries are now superintending works on this side, and there are several manufactories to be erected at different points during the coming year.

NOTE RELATIVE TO THE ESTIMATION OF THE COMMERCIAL VALUE OF COALS CONTAINING LARGE QUANTITIES OF ASH.

BY PROFESSOR R. H. THURSTON.

A question has lately been presented, involving the determination of the effects of an excessive amount of ash in modifying the commercial value of anthracite coal. The method of determination adopted will probably be of interest, since there is at present no generally accepted and standard method in use among engineers.

The value of a coal depends upon many circumstances. The proportions of uncombined carbon and hydrogen, the form in which hydrocarbons are contained in the fuel, the physical characteristics of the coal, and the chemical constitution and the percentage of the ash, all affect its market value. In individual cases, also, the form of heating or other apparatus in which the coal is burned influences the relative value of fuels equally good in other respects, one steam boiler, for example, being well adapted for anthracite, and another for bituminous coal.

Where the difference between two coals lies principally in their relative percentages of ash, the comparison is easily made.

The anthracites contain so little other combustible matter that, as shown by Professor Johnson,* their calorific value is proportional to the percentage of contained carbon, very nearly. Their commercial value is somewhat different.

The depreciation produced by presence of non-combustible matter occurs in the following ways:

First. A certain amount of carbon is required to heat the whole mass to the temperatnre of the furnace, of which a large part is lost. It follows, therefore, that a coal containing a certain small quantity of combustible would have no calorific value, and, consequently, would be worthless in the market.

Second. The presence of a high percentage of ash in a fuel checks combustion by its mechanical mixture with the combustible portion of the coal. A coal will, hence, have no commercial value when the proportion of refuse reaches a limit at which combustion becomes impossible in consequence of this action.

Third. The cost of transportation of ash being as great as that of transporting the combustible, the consumer paying for ash at the same rate as for the carbon, and also being compelled to go to additional expense for the removal of ash, these facts would also determine a limit beyond which an increased proportion of ash would render the fuel value less.

Fourth. The determination of the financial losses due to increased wear and tear of furnaces and boilers, of incidental losses due to inequality or insufficiency of heat supply, and to the many other direct and indirect charges to be made against a poor fuel, will also indicate a limit which will have a different value for each case; but which will, in most cases, be difficult of even approximate determination.

The determination of the minimum proportion of combustible, under the first case, is thus made, assuming this heat to be entirely wasted.

The specific heat of ash is usually nearly 0·20. Let X represent the percentage of ash which is sufficient to render the coal valueless. Then, since each pound of carbon has a heating power of 14,500 thermal units: $14{,}500(100 - X) = A$, represents the available heat of a unit in weight of the fuel.

$100 \times 0{\cdot}20 \times 3{,}000^\circ = B$: represents the heat required to raise this same amount of coal to a temperature equal to that of the furnace, which is here assumed at 3,000° above the surrounding atmosphere.

Since these quantities, A and B, are equal: $14{,}500\,(100 - X) = 100 \times 0{\cdot}2 \times 3{,}000^\circ$, and $X = 96$ per cent.

The minimum quantity of fuel permissible is, therefore, four per cent, where the first consideration only is taken into the account.

The influence of the second is at present indeterminable in the absence of experiment.

The cost of transportation of ash to the consumer, as a part of the fuel, has no bearing in the determination of its value to him. The removal of ash is a tax upon the consumer which may be considered as the equivalent of the loss of a certain weight of combustible received. Since this cost fluctuates with the market value of coal, and since its amount is determined by the same causes, it is easy to make the statement in that form.

This cost is about ten per cent of the value of coal, weight for weight, and is therefore assumed at ten per cent of the proportion of ash found in the coal.

The losses, direct and indirect, coming under the fourth head, vary greatly and are sometimes very serious. An approximate estimate for an average example is taken, and is considered to be equal, at least, to a percentage of the total value of coal, in utilizable carbon, which equals one half the percentage of ash.

Comparing two anthracites, which we will suppose to contain, respectively, fifteen and twenty-five per cent ash, eighty-five and seventy-five per cent carbon, the first being a well known standard coal, selling in the market at six dollars per tun, we may, using this system of charging losses against equivalent values in combustible carbon, determine the proper commercial value of the second kind.

FIRST EXAMPLE.—From the 85 per cent carbon:

Deduct for heating to furnace temperature	0·040
" " transportation of refuse, 10 per cent of 15	0·015
" " other losses, 50 per cent of 15	0·075
Total	0·130

Leaving available and valuable carbon 85 — 13 = 72 per cent.

SECOND EXAMPLE.—From the 75 per cent carbon:

Deduct for heating to furnace temperature	0·040
" " removal of ash, 10 per cent of 25	0·025
" " sundry losses, 50 per cent of 25	0·125
Total	0·190

Leaving valuable available carbon 75 — 19 = 56 per cent.

Finally, if $6.00 is paid for 72 per cent available combustible, for 56 per cent we should pay $\frac{56 \times 6}{72} = \$4.66\frac{2}{3}$.

Taking a third example, in which the fuel contains the unexceptionally large proportion of 30 per cent ash, we should, by similar method, proceed as follows, deducting from the seventy per cent carbon, as before, the estimated charges against it.

THIRD EXAMPLE:

Deduct for heating	0·040
" " removal of ash, 10 per cent of 30	0·030
" " sundry expenses, 50 per cent of 30	0·150
Total	0·220

Leaving available carbon, 70 — 22 = 48 per cent, which would be worth $\frac{48 \times 6}{72} = \$4.00$.

Had the first coal had a market value of seven dollars per tun, the second and third would have been worth, respectively, $\$5.44\frac{4}{9}$ and $\$4.66\frac{2}{3}$.

This method is evidently largely empirical, and its results are but approximate. It is, however, simple and easily applied, and will often be found of use in the absence of more precise means of determination. Those whose experience may differ from that of the writer can readily modify the values for themselves.

Stevens' Institute of Technology, Hoboken, N. J.
December, 1873.

*Report to the Navy Department on American coals.

THE ALBERT IRON BRIDGE.

The Albert Suspension Bridge, over the river Thames, at Chelsea, London, was designed by Mr. R. W. Ordish, upon his rigid suspension principle. It is 710 feet long, with one center span of 400 feet, and two side spans of 155 feet each, the roadway being 71 feet wide between the parapets. The appearance of the structure is seen from the annexed engraving, Fig. 1, and one of the piers, with the tower and a cross section of the roadway, is also shown on a larger scale in Fig. 2.

THE ALBERT IRON BRIDGE, LONDON, ENGLAND.—Fig. 1.

Each river pier is formed of two concrete columns within cast iron cylinders, placed 53 feet 6 inches apart from center to center. At base the cylinders are 21 feet diameter, 4 feet 6 inches deep, and 1¼ inches thick. Above the conical pieces, P, Fig. 2, the cylinder is 15 feet diameter, made in lengths of 6 feet, and 1¼ inch thick. As the iron cylinders have no permanent load upon them, no exact bearing is required in the joints, which are, therefore, not faced.

A joint, formed of hemp wrapped on hoop iron, was found sufficient to compensate for irregularities in the castings, and to keep out the water in the process of sinking. The cylinders were forced down by dead weight, through eight feet of gravel and one foot of sand, into the London clay, the excavation being carried on within the cylinders as they sank. The clay, when pierced to a depth of ten feet, was found sufficiently hard for a foundation, and upon this the the concrete was deposited. This concrete is made of shingle, sand, and Portland cement, and at base the cement forms one third of the mixture, the proportion being reduced with successive layers of concrete to 1 in 7 at the top. Within a week of the columns being completed the concrete became as hard as stone, affording ample strength for the load of about seven tuns per square foot which comes upon it. The two columns forming each pier are united and stayed by the lattice girder, B. Upon each concrete column an octagonal base plate, C, 11 feet 6 inches diameter, 2 feet 2 inches deep, and weighing 20 tuns, is placed, the upper surface of the base plate being faced in the lathe to receive the superstructure of the towers. The towers are made entirely of cast iron, successive tiers of columns being united at intervals by large octagonal castings. The castings, D D, are constructed as saddle plates for the main chains, and smaller saddles, E E, above receive the catenary wire rope. The hight from the bottom of the cylinders to the top of the concrete column is 50 feet, and thence to the upper saddle 70 feet 6 inches.

The platform is composed of two lines of plate girders, G G, 7 feet 6 inches deep, with bottom flanges 16 inches wide, and top flanges 9 inches wide. At intervals of 8 feet, cross girders, K, 2 feet 6 inches deep, are riveted to the main girders, and stiffened by longitudinal girders or distance pieces, H. The roadway is formed of fir blocks 4 inches deep, laid on longitudinal fir planks 7 inches deep.

It will be seen from the cross section of the bridge that the plane in which the chains lie is inclined, and that the web of the main girder lies in the same inclined plane. By this arrangement, the entire width of the platform is kept within the opening of the towers, and the roadway is not contracted at the towers, as is the case where the attachment of the chains to the platform is perpendicular to the saddle.

The anchorage for the chains and the catenary is formed in a peculiar manner within an iron structure, and is perfectly independent of the great mass of masonry generally employed. It consists of a cast iron cylinder, 20 feet 6 inches deep and 3 feet internal diameter, enlarged at the bottom into a chamber 5 feet diameter, for anchoring the chain. This cylinder is watertight, and provided with a man hole and steps, so that the anchorage can be examined at any time, and cleaned and painted when necessary.

The bridge is calculated to carry, with a strain of 5 tuns per square inch on the chains and 9 tuns on the steel wire, a moving load of 70 lbs. per square foot. The headway for vessels below the platform varies from 21 feet to 38 feet, according to the tide. The weight of iron work in the bridge is 1,530 tuns. We are indebted to *Iron* for these illustrations.

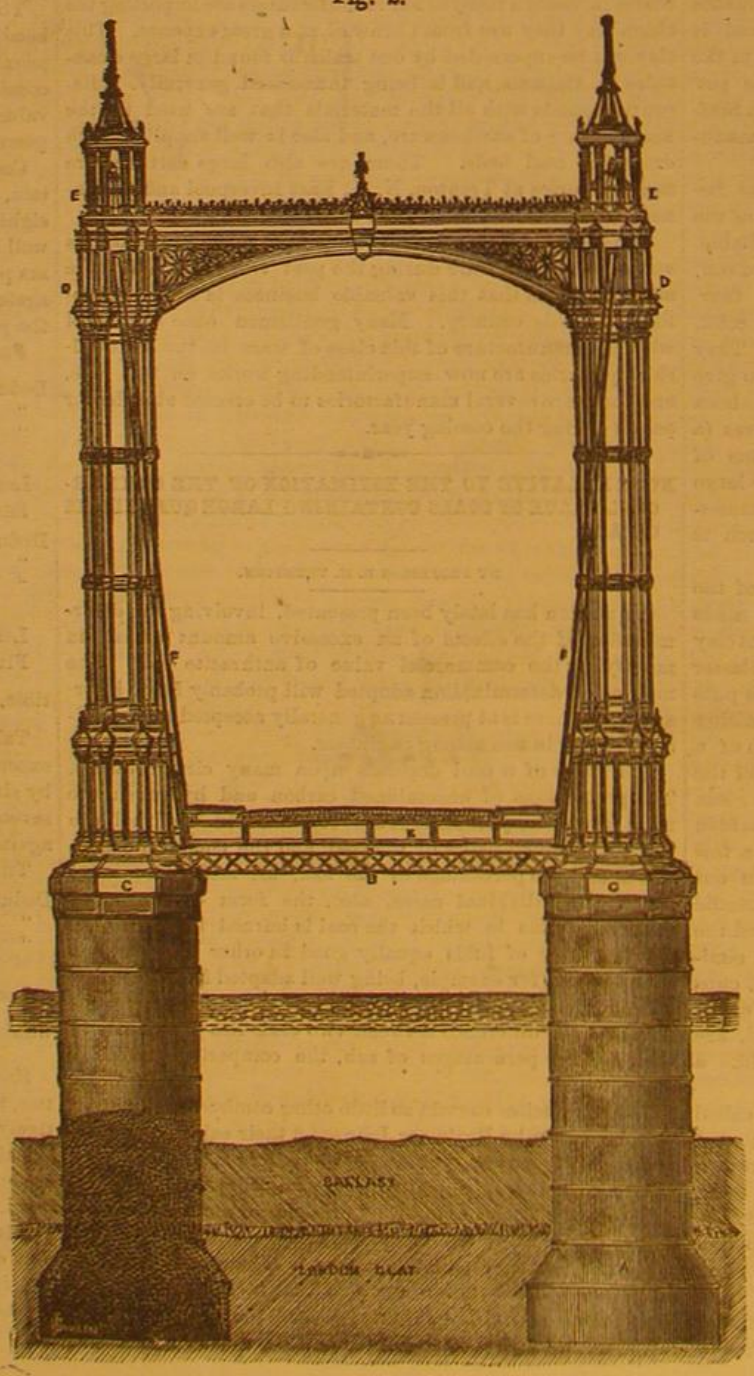
To Impart to Coarse Wood the Appearance of Polished Mahogany.

The following process is recommended in *Wiederhold's Trade Circular:* The coarse wood is first coated with a colored size, which is prepared by thoroughly mixing up, in a warm solution of 1 part of commercial glue in 6 parts of water, a sufficient quantity of the commercial mahogany brown, which is in reality an iron oxide, and in color stands between so-called English red and oxide of iron. This is best effected by adding in excess a sufficient quantity of the dry color with the warm solution of glue, and thoroughly mixing the mass by means of a brush until a uniform paste is obtained, in which no more dry red particles are seen.

A trial coat is then laid upon a piece of wood. If it is desired to give a light mahogany color to the object, it is only necessary to add less, and for a darker color more, of the brown body color. When the coat is dry, it may be tested, by rubbing with the fingers, whether the color easily separates or not. In the former case, more glue must be added until the dry trial coat no longer perceptibly rubs off with the hand. Having ascertained in this way the right condition of the size color with respect to tint and strength, it is then warmed slightly, and worked through a hair sieve by means of a brush. After this it is rubbed upon the wood surface with the brush, which has been carefully washed. It is not necessary to keep the color warm during the painting. Should it become thick by gelatinizing, it may be laid on the wood with the brush, and dries more rapidly than when the color is too thin. If the wood is porous and absorbs much color, a second coat may be laid on the first when dry, which will be sufficient in all cases. On drying, the size color appears dull and unsightly, but the following coat changes immediately the appearance of the surface. This coat is a spirit varnish. For its production 3 parts of spirits of wine of 90° are added in excess to 1 part of red acaroid resin in one vessel, and in another 10 parts of shellac, with 40 parts of spirits of wine of 80°. By repeated agitation for three or four days, the spirit dissolves the resin completely. The shellac solution is then poured carefully from the sediment, or, better still, filtered through a fine cloth, when it may be observed that a slight milky turbidity is no detriment to its use. The resin solution is best filtered into the shellac solution by pouring through a funnel loosely packed with wadding.

When filtered, the solutions of both resins are mixed by agitating the vessel, and letting the varnish stand a few days. The acaroid resin colors the shellac, and imparts to it at the same time the degree of suppleness usually obtained by the addition of Venetian turpentine, or linseed oil. If the varnish is to be employed as a coat, the upper layers are poured off at once from the vessel. One or two coats suffice, as a rule, to give the object an exceedingly pleasing effect. The coats dry very quickly, and care must be taken not to apply the second coat till the first is completely dry.

Fig. 2.



Profits of Co-operation.

Some eight or ten years ago, Joseph D. Holmes, Charles Jordan, and William Millard, three young farmers living almost within a stone's throw of each other, decided to join in establishing a dairy milk route from their farms to Pawtucket, R. I., some six miles away. Neither farm was large enough to sustain a route alone, but the three together could do it easily. Neither wanted to take the place of a middleman and do all the marketing, nor did either wish to give up his business to a middleman. So they agreed that each should take his turn on the milk wagon.

The milk accounts are all kept in one book, and the buyers at the village settle their bills by this book, whether it comes by one or another of the members of the company. Each of the three men goes with the wagon every third day in regular order, unless, for accommodation sake, one goes a trip for one of the others. Each uses his own horse and wagon, and each knows the amount of milk that is taken from the different farms every day.

The two trips that each one makes every week enable him to market most of his other produce, such as apples, potatoes, sweet corn, tomatoes, and other garden products, of which each one raises considerable quantities, without making special trips for such purposes. Nor is there any hitching up and going to the store for purchase; all the buying, as well as selling, being done on their regular market days; and they are all in daily communication with the post office, which is no small convenience to farmers.

Under this system of partnership the cost of marketing is reduced to the minimum, while each bears his just proportion of the expenses, and receives equal share in all the advantages of the combination. Since this arrangement has been established, all their farms have been really enhanced in value. The young men have increased their stock, and it is better fed and better housed. Buildings have been repaired and enlarged, more and better tools purchased, and the land is constantly increasing in fertility and productiveness. But little complaint is heard from them about hard times for farmers. They pay their bills, take the papers, and know what is going on in the world outside.

We have been familiar with this company from its organization, and believe the example these men have set is worthy of imitation by many farmers who are now grumbling about the cost of getting their goods to market.—*New England Farmer,*

Patents.---Record of One Week's Issue.

The *Inter-Ocean* of Chicago thus sums up one week's business of the Patent Office, and gives a *resumé* of the subjects patented and the number of patentees from each State. The writer says:

In whatever manner the Cuban difficulty, the President's message, and the assembly of Congress may affect other interests, certain it is that business at the United States Patent Office runs as smoothly as ever, with a fair increase in the number of applications for patents over the average of the past four or five weeks. In case of a war in Spain, there is certain to be a number of applications for patents for new and improved cannon, mitrailleuses, monitors, and like death-dealing appurtenances and appliances; but, as yet, there has been no perceptible increase of applications of this particular kind.

There are at present pending in the Patent Office forty-six applications for the extension of patents about to expire. One of these is for the famous Fairbanks platform scales, granted originally December 20, 1859. Another is one of the Woodruff patents for seats and couches for railway cars, which is to be heard on the 7th of January next. This patent is owned wholly in Chicago. Two extensions were granted during the past week, both controlled by the same parties, and both relating to the manufacture of rubber belting.

Six designs were patented and ten trade marks registered; none of these were furnished by Chicago. A St. Louis manufacturing firm registered the words "Golden Crown" in combination with a crown printed in gold, as a trade mark for agricultural implements.

The number of original patents issued for the week is 229, and 11 reissues. The former, as regards the Western and Northwestern States, are divided as follows: Illinois, 12 (of these the city of Chicago comes in for only one patent this week); Indiana, 9; Wisconsin, 6; California, 6; Michigan, 5; Missouri, 5; Iowa, 3; Minnesota, 1; and Nebraska, 1 Wisconsin and California each claim one reissue.

The solitary Chicago patent is taken out by J. A. Roche and G. V. Orton, and is for an improved band-sawing machine. The saw guide, being attached to one end of a horizontal bar which is made vertically adjustable, constitutes the main feature in the invention.

The other Illinois patents are: Stove damper, patented by H. H. Huntly, of Quincy; harvest rake, patented by E. Lippincott, of Brighton; drawbar in draft equalizers for wagons, and clip for wagon axle skeins, both patented by J. M. Orput, of Malta, one half of each patent by him assigned to D. Safford, of South Grove; corn planter, patented by A. Springsteen, of Oquawka; road scraper, patented by J. W. Weston, of Windsor, assignor to J. M. Jackson, of the same place, tyre tightener, patented by Wm. Bellairs and Wm. Ough, of Atkinson; hay press, patented by H. F. Blank, of Liberty, cotton planter; patented by C. H. Nixon, of Polo; binder attachment for harvesters, patented by H. Porter, Polo; and washing machine, patented by J. Trickett, Quincy.

Indiana's new patents are the following: Hay knife, patented by John S. Ball, Mishawaka; car spring, patented by E. T. Russell, Indianapolis; cotton, harvester, patented by Wm. H. Pedrick, Richmond, car coupling, patented by Wm. A. Cochran, Flat Rock, assignor to himself and James T. Burch, of the same place; hand corn planter, patented by Eli Rogers, Rochester; process of retouching photographic negatives, patented by S. H. Wright, Terre Haute; bed bottom, S. B. Freeman, Fort Wayne; eaves trough, P. F Kiblinger, Millersburgh; and plow, James Oliver, South Bend.

Next in order comes Wisconsin, with the following six patents for new inventions: Carriage top, patented by James N. Gill, of Oshkosh; soda water draft tube, patented by Otto Zwietusch, of Milwaukee; butter worker, patented by D. W. Dake, of Beloit; binder's attachment for harvester, patented by Thomas Urdahl, of Cross Plains, assignor to Simeon Mills, of Madison; rotary grain distributer, patented by A. D. Foote, of Berlin; assignor to M. Helmer, of Milwaukee; and revolving stool or chair, patented by J. J. Vollrath, of Sheboygan. The reissue is for a tag holder (patented August 6, 1867), to Thomas T. Bottomley, of Burlington, assignor to Pratt & Letchworth, of Buffalo, N. Y.

California this week has an equal number of patents, nearly all of which are for ore crushers, ingot molds, and similar appurtenances used in the production and refining of the precious metals, which constitute her chief branches of wealth and industry.

Missouri leads off with a shaving mug, patented by A. J. Furr and W. C. Knaus, of Boonsborough. Their mug is provided with a lamp for heating the water, and the detachable soap dish covers the mug and rests in the water. The water pours through an opening into a cup on the outside of the mug, in which the brush may be dipped. The other four patents are: Ice house, patented by A. Wilbur, of Cedar City; churn patented by John P. Friest, of Chillicothe; wash boiler, patented by William H. Hammond, of Syracuse; and a combined table and secret writing desk, patented by Charles Kade, of Lexington.

Michigan claims the following five patents. Stilt, patented by I. S. Sheears, of Ypsilanti; paper holder shelf, patented by George W. Hawkins, of Clayton; sleigh, patented by A. D. De Laro, of Goodrich. In this sleigh, as represented by the model, the rear end of the tongue is mortised into a cross bar, which is pivoted in front of a front beam, the draft in this manner to be applied directly to the front beam. Valve, patented by Charles F. Murdock, Detroit; and a whiffletree, patented by John Parker, of Pontiac, assignor of one half his right to James A. Hubbs, of Cato, Mich., complete the list for Michigan.

Iowa's three patents are for a kneading board, patented by H. P. Jones, of Davenport; a hub-boring machine, patented by F. Jonas, of Burlington, assignor to himself and George O. Ray, of the same place; and a numerical filing case, patented by George W. Bettesworth, of Cedar Rapids.

Minnesota this week is only represented by the patent of A. G. & H. W. Mowbray, of Stockton, for a middling bolt; and Nebraska by the patent to Tobias Billesbach, of Kearney Junction, for a new method of burning brick.

A party in New York has invented a postal card of peculiar manufacture. It is coated with various chemical salts, and the action between these compounds and the deposit from a metallic pencil renders the writing indelible.

WORCESTER JAPANESE PORCELAIN AT VIENNA.

The English china court at the Vienna Exposition was a department of special attraction. It must have been remarked that public taste, led by the judgment of art connoisseurs in China, has long been directed to the peculiar treatment of ornamental design in Satsuma and Japanese manufacture. The Worcester Works have taken advantage of this taste to design specially for the Vienna Exposition a large collection of ceramic art work, which has gained the attention of illustrious visitors, art connoisseurs, and the public, by its unique style and the perfect taste and refinement in which its design is treated. They brought out a new tint of color for their vases and figures, resembling ivory, but more mellow in depth of color and with a creamy softness that rivals the Satsuma as a ground color for the sober tints and finely chased gold work and bronzing of the Japanese style of decoration. The designs now in question have all the repose of Japanese coloring, combined with the more correct taste in outline of Western art in the forms of the objects. It is apparent that they have all been the subject of careful study; for, while there is no mere imitation of the Japanese, the feeling of that peculiar style has been seized, and thoroughly worked out, with great refinement and with the intelligence of an art student. Not only was every form expressly modeled for these subjects, but the peculiar tints of colors were specially produced by the Worcester color chemists, with the bronzes of various shades. Mr. R. W. Burns, F.S.A., the art director and one of the proprietors of the Worcester Works, has designed and produced all these articles; and he has been ably seconded by his chief modeler, artist, and chemist, Messrs. Hadley, Callowhill, and Bejot, to whom have been awarded medals by the jurors of the Vienna exhibition; while to Mr. Burns and the Worcester Works a diploma of honor has been awarded. We are indebted for the illustration to the London *Illustrated News*.

THE WORCESTER JAPANESE PORCELAIN AT VIENNA.

IMPROVED FURNITURE CASTERS.

We illustrate herewith three new forms of furniture casters, recently patented through the Scientific American Patent Agency by Mr. Cevedra B. Sheldon, of No. 6 State street, New York city. They seem to possess more than an ordinary degree of novelty and utility among this class of inventions.

The arrangement shown in Fig. 1 consists in a metal ball, which is contained in a cup, B, which is stamped from a single piece of metal, and has its lower edge turned inward so as to confine the caster ball and, besides, a number of small friction balls, inclosed as shown above the latter. Outside of B is a casing, and in the annular space between is placed a lining of india rubber, C, or other elastic material. The friction balls are placed in sufficient numbers to cover about two thirds of the surface of the caster ball, and are prevented from reaching the top of the latter by a cavity on the top of the cup, B. The screw, which attaches the device to the leg, is fastened to the shell of the caster by means of a cup-shaped nut, D, which connects with the body of the shell.

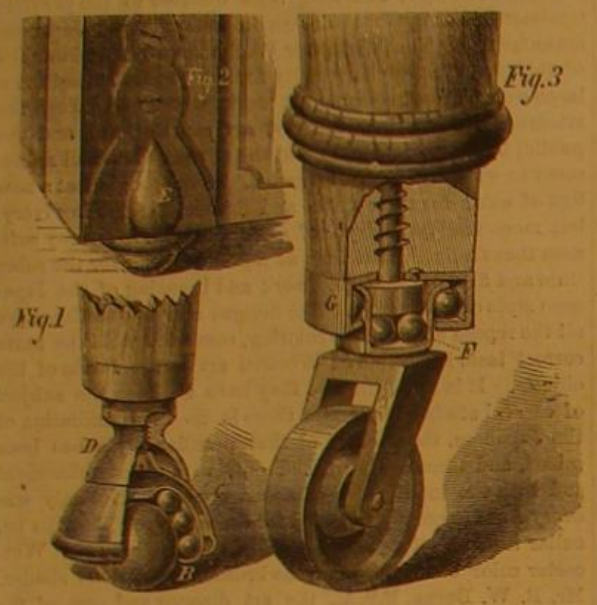


Fig. 2 shows the invention more especially adapted to protecting trunk casters from injury In this case the cup in which the ball revolves is secured in a cavity formed in the bottom of the trunk by means of tongues, E, struck up from the sheet metal lining of said cavity. Thus arranged, it is stated, the caster will sustain severe concussions and great pressure.

Fig. 3 represents the application of the friction ball system to the ordinary wheel caster. In the top of the bracket is a corrugated cup, F, containing a number of the small spheres. G is a cap rigidly attached to the fastening screw, which forms an annular box outside of the cup, F, and also incloses friction balls, as shown. The head of the fastening screw, it will be noticed, rests upon the balls in the cup, F, while the balls outside the latter serve to keep the caster in place. By this means, it is stated, the friction is greatly reduced, and the caster wheel more readily turns and conforms to the motion of the piece of furniture.

AUTOMATIC BRAKE.

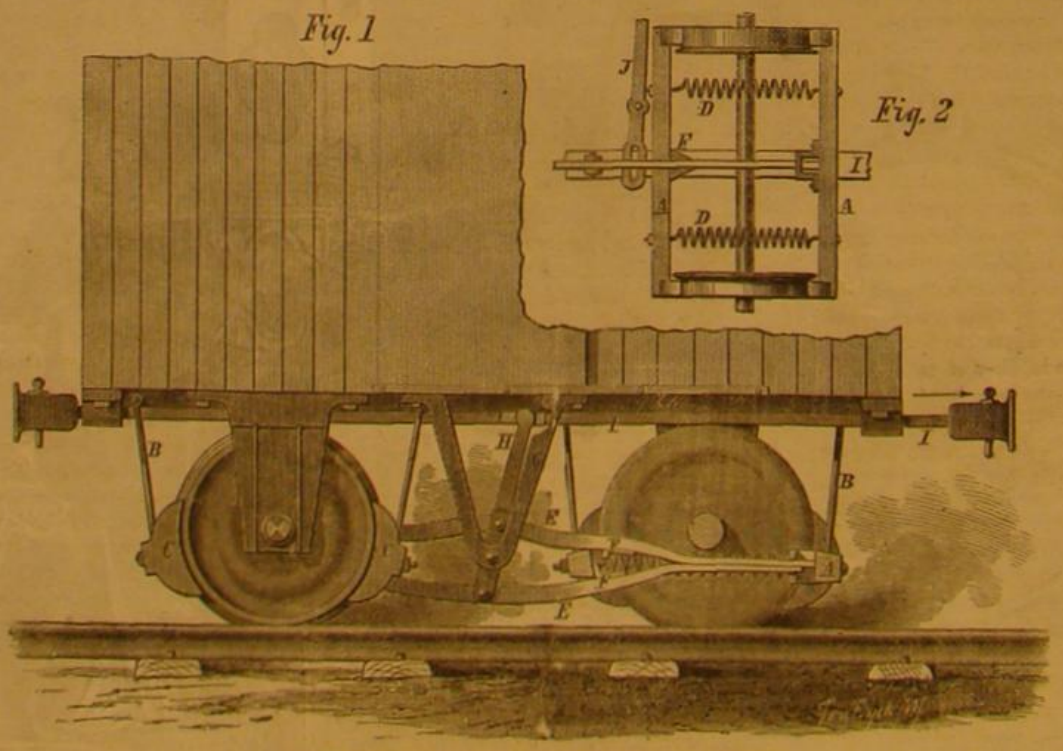
The inventor of the device herewith illustrated has produced a brake which, whether it be employed in its present form or in such modified shape as occasion may require, will, we consider, be found to be based upon a principle of doubtless considerable value. Briefly described, the apparatus is a combination of brake shoes with suitable springs, whereby the friction of the former is constantly maintained against the periphery of the wheels, so long as no pushing or pulling force is applied to the vehicle; but the moment a slight drag is brought to bear upon the drawbar, the brakes are automatically released, leaving the wheels free to rotate. It is not necessary to particularize, in any detail, the very evident uses to which this invention may be applied. On railroad cars it places in the hands of the engineer the immediate control of the train, as he has simply to cause his engine to cease pulling, when every brake is instantly applied. It is believed to have an advantage over the air and other brakes controlled from the locomotive, in that, while it dispenses with the necessity for brakemen, it requires, as will be seen from the following description, no coupling of tubes or other apparatus between the cars, the simple attaching together of the vehicles in the ordinary mode being all-sufficient to render it ready for immediate action. The device will be found of utility in descending grades, in its automatic check upon the momentum of the train. For horse cars, it is perhaps equally as well adapted, as it avoids the use of cranks to govern the brakes, requiring the use of one hand of the driver, or of an extra man when double teams are hitched on during bad weather; and besides, it allows of the car stopping at any point almost immediately.

Our engravings are designed to give a clear idea of the mechanism without referring it to any particular class of vehicle. Fig. 1 is an elevation with portions broken away, and Fig. 2 is a plan view of more important parts. Horizontal brake bars, A, are suspended from the car bed by means of longitudinally vibrating hangers, B, and are provided with brake shoes, C, at their extremities, which are made to fit snugly against the peripheries of the wheels. As shown in Fig. 2, and to the right of Fig. 1, the bars, A, are connected in pairs by helical springs, D, which are of sufficient strength to draw the brake shoes closely against the wheels. E E are two rods, the outer ends of which are supported by guides and abut against the two outer brake bars. These rods are designed to release the brakes from the wheels, and are made in curved shape so as to take the position shown in Fig. 1, that is, one above and the other below the two intermediate brake bars. Shoulders are formed upon them at F, which abut against the intermediate brake bars, and which operate in conjunction with the ends to release the brakes. G is a hanger secured rigidly to the car bed, and pivoted to which is a lever, H, the upper end of which plays loosely in a longitudinally movable drawbar, I, which is attached to the car bed by suitable guides. To the lever, H, the releasing rods, E, are pivoted, as represented, one below and the other above the fulcrum pin. To the extremities of the drawbar, H, are attached drawheads of any desired form, which are backed by the usual supports to take the strain. It is evident, if the drawhead on the right be moved in the direction of the arrow, one of the shoulders and one of the extremities of each releasing rod, E, will press against their respective brake bars, A, and force the brake shoes from the wheels, and a similar effect will take place if the opposite drawhead be pulled upon. Hence, as we noted in the beginning, it is merely necessary to remove the strain to cause the instant application of the brakes by the contraction of the springs, while their removal is effected with equal celerity as soon as even a slight force is re-applied.

If it should be desired to release the wheels of a car from its brakes, this can be readily done by means of a lever, J, Fig. 2, which is pivoted to the car bed and connected by an oblong slot and pin to the drawbar, H. The outer end of the lever may be attached to a suitable winding-up rod by a chain and ratchet mechanism, so that the brakes may be held off for any required time. This contrivance, we learn, may be placed at one or both ends of the car and operated by a person on the platform.

It will be noted that the springs not only serve to apply the brakes, but that they also will operate as buffers to prevent shocks and concussions while a train is being made up or is in motion. The inventor also states that the device is applicable to ordinary wagons, and that he has thus employed it with much success. The draft tongue in such case is attached to the drawbar and a locking device applied to it, for allowing the springs to hold the brakes in contact with the wagon wheels while descending hills.

Patented November 11, 1873. For further particulars address the inventor, Mr. Eliot P. Harrington, Volusia, Chatauqua county, N. Y.



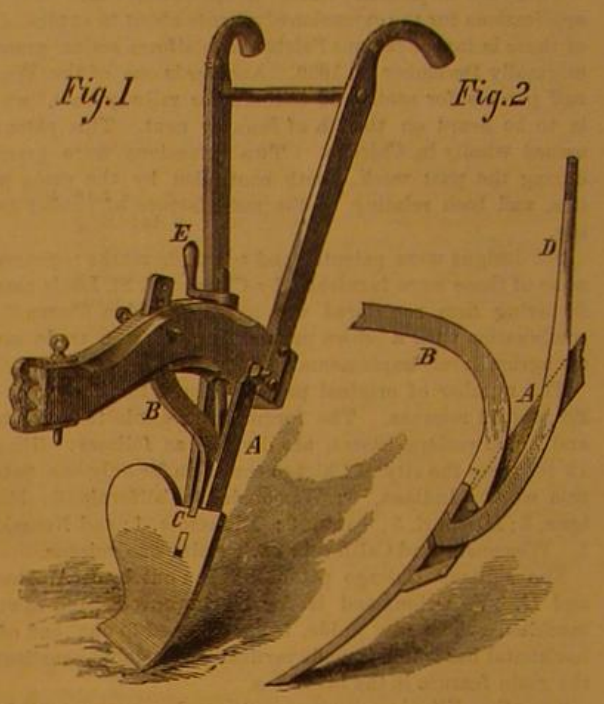
HARRINGTON'S AUTOMATIC BRAKE.

Benefactions of an Inventor.

A few weeks ago we announced the death of Seth Adams, of Boston, an inventor of no small reputation, who had amassed a large fortune out of his patents and the business he had built up under their fostering protection. The following are among the public benefactions, designated in his will, to Boston charitable institutions: $1,000 to the Needle Woman's Friend Society; $30,000 to the Consumptives' Home; $20,000 to the Home for Aged Men; $20,000 to the Association for the Relief of Aged Females; $10,000 to the Baldwin Place Home for Little Wanderers; $5,000 to the Boston Provident Association; $1,000 to the Industrial Society of Boston; $500 to the North End Mission; $1,000 to the Boston Young Women's Christian Association; $500 to the Children's Aid Society; $800 to the Female Orphan Asylum; $500 to the Temporary Home for the Destitute, $500 to the Children's Hospital; and $1,000 to the Society for the Prevention of Cruelty to Animals. A liberal sum is also donated to the town of Rochester, N. H., to be known as the Adams Fund, the income of which is to be paid to poor widows and orphans of that town.

IMPROVED PLOW.

The object of the new form of plow herewith represented is to avoid the use of the heel bolt, and to allow the plowshare to be removed or placed in position with increased facility and celerity, simply by turning a hand screw on top of the beam. It is claimed that there is nothing about the device to wear out, give way, get lost or misplaced, or become out of order. No single portion is detached at any time, and the operator can tighten the fastening apparatus while plowing with perfect ease.



The standard bars, A, are set into recesses of the beam and pivoted thereto by a strong cross bolt. Their lower ends are rigidly connected so as to form a firm support for the under side of the plowshare B is a curved brace, also rigidly attached to bars, A, and extending up through a mortise in the beam. Its upper end is perforated so that the brace may be locked by a crossbar, according to the angle of inclination under which the plowshare is set. A lug, C, formed upon the same brace, projects at its lower end beyond the standard, A, and is applied like a jaw into a recess of the share, as more clearly shown in the perspective view, Fig. 1. D is the adjusting rod, which passes between the standards and up through a conical perforation in the beam. Its upper end is threaded and raised or lowered by a suitable crank, E. The lower extremity curves around the brace, B, and projects beyond the standards into an aperture in the plowshare, as shown in section, Fig. 2. The share is therefore held in a firm and wedge-like gripe between the tapering jaw on the adjusting rod, and that already noted on the brace, B.

Different shares, we are informed, may in this manner be attached to the plow, as necessitated by the various requirements of farming, and their angles of elevation and depression be determined by simply adjusting the fore end of the brace.

The arrangement generally, the inventor states, is such as to offer no resistance to the soil slipping smoothly over, as there are no bolt heads or similar projections to catch. The plow also has a deep evenly curved throat, so that it cannot choke with grass, weeds, etc. We learn that the device obtained the highest premium at the Fair of the Georgia State Agricultural Society, at Macon, Ga.

Patented through the Scientific American Patent Agency, November 11, 1873. For further particulars address the inventor, Mr Andrews Riviere, Barneaville, Pike county, Ga.

J. WRITES to complain of the unnecessary delay of the courts in adjudicating on patent cases; and he thinks that inventors whose rights have been infringed are hardly treated. He states that the equity calendar of the Southern District of the State of New York has on it a long list of cases which have been ready for hearing for a year or more.

Correspondence.

Cheap Telescopes.

To the Editor of the Scientific American:

In your issue of December 13, 1873, W. M. asks How can a mechanic construct a cheap telescope powerful enough to see Jupiter's moons, Saturn's belts, etc.? The following is a plan which I adopted more than twenty years ago.

I called on a dealer in optical lenses and selected a meniscus, one inch in diameter and of 48 inch focus. This was for my object glass. I had already in my possession a two lensed double convex jeweller's eye glass; one of these lenses was used for the eye piece, its focal length being a trifle over one inch. The tube was made of pine wood. A piece of straight evenly grained one inch pine board, two inches wide and eight feet long, was cut in the middle, and the two pieces, after making a tapering semicircular groove in each, well glued together. This done, the next thing was to give it a round, tapering form, two inches in diameter at one end and a trifle over an inch at the other. This was done with a common carpenter's plane. I now had a tube four feet long with a tapering hole through its length, and 1¼ inches in diameter at its largest end. Two wooden cells for the lenses were then turned in a lathe, and were made to go on to the tube, as does the cover of a wooden pill box. A round hole, the size of the lens, was made in each, the meniscus being contracted to ⅞ inch, and the eye glass to ¾ inch diameter. The piece carrying the eye glass was made so as to slide some distance on the tube, for adjustment to distinct vision. The tube was painted and varnished, and mounted equatorially; and it proved to be a good instrument, showing Jupiter's moons, their movements and eclipses, handsomely, the ring of Saturn, the horned appearance of Venus, the mountains and craters on the moon, the spots on the sun, etc. Several of the nebulæ were also visible, especially those in *Andromeda*, *Orion*, *Hercules*, and *Sagittarius*. This instrument has been a great pleasure to me and my family of boys and girls, and even my neighbors, and the whole need not cost over two dollars, beside the time in making, provided one is a mechanic.

The meniscus (concave on one side and convex on the other) is the proper form for a single lens object glass, and a plano-convex lens makes the best form for the eye piece. Care must be taken to so set the lenses in their cells that their foci will meet centrally. When this is the case, the lenses are said to be well centered, and in that way we get rid of most of the prismatic color. Another point that wants attention is the mounting. Absolute steadiness is required for close observation. I used to put mine upon a post set firmly in the ground. The equatorial arrangement for mounting is described in nearly every work on telescopes.

I hope not only W. M. but a thousand others will be induced to build themselves telescopes. There is no one thing that can be put into the hands of youth that will enchant them like a telescope. They will leave all other amusements and gather around that marvelous revelator

Alvan Clark, of Cambridgeport, Mass., "the Herschel of America," many years ago might have been seen peering into the heavens with his little home-made tubes. He had asked the question: How can I make a cheap telescope? That question he answered for himself, and now his name and his fame are everywhere connected with his ponderous achromatics. B.

Bellows Falls, Vt.

Keeping Poultry to Enrich Lands.

Colonel Waring, in his "Elements of Agriculture," says: Poultry dung is nearly equal in value to Peruvian guano (except that it contains more water). If granted that a hen will consume, of the different kinds of grain, meat, and vegetables, during the year, the equivalent of two bushels of corn, which weigh 120 pounds, then it is certainly low enough to place the excrement—the result of the digestion of these two bushels—as equivalent to fifteen pounds of guano. As the manure from 100 fowls, during a year, would amount to 1,500 pounds of guano, taking the above supposition as at least safe: and as 300 pounds is ordinarily sufficient for an acre of corn, it will be seen that the manure from 100 fowls will make compost enough for five acres. The experiment has been tried by the writer, of applying, to one acre of corn in the hill, the manure of twenty hens one year, mixed with swamp muck, in the proportion of one part hen manure and three parts muck, and the result was a better crop than upon an adjoining acre enriched, for sake of experiment, with a good fair ordinary dressing of stable manure.

New Bridge over the Hudson.

The corner stone of a new railway bridge, to span the Hudson river at Poughkeepsie, N. Y., was recently laid with masonic ceremonies. In an engineering point of view, the work will be an extensive one. Its object is to connect Boston, Providence, Portland, Worcester, the iron ore regions of Connecticut, Duchess county, and the Hudson river with Scranton, Easton, the Delaware river, the coal and oil fields of Pennsylvania, Harrisburgh, Pittsburgh, Oswego, Buffalo, and the West, by a route in which there will be a gain of some eighty miles in a total of 318 miles, or a saving of some thirty per cent. The structure will be of the truss shape, and the railroad tracks will be on the upper or top chord, at an elevation of 194 feet above the river. By the terms of the charter, the company are empowered to erect four piers in the river, at a distance of not less than 500 feet apart. The entire length of the bridge will be about one mile, of which a trifle less than 2,500 feet is over the channel of the river. The other half will consist of land approaches, mainly on the east or Poughkeepsie side. The land piers will be built of solid granite or blue stone masonry. They will be eight or ten in number, and will vary in hight from 20 to 80 or 90 feet. The piers on the bank will be somewhat similar, but higher, and also more massive and substantial. The piers in the river present the greatest difficulty to the engineer, as they must be sunk about 130 feet below the high water level in order to secure a solid foundation. The cost will be about $2,600,000.

THE LATE PROFESSOR AGASSIZ.—(See page 2.)

SAMUEL NELSON.

Samuel Nelson, ex-associate Justice of the Supreme Court of the United States, whose retirement from the bench took place about a year ago, recently died of apoplexy at his residence in Cooperstown, N. Y. We extract a portrait of this eminent jurist from the *Science Record* for 1873.

JUDGE NELSON, OF THE UNITED STATES SUPREME COURT.

Born in this State, in 1792, he was admitted to the bar in 1817, and six years later began the active judicial career which terminated in his retirement from public life, a step taken not on account of impaired mental vigor or from fear that the great causes which he would be called upon to decide would be beyond his grasp, but because he felt that the weight of eighty years precluded his assuming the physical labor incident to his full share of the work of the high tribunal of which he was so prominent a member. First circuit judge, then associate justice of the New York Supreme Court, and finally Chief Justice, Judge Nelson, perhaps more than any other of his associates, contributed in the production of the decisions which have shed so brilliant a luster upon the past records of the judiciary of New York, and which are received as high authority in every court where the great principles of the common law prevail. In 1844, he was called by President Tyler to the bench of the United States Supreme Court, to occupy the office from which he eventually retired.

In questions of admiralty and international law, Judge Nelson was considered as one of the greatest living masters, but it is probable that his extended knowledge of these important branches of jurisprudence was even exceeded by his vast experience in the varied and complicated causes arising from the litigations appertaining to patents. In this connection, one of the most eminent lawyers of this city says of him that it was his habit "to labor most earnestly during the trial and upon the argument of causes: and again and again would he descend from the bench, especially when complicated machinery or specimens illustrative of science or models of vessels intended to develope the relations of colliding ships have been before him, and by their close and repeated study strive to understand the real points in controversy * * So thoroughly did he investigate questions of science and mechanics, and so sound a judgment was he known to form on these subjects, that his opinions concerning them were by courts and counsel accepted as of greater authority than those of any other judge, until finally, and for many years before the close of his labors at the circuit, patentees felt that, when he had passed judicially on their rights, they were substantially settled; and hence there came before him repeatedly, from distant points, cases involving the validity of the most valuable patents in the country, and to his decisions the parties generally submitted without appeal."

One of his last official acts was participation in the Joint High Commission charged with the settlement of the Alabama claims; and here his unexcelled proficiency in international jurisprudence contributed largely to the speedy and equitable adjustment of that grave question of international difference. His death, though sudden, was a fitting close to the evening of a grand and noble life. A slight illness confined him to his chair, in which, surrounded by his family circle, he peacefully breathed his last without tremor or pang, leaving to posterity the rare example of a magistrate, who for half a century, has preserved his ermine without stain or spot, and whose words will be handed down as the monuments of unvarying justice, stern integrity and profound learning.

SCIENTIFIC AND PRACTICAL INFORMATION.

CHEMICAL SUGAR.

One of the most important of chemical discoveries is that of the artificial creation of alizarine. By reducing natural alizarine by zinc powder, Groebe and Liebermann obtained anthracene, $C_{14}H_{10}$. Then reflecting that coal tar was an inexhaustible source of the latter product, they attempted to obtain, by synthesis, alizarine and even purpurine. But alizarine has for its formula $C_{14}H_8O_5$, and hence it became necessary to add to anthracene 5 atoms of oxygen, and to subtract 2 atoms of hydrogen. To obtain this result the investigators had recourse to bichromate of potash and sulphuric acid. Then treating the body with a solution of caustic alkali at a temperature above 388° Fah., a blue mass was gained, the aqueous dissolution of which precipitated, by an acid, either artificial alizarin or purpurine, according to the degree of oxidation. This chemical product, now employed in the art of dyeing, has given results even superior to those obtained from madder and its derivatives.

The process briefly reviewed above suggests the idea that sugar might be made by a somewhat similar course. Sugar has for its formula $C_{13}H_{11}O_{11}$, and is resembled by a large number of chemical bodies. Glucose, for example, gives $C_{12}H_{14}O_{14}$; cellulose, $C_{12}H_{10}O_{10}$. Now, supposing that on these bodies a chemical reaction of the same nature as that of bichromate of potash and sulphuric acid on anthracene could be effected, would it not be possible to produce a chemical sugar?

FUSION OF PLATINUM.

The fusion of platinum has been effected by M. Violette. Partly in fragments and partly in a state of sponge, it was placed in a Hessian crucible lined with plumbago, and subjected for one hour to the heat of the furnace. A perfectly fused button of platinum, of the same weight as that of the metal introduced, was found at the bottom of the crucible.

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ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations (which are approximate only) and for the observations in the accompanying notes, I am indebted to students. M.M.

Positions of Planets for January, 1874.

Mercury.

Mercury should be looked for in the morning, in the early part of the month, as it rises before the sun, at 6h. 12m. on the 11th, and sets at 3h. 15m. P. M.

On the 31st it is very near the sun in right ascension, passing the meridian eight minutes after noon, rising at 7h. 23m. A. M., and setting at 4h. 53m. P. M.

Venus.

Venus is not well situated at the beginning of the month, and becomes less so at the end, as it passes the meridian within a few minutes of noon on the 31st.

On the 1st Venus rises at 6h. 38m. A. M., and sets at 3h. 36m. P. M. On the 31st Venus rises at 7h. 7m. A. M., and sets at 4h. 37m. P. M.

Mars.

The apparent diameter of Mars is becoming less. It comes to meridian earlier in the afternoon from the 1st to the last of January; but as it is moving northward in declination, it is longer above our horizon and so sets a little later.

January 1, Mars rises at 10h. 12m. A. M., and sets at 8h. 42m. P. M. January 31, Mars rises at 9h. 5m. A. M., and sets at 8h. 43m. P. M.

Jupiter.

Jupiter is coming to a position more favorable, and rises on the 1st at 11h. 18m. P. M. Its apparent motion among the stars is very slow on the 1st, and on the 16th it seems to be stationary; after this time its motion among the stars is reversed, and it seems to retrograde, or move in a westerly direction, in consequence of the more rapid motion of the earth.

On the 31st Jupiter rises soon after 9 P. M., and is very nearly in the path of the celestial equator, being above the horizon a little more than 12 hours. It comes to the meridian on the 31st at 3h. 26m. in the morning, and is then at an altitude (in this latitude) of 49° 6′.

Saturn.

On the 1st Saturn rises at 8h. 50m. A. M., and sets at 6h. 18m. P. M. On the 31st Saturn rises at 7h. 4m. A. M., and sets at 4h. 38m.

It will be believed that Saturn is not well situated for observation, its daily path being very far south, and its position nearly the same as that of the sun throughout the month.

Uranus.

Uranus rises on the 1st at 6h. 53m. P. M., and sets at 9h. 15m. A. M. On the 31st Uranus rises at 4h. 48m. P. M., and sets at 7h. 13m. A. M. It is among the small stars of *Cancer*

Neptune.

Neptune rises 22m. after noon on the 1st, and sets at 1h. 20m. the next morning. On the 31st it rises at 10h. 26m. A. M., and sets at 11h. 24m. in the morning.

Sun Spots.

Cloudy weather has seriously interrupted the record of sun spots by photography. Since November 14, impressions have been obtained only on the 22d, 25th, 26th, and 29th of November, and on the 6th of December. Three small groups near the western limb appeared on the 22d, none of which could be referred to any group of the 14th. By the 25th they had disappeared and a pair of small spots was found occupying about the same place as those of the 22d. This pair was also seen in photographs of the 26th and 29th, being on the latter day a very short distance from the western limb. The picture of the 26th shows a large spot just at its entrance on the disk. This was also visible on the 29th, the sun's rotation having carried it further toward the center. On December 6 there was a fine cluster approaching the center, and a smaller one below the larger and nearer the eastern limb. A spot near the western limb seemed by its position and shape to be identical with the large one of the 26th and 29th, and, if so, was unusually invariable. Faculæ have been visible in every case, but not of remarkable extent.

Barometer and Thermometer.

The meteorological journal from November 16 to December 13 gives the highest barometer, December 2 and December 7, 30·57; the lowest barometer, November 18, 28·68; the highest thermometer, December 4, at 2 P.M., 55°; the lowest thermometer November 20, at 7 A. M., 6·5°.

Amount of Rain.

The sleet and snow which fell between the evening of November 23 and the morning of November 25 amounted to 2 inches.

The rain which fell between the evening of December 8 and the afternoon of December 9 amounted to 0·75 inches.

The rain which fell between the afternoon of December 11 and the afternoon of December 13 amounted to 1·575 inches.

Old Fruit Cans.

Empty tin fruit cans, like old hoop skirts, are a nuisance when out of place. The question is: What is their place? and I should be willing to answer it a hundred times, if I could banish them from the gutters, the ash heaps, the vacant lots, and, above all, from the hands of the boys. I shudder now at the very suggestion of their ever being used again as music boxes, strung with rosined chords. Did that epidemic visit your locality, my dear reader? If so, you would be in haste to prevent the slighest possibility of its recurrence. But to the remedy.

In the first place, to open the cans properly, put hot coals on and around the little soldered tip on the top, until the solder melts, then scrape off lid and coals together, with a table knife. Be careful, however, not to set the cans on the hot stove before they are opened, by which little neglect steam enough to burst the can might be generated, which would not be a very pleasant or profitable method of opening it. When opened properly, you have a smooth, round orifice through which to remove the fruit.

When the cans are empty and dry, invert them on hot coals in the stove for half a minute, or on a hot stove, until the solder melts and loosens the remaining top of the can; then strike it off, smooth off the bits of solder, and you have a very convenient cooking utensil. For a lid, use a saucer, or the covers to old tin pint cups or pails. Rice, wheat, samp, pearl barley, split peas, and many other dishes for a small family, and small dishes for a large family, can be cooked in them, either standing directly on the stove, or placed in a large boiler or saucepan of water, to prevent the possibility of their burning. It also saves more costly tin utensils; for this method of boiling in water is hard on the tin ware. One can may be kept for onions; others can be used for baking or steaming rye and Indian bread, and some kinds of pudding.

They are also convenient for pantry use, for holding articles to be used in cookery or in the laundry; for garden seeds, for paint pots, and for many other things that will suggest themselves to every housekeeper, and for which indeed they would long ago have been used but for the untidy jagged edge made by the common method of opening them. If covers are wanted for them in these capacities, discarded rims and lids may be put together with a little solder.

If there are tin shears at hand, and any one to use them, the cans may be made into very passable scoops. Take several of them at a time to a tinner, and he will cut them into the shape for a trifle. It saves time to have a scoop in every meal tub, flour barrel, sugar pail, and starch box. In short, old tin cans are far better for many purposes than for street organs, or for ornaments to dogs' tails. Suppose we change the tune, and have better economy, more and a higher grade of music.—*Science of Health.*

What a Scientific Englishman thinks of Scientific Americans.

Mr. R. A. Proctor, the eminent English astronomer, is now in this country, and, in a recent speech before the Lotos Club in this city, made the following interesting remarks:

He had known before he had arrived, and had more clearly recognized since, that American scientists were doing noble work, and that the people of America were in advance of Europe in the general attention given by them to science. He had been amazed by the character of the audiences before whom he had lectured, not solely by their number, though that had surprised him, but by their close attention to the facts presented to them, and by their appreciation of the bearing of those facts. He had visited also American colleges and other institutions, and had been struck by the great advantages which the methods there employed possessed over those adopted in England. He had strongly felt the hope that one day his own children might receive a portion of their education in America. He proceeded to remark that, to every thinking mind, America presents a deeply interesting subject of study. There are being worked out, in this great country, the great problems which occupy the attention, indeed, of statesmen and politicians on the other side of the Atlantic, but the solution of which there, if solution is to be hoped for, is trammeled by the influences of old traditions, by the effects of class distinctions, and by other circumstances not readily classified or analyzed, but operating only too effectually to retard progress. Even in science the difference was to be recognized. He could venture, indeed, to remark that he might to some degree claim the sympathy and support of American thinkers, because of the efforts which he had made to resist the influences which oppress science in England. One of these is "authority"—not authority in its legitimate sense, but authority unduly allowed to affect the freedom of thought. Here in America men of science recognize authority as a form of scientific evidence, because the fact that a great thinker has held such and such a view is *pro tanto* evidence in favor of the justice of the view. But Americans refuse to allow authority to decide scientific questions; and when newly discovered facts show that views firmly held by great authorities should be modified or abandoned, the American student of science is not prevented by undue respect for authority from accepting the new truths thus indicated. In this respect, he had himself thought and acted as an American would. His so doing had, he feared, proved unpleasing to many in England, who preferred to stand on the old ways. Even more unpleasant to many had been his opposition to the old fashioned notion that only the official astronomer can do effective work, either in observation or in the discussion of observations. He mentioned how the Astronomer Royal of England had embodied this feeling in the opening sentences of a well known work on popular astronomy, where he divided astronomical students into those who are "officially connected with Government observatories, and those who are not." Mr. Hind had once rebuked him (Mr. Proctor) for quoting an observation made by an amateur astronomer, not that Mr. Hind denied that the particular fact had been noted, but because the gentleman who had made the observation had not made for himself a great scientific name. This, Mr. Proctor remarked, appeared to him a most mischievous mistake; and he believed that science in any country would never make such progress as it might, so long as considerations such as this were allowed to operate. He quoted another illustration of the tendencies of the official mind. When Miss Mitchell, the distinguished American astronomer, had discovered a certain comet, the Astronomer Royal (one of the council who had to determine whether she should receive a gold medal for that achievement) opposedthe award because, "although Miss Mitchell had certainly discovered the comet, she had not sent news of the discovery by the first mail." [Laughter.] Fortunately the Astronomer Royal was overruled by his colleagues nd the award was made. Mr. Proctor proceeded to remark on two points in connection with American scientific work —first, the effective way in which it was carried on, new and important facts being continually added to our knowledge by American scientific workers; and secondly, the small regard paid by Americans to questions of priority. He remarked that, in two special instances, relating to the work of Professors Cooke and Winlock, of Cambridge, Mass., he had been unwittingly guilty of injustice in assigning the credit to others; and the mistake, though noted long since by those gentlemen, had been allowed to remain uncorrected. It appeared to him, in fact, that American students of science were altogether less disposed to controversy than their European fellow workers.

[Miss Mitchell has since explained that the medal was to be awarded, according to the terms prescribed by its donor, the late king of Denmark, only on condition that the news of the discovery be forwarded by the first mail.—EDS.]

The Automatic Telegraph System.

This system is being tested by the Philadelphia, Reading and Pottsville Telegraph Company, and found to work very satisfactorily between their main offices in Philadelphia, Reading, and Pottsville, upon a line which also has a number of offices using the Morse system.

On Tuesday, the 2d inst., the Automatic Telegraph Company's wire between Washington and Philadelphia was connected at Philadelphia to one of the P., R., and P. Telegraph Company's wires between Philadelphia and Pottsville, and the President's message, containing about 11,500 words, sent direct from Washington to Pottsville, Pa., by the automatic system; and the time occupied in its transmission upon a single line between the points named was 34 minutes, being an average of 337 words per minute. It could, however, have been sent in less time, as no effort was made at the time to obtain speed. The message was perforated at Washington by young ladies, who each averaged about 25 words per minute. The characters recorded on the chemical paper at Pottsville were plain and distinct, and easily read by three operators, who translated the characters to three copyists, each averaging about 35 words a minute.

Upon the same day, the President's message was transmitted over the lines of the Western Union Telegraph Company direct from Washington to Pottsville, by the Morse system; and according to a statement published in the *Pottsville Standard*, it occupied the time of four wires each for nearly two hours and a half.

Had the message been sent by the Morse system upon a single wire between the points named, it would have taken about 10 hours, as there was considerable escape on the wires that day, owing to a damp and drizzling rain.

The Bee Keeper's Convention.

The third annual convention of the North American Bee Keeper's Society, recently held at Louisville, Ky., was very sparsely attended, the delegates present being 18 in all, an unaccountably meager representation, as compared with the large meetings of the two previous years. There was an informal talk of broad comb and its probable formation; one member related his loss of thirty colonies in consequence of the singular disappearance of the queens, owing, it was thought, to a disease generally prevalent during the year, and which proved particularly fatal to the queens, killing them a short time after the attack. A general expression upon the subject showed a unanimity in favor of sugar sirup, or pure white candy, in preference to late fall honey as food for weak swarms in winter, and one member advised that it be prepared by dissolving a quart of "coffee crushed" in a pint of boiling water. Alsike clover was very highly recommended, some deeming it superior to the white or red, not only as bee pasturage but for cattle feed as well. A remark was made to the effect that the consumers may easily be in error when they suppose that the presence of comb in the honey sold in the market is a sufficient guarantee of excellence, and that extracted honey is necessarily adulterated, it being a trick of the trade to place comb in manufactured honey in order to help the sale of the worthless article.

PROFESSOR PROCTOR, the English astronomer, treats largely upon the probabilities of other worlds than this being inhabited, the conclusion being that, of the inner planets, Mercury, Venus, the Earth, and Mars, our planet only was in condition to be inhabited by beings like the dwellers upon the earth. Mercury and Venus must be too hot, and Mars too cold. Of the other planets, their condition was not probably such as to permit of habitation by creatures such as ourselves.

D. K. N. suggests, in the laying of ocean cables, that communication between the deep sea line and floating buoys, all along the route, be arranged. A ship in distress could, by sending a boat and crew to one of the buoys, send word to the shores for help. The idea is practical, and will probably be some day carried out.

J. H. M. writes to point out the fact that an acre is the square of the hypothenuse of a right angled triangle whose sides are, respectively, 66 feet and 198 feet, or 4 rods and 12 rods.

NEW BOOKS AND PUBLICATIONS.

THE ILLUSTRATED ANNUAL REGISTER OF RURAL AFFAIRS and Cultivator Almanac for the Year 1874. With 150 Engravings. Price 30 cents. By J. J. Thomas, Editor of the "American Fruit Culturist," etc. Albany, N. Y.: Luther Tucker & Son, 395 Broadway.

THE FLASH LIGHT TELEGRAPH, or Telegraphing Made Easy. By M. Gustin. Troy, Pa.: Gazette Office.

A code of signals for telegraphing by means of lights!

LECTURE ON PHYSICAL ASTRONOMY. Delivered before the Austin Library Association. By Matthew Hopkins.

Mr Hopkins proposes to war with faith in the hypotheses of Newton and "strikes Baal in his temple, with mailed hand armored in triple steel." We quit reading this pamphlet, which is a miracle of discursiveness and vagary, with wonder as to how long the author could continue in the same style without approaching his subject.

PHARMACOPŒA GERMANICA: The German Pharmacopœia. Translated by C. L. Lochman. With an Appendix explanatory of the French Metrical System, and Tables of Weights and Measures, etc. Philadelphia, Pa.: David D Elder & Co., 430 Market street.

The preparation of a German pharmacopœia, to take the place of the numerous and widely different text books so long used in the different countries of that empire, has recently been completed; and Mr. Lochman publishes a translation of it, believing with reason that its completeness and recent date will make it valuable to the American druggist.

THE SCIENCE OF HEALTH: a new Monthly, devoted to the Restoration and Preservation of Health on Hygienic Principles. Amply Illustrated. Volume III, July to December, 1873. New York: S. R. Wells, 389 Broadway.

Our readers' attention has frequently been called to this useful periodical, not only in this column but by the numerous extracts from its pages, wherein is found much matter of value to the housekeeper, as well as sound information and advice on the specialty to which it is dedicated. We especially commend it to the attention of young people of both sexes, whose carelessness on the subject of hygiene is often fraught with the most dangerous consequences.

THE GALVANOMETER AND ITS USES: a Manual for Electricians and Students. By C. H. Haskins. With Illustrations. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

This is an exceedingly neat little work, in pocket book form, containing the laws and rules of measurement of the quantity and tension of electric currents together with tables and formulæ. There seems to be nothing omitted from it that a telegraphic engineer, engaged in making measurements and calculations, could possibly need.

THE VIENNA EXPOSITION EXHIBIT OF KRUPP'S STEEL WORKS, Essen Prussia.

Messrs. Thomas Prosser & Son, of 15 Gold Street, in this city, agents for Fried Krupp, have forwarded us a photograph of the world-renowned steel works together with a catalogue of the articles exhibited by the firm at the recent Vienna Exposition. Forty-one different specimens were there shown, ranging from small parts of mechanism to a cast steel block weighing 52½ tuns. The pamphlet also contains a description of the works, calculated to give an idea of their successful administration as well as of their unprecedented extent.

THE AQUATIC MONTHLY has recently changed publishers, and is now issued by August Brentano, the very enterprising dealer and importer of foreign periodicals, No. 33 Union Square, New York. The editorial management remains unaltered, and hence lovers of aquatic sports may rely on their representative journal being conducted with the same ability which has characterized it from the outset. The December number before us is full of fresh and interesting news about boating, yachting and athletic pastimes, together with much entertaining correspondence from the pens of writers evidently *au fait* in all matters concerning our amateur marine. Subscription price, $4.00 a year.

SCRIBNER'S MONTHLY for January contains a ludicrous burlesque scientific story about the great air line to the moon, adapted from the French of Jules Verne. With just enough scientific truth to give the narrative a semblance of fact, and with much detail, the plan for shooting a hollow projectile, out of a gun 900 feet long and six feet thick, sunk in the earth, is described; and a number of engravings, one showing the interior of the shell with the voyagers inside, are added. Huge telescopes, the writer says, are built and at the appointed time, 140,000 pounds of gun cotton are ignited under the projectile; the latter departs, but after several days' waiting, the big telescope observer on the Rocky Mountains discovers that its movement has been changed to a circular motion of great velocity, and it describes an elliptical orbit, distant 2,833 miles from the moon, of which it has become a satellite. The magazine presents its usual varied and excellent table of contents, and offers a rich treat in the way of articles and poems from eminent writers, among whom we note J. A. Froude, R. H. Stoddard, John G Saxe, Bret Harte and others. Published by Scribner & Co., 654 Broadway, New York. Subscription, $4.00 a year.

OUR old friend the ECLECTIC MAGAZINE begins the new year and its nineteenth volume (new series) with a number brimfull of good things, selected with excellent discrimination from foreign and American periodicals. Those interested in Lieutenant Steever's present explorations in Palestine will find, in the paper on the "Land of Moab," some valuable information concerning that famous country. "Spanish Life and Character" is another article of timely interest, and the serial Russian novel, "Spring Floods," is continued. There is a monograph on Lafayette, a few choice poems, and numerous papers of merit on general topics, besides the usual editorial miscellany, and an initial steel engraving. E. R. Pelton, publisher, 108 Fulton Street. Subscription price, $5.00 a year.

ST NICHOLAS is unquestionably the best children's journal that has yet appeared in this country; and we can say so with all the more certainty since it has been consolidated with that standard juvenile periodical OUR YOUNG FOLKS. Messrs. Scribner & Co., of 654 Broadway in this city, conduct the new paper, and if their wish for 100,000 readers among the youngsters is not fulfilled it will be through no fault of theirs. The holiday number is elegantly printed, exquisitely illustrated, and as for the stories—well, Science had to stand aside for a while, until we had read them and enjoyed them ourselves. There is something for everybody: tales of adventure for the boys, fairy yarns, a funny story in easy French, and even a couple of pages of big print and short words which the pet of the household can spell out for "her own self." It will make an admirable Christmas present. The two back numbers for this year and the magazine for 1874 fourteen copies in all, will be sent for $3.00.

THE ATLANTIC MONTHLY has changed publishers, and is now issued by Messrs. H O Houghton & Co., 219 Washington street, Boston. The number for January is remarkably attractive, and will be of especial interest from the fact of its containing the last writing of the late Professor Agassiz—a paper setting forth his convictions on the Darwinian theory, and beginning a series of which his death has prevented the completion. We note poems by Whittier, Holmes, and Bayard Taylor, a thoughtful and able paper on local taxation by the Hon. David A. Wells, and a very curious article on the origin of the $ (dollar mark), which is said to be the oldest symbol known to the human race. Subscription price, $4 a year.

THE GALAXY for January opens with a paper on the Duke of Argyll by Justin Macarthy into which is condensed considerable information regarding apparent anomalies in the English peerage. Call Benson discourses on Physics. Impediments to Social Success,' and Richard Grant White contributes a scholarly paper on 'Linguistic and Literary Notes and Queries.' J. S. Black criticizes Hon. Charles Francis Adams' Seward eulogium with even greater sharpness than is found in the recently published strictures on Gideon Welles. The number contains the usual amount of table talk and entertaining miscellany. Subscription price, $4 a year.

DECISIONS OF THE COURTS.

United States Circuit Court—Northern District of Illinois.

PATENT MACHINE FOR PRESSING AND STAMPING SHEET METAL.—REVOCATION OF PATENT.—FRANK STURGES, OLIVER H. LEE, AND WILLIAM S. POTWIN *vs.* ISAAC VAN HAGEN.

This cause having come on to be heard upon the bill of complaint, answer, and replication herein, and the proofs, documentary and written, taken and filed in said cause, now, therefore, on consideration thereof, and on motion of N. C. Gridley, counsel for complainant, it is ordered, adjudged, and declared, and the Court doth hereby order, adjudge, and decree that the Letters Patent of the United States of America, No. 114,068, bearing date April 25, A. D. 1871, and issued to the said defendant Isaac Van Hagen, be, and the same is hereby revoked, vacated, and declared null and void, and of no effect, and that the said defendant Isaac Van Hagen be, and is hereby, divested of all right and interest he had, under and by virtue of said Letters Patent, in and to the "Improvement in Machines for Punching and Stamping Metal" therein described.

And it appearing to the Court from admissions of the parties made on the hearing, that said defendant is the sole owner of said patent, it is further ordered, adjudged, and decreed that the same defendant, Isaac Van Hagen, do, within sixty days from the date hereof, surrender and deliver up to the clerk of this court, the said Letters Patent No. 114,068. And thereupon the said clerk shall write with ink across the face of said Letters Patent the words "revoked, vacated, and declared null and void by the Circuit Court of the United States of America for the northern district of Illinois," and shall then transmit the said Letters Patent, so canceled, properly enveloped, to the "Secretary of the Interior of the United States of America, Washington D. C." And it is further ordered, adjudged, and decreed, that the record of the said Letters Patent, No. 114,068, be canceled, quashed, and annulled.

And it is further ordered that the clerk of this court, after the expiration of sixty days from the date hereof, do transmit to the Secretary of the Interior, Washington, D. C., a certified copy of this decree.

And it is further ordered, adjudged, and decreed that the said complainants do recover of the defendant their costs and disbursements in this suit to be taxed.

NOTE.—The above decision of the United States Circuit Court appears to be confirmatory of the action of the Commissioner of Patents in 1872 in setting aside the claims of Van Hagen.

This case appears to have been a deliberate attempt, by a party who was not the inventor, to obtain and hold a patent for an invention which rightfully belonged to another. It is rare that such attempts are made, and in general they ignominiously fail, as in this case.

The original decision of the Commissioner, giving the various facts, will be read with interest, and we therefore present it in full.

HUNTINGTON *vs.* VAN HAGEN.—*Interference.*

[*Appeal from the Board of Examiners-in-Chief in the matter of the interference between the application of Frederick M. Huntington, filed June 25, 1872, and Letters Patent No. 114,068, issued to Isaac Van Hagen, April 25, 1871, for* MACHINE FOR PRESSING AND STAMPING SHEET METAL.—*Decided July 25 1872.*

LEGGETT, *Commissioner:*

The invention in controversy is an attachment for a machine used in the manufacture of sheet metal covers for cans, boxes, etc. The question at issue is not which party made the invention first, but which invented the device. There is no pretense that each invented the device independently of the other. Each swears positively that he made the invention and disclosed it to the other. The language of each is so positive, and the detail of each is so minute and particular, yet so directly antagonistic, as to leave no doubt but one or the other of the parties has deliberately committed perjury. As there is no direct attempt to impeach either, the testimony of one offsets the other, and that of neither has any value in the case except so far as it is corroborated by other testimony.

At the time the invention was made, both parties were employed in the shops of Frank Sturges & Co., in Chicago—Van Hagen as general superintendent, and Huntington as foreman of one class of work.

Van Hagen claims to have conceived the invention in May, 1869, and says that he very soon afterward explained it to his attorney. In this statement he is fully corroborated by his attorney, but by no one else—not even by the other witnesses called by himself. The attorney only testifies as to the time that Van Hagen consulted him, and fixes that time in the summer of 1869. He made a record of the matter in his books; but all of his books and records were burned in the Chicago fire last October. He therefore testifies only from memory.

Huntington claims to have had the idea of his invention as early as April or May of 1868, and that in 1869 he explained it to Harding and Wright, two men who worked in the same shop with himself. He also swears that early in the spring of 1870 he took Van Hagen to a Fowler press in the shop and explained to him the invention and how to attach it to the press. Soon after this Huntington commenced the construction of the device. The draftsman, the pattern maker, and several other workmen in the shop testify that they received all their instruction and direction from Huntington, and that Van Hagen gave no directions except in the capacity of general superintendent. He told them to follow the instructions of Huntington in this matter. During the whole of this time the invention was talked of all through the shop as Huntington's. Even Van Hagen spoke of it as Huntington's invention, and advised Frank Sturges & Co. to pay Huntington one hundred dollars, in addition to his regular salary, for making the improvement to the Fowler press, and the money was handed to Van Hagen to pay to Huntington. It seems that Van Hagen never, to any member of the firm or to any one about the shop, spoke of the invention as his, until after he had obtained a patent for it. The only person to whom he ever disclosed the fact that he had made an invention was his attorney. If the conversation with his attorney had been in the summer of 1870, instead of 1869, then Van Hagen's claim to the patent would rest entirely upon his own testimony, contradicted by Huntington, who is abundantly sustained and corroborated. If the invention was Van Hagen's, why did he not claim it when it was being constructed in the shop, and when all the men talked of it as Huntington's? Why did he tell Mr. Sturges and Mr. Potwin, members of the firm, that it was Huntington's invention, and induce them to pay Huntington one hundred dollars for making it? I cannot resist the conclusion that Van Hagen never knew or thought of the invention until Huntington explained it to him early in 1870, and that his talk with his attorney about it was in 1870, instead of 1869. The attorney speaks too positively as to dates. It is one of those things in which a man is most liable to be mistaken. He conversed with this client as one of many, and it is not at all strange that he should be mistaken as to the year. Early in 1870 Huntington explained his invention to Van Hagen. Van Hagen recognized its value, and went to his attorney and represented it as his own. He attempted to explain it, but did not know enough about it to make it intelligible, for the attorney swears that he could not understand it from his first explanation. He then waited until Huntington had finished a working machine, when he was able to comprehend it sufficiently to explain it intelligently to his attorney, and the attorney gave him his opinion that it was patentable.

I am clearly of the opinion that the invention belongs to Huntington. The decision of the Board is therefore affirmed, and priority awarded to Huntington.

COMMISSIONER'S DECISIONS.

INTERESTING DECISION IN RELATION TO ASSIGNMENTS OF PATENTS.—HOLMES AND SPAULDING.—*Reissue.*

[*In the matter of the application of Daniel Holmes and John Spaulding, for reissue of patent No.* 19,465, *dated February* 23, 1858, *reissued May* 13, 1862, *No.* 1,307, *and extended February* 27, 1872. *Subject,* CARPET BEATING MACHINE.—*Decided December* 4, 1873.]

LEGGETT, *Commissioner:*

The question has been raised under Rule 63, in making up the file of his application, whether all the parties in interest have joined in the application. The inventors were Joseph Harris and Daniel Holmes. Previous to the grant of the patent, and on the day of making application therefor—to wit, the 15th day of December, 1857—they executed an assignment of the invention to Holmes, and requested that the patent be issued to him, which was done. The question is whether that assignment conveyed the extended term of the patent, which has recently been obtained. If it did, then this application is concurred in by all the parties in interest; and if it did not, then Harris or his assignees now have an interest, and should be joined.

The Supreme Court of the United States, in *Nicholson Pavement Company vs. Jenkins* (*Official Gazette*, vol. 1, p. 465), said: "An assignment of an interest in an invention secured by Letters Patent is a contract, and, like all other contracts, is to be construed so as to carry out the intention of the parties to it. * * * There is no artificial rule in construing a contract, and effect, if possible, is to be given to every part of it, in order to ascertain the meaning of the parties to it."

A deed assigning in terms all one's right, title, and interest in a *patent*, it is well settled, does not convey the extended term. It must be expressly conveyed; and the intention to convey it must appear from the language of the deed, or it will not pass. But both the legal and equitable interest in the extended term may be conveyed before the extension has been granted. (*R. R. Co. vs. Trimble*, 10 Wallace, 367,) and probably also before the grant of the patent.

I know of no case in which the mere assignment of the *invention* or *improvements*, either before or after the grant of the patent, has been held to convey the extended term. Something more explicit is required. In both the cases before the Supreme Court, above cited, in which it was held that the respective assignments there under consideration conveyed the extension, the language fully and clearly indicates an intention to convey it. The patents had been granted, and the words in the granting clauses, after conveying the patents, expressly conveyed all future interests in them which might accrue to the assignors.

The following sufficiently exhibits the assignment in this case:

"And whereas Daniel Holmes aforesaid has agreed to purchase from us all the right, title, and interest which we have or may have in and to the said Letters Patent to be granted therefor, and has paid to us, etc.

"Now, therefore, this indenture witnesseth that for and in consideration of the said sum to us paid we have assigned and transferred, and do hereby assign and transfer to the said Daniel Holmes, the full and exclusive right to all the improvements made by us, as fully set forth and described in the specification which we have prepared and executed preparatory to obtaining Letters Patent therefor. * * * And we hereby authorize and request the honorable Commissioner of Patents to issue the said Letters Patent to the said Daniel Holmes, as the assignee of our whole right and title thereto."

Taking this whole deed together, in accordance with the rule stated by the Supreme Court, above referred to, so as to give effect, if possible, to every part of it, I think it quite clear that there is no intention exhibited to convey, and therefore that there was no conveyance of, the extended term. The only words which, without qualification, might clearly indicate such an intention are the following in the recital: "And whereas Daniel Holmes aforesaid has *agreed to purchase* from us all the right, title, and interest which *we have or may have* in and to *the said invention, and* in and to *the said Letters Patent* to be granted therefor."

Then follows the granting clause, conveying "all the *improvements* made by us, as fully set forth and described in the specification, preparatory to obtaining Letters Patent therefor."

Were this all, the effect of the instrument might, perhaps, be a matter of doubt; but then follows what was evidently intended as the *habendum*—always of importance in aiding a proper construction of the granting part of a deed—which clearly specifies that Holmes is to hold as assignee the "*patent*" merely. This limitation of his interest is apparently in conflict with the language of the recital; but it may be harmonized with that language by construing the words "*or may have*," in the recital, as referring to the patent which was about to be obtained when the assignment was made. Either that must be done or the *habendum* must be ignored, which must be contrary to both law and reason.

I think Harris or his assignee has an interest in the extended term, and should join in this application for reissue.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business, and their large corps of assistants, mostly selected from the ranks of the Patent Office, men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office; enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents.*

This 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 Drawing, 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.

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.

Caveats.

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

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.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent. Address MUNN & Co., Patent Solicitors, 37 Park Row, New York city.

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, opinions, and advice, no charge is made. Write plainly, do not use pencil, nor pale ink: be brief.

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

Recent American and Foreign Patents.

Improved Ash Sifter.

Levi Marsh, South Adams, Mass.—This invention is an improved ash sifter so constructed that the coal may be sifted without the escape of the fine ashes through the room. The box is provided with a close cover supported upon legs, so that an ashpail may be placed beneath to receive the ashes which are allowed to escape through a hole in the bottom by drawing out a slide. In one end of the box is a spout through which the coal may be allowed to escape by drawing up another slide. In using the sifter, the ashes and coal to be sifted are poured into a sieve within the box, and the handle of a shaking rod is moved back and forth quickly. When the ashes have been all shaken out, the rod is turned slightly, causing the forward end of the sieve to drop, so that a fastening of a door comes in contact with the inner end of the spout. The door thus becomes unfastened, allowing the coal to escape through the spout into the receptacle placed beneath. As soon as the coal has been discharged, the slide is inserted, and the sifter allowed to stand until the ashes have all settled. The slide is then withdrawn and the ashes allowed to escape into the receptacle placed beneath the sifter. The door is then refastened, and the sifter is again ready for use.

Improved Hemmer for Sewing Machines.

William Lee Apthorp, Tallahassee, Fla.—This invention consists of a hem-turning scroll for the edge of the cloth, permanently attached to the ends of a piece of wire, which constitutes the frame by which said scroll is supported and attached to the machine. On this a scroll guide for the fold of the cloth is fixed so as to slide toward and from the edge-turning scroll to suit the width of hem required.

Improved Method of Burning Brick.

Tobias Billesbach, Kearney Junction, Neb.—This invention is a method of burning layers of bricks in a kiln by plastering up successive portions of the sides of the kiln, beginning at the bottom, and continuing it at intervals toward the top as the burning advances. If the kiln is continued to a considerable length, the burning of one part will be completed, the bricks removed, and a new kiln commenced while another part is being finished, thus making the operation continuous.

Improved Adjustable Scaffold.

John Dillon, 424 Fourth avenue, New York city.—The two parts of the extension truss are hinged together near the top so as to fold up and be easily detachable as necessary in the application of the parts. The tops of the halves are united by laterally connecting boards and a hinged board, which fits over the recess formed at the adjoining top ends of the parts. The recess is lined with metal plates, and serves to hold a vertical cross board, passed through the same, which projects at both sides of the truss and supports the boards connecting with the next truss. Strong bolts are inserted through the top boards for retaining the longitudinal pieces on which the framework or platform connecting the trusses is laid. The front and rear parts are inclined toward each other, so as to brace the top, and both parts may be extended to and adjusted at different hights. When the truss is folded up, the boards connecting the trusses may be secured between the steps of the front part, serving thereby as support for paint pots and other implements. In similar manner, either half may be used as a suspended platform for painters, for painting the outside of houses, while the detached front part may be applied as an extension ladder. In its common form it is also used as a step ladder.

Improved Guano and Seed Distributer.

James H. Boyd, Plain, S. C.—A tubular plow stock extends downward from the beam in the ordinary way. Said beam is mounted on a wheel and carries a hopper for the seed, said hopper being mounted in front of the handles, and sufficiently above the beam to admit the shaking and distributing shoe under it. This shoe is arranged to discharge into the stock at the top, and is actuated by a rattle staff and pins on the side of the wheel. The furrow can be made any required depth, so that cotton seed may be planted in the furrow above the fertilizers deposited at the bottoms.

Improved Clock Escapement.

Aloys Platt, New York city.—There is a spring-pressed swinging bar that engages the scape wheels, provided with a side stud, operated by an arm which disengages a pallet for the scape wheels. The bar which carries the arm is pivoted to the frame connected to the pendulum through a slot, and carries a pallet at its lower end, which receives the impulse of the escapement wheel, and transmits it to the pendulum. Immediately after the pallet has received the impulse of the scape wheel, the latter is arrested by the first pallet, and the pendulum bar swings back to the right, the pallet passing over the teeth of the wheel, which are held while the wheel stands, so that they do not cross the path of the pallet. The arm has a pin, going through a vertical slot in the bar, to hold it at the right position for striking the stud, and limiting its rise when it escapes from said stud, which it does by swinging upward, the point being thrown up by the inclined face of the stud upon which it strikes. The hight at which the point of the arm will strike the stud and from which it will escape to regulate the action may be varied.

Improved Cultivator Plow.

William Bagnall, Otsego, Ohio.—To the foot, a little in the rear of its middle point, is secured, or upon it is formed, the lower end of the forward standard, the upper end of which is secured to the beam. In the upper side of the forward part of the foot is formed a shoulder for the forward end of the plow plate to abut against. From the shoulder the upper side of the foot curves slightly upward, said curve being continued upon the lower part of the standard to form a seat for a smaller or weed-cutting plow. The standard is made with an offset to form a seat for the upper part of the larger or dirt-throwing plow, the lower end of said plow fitting and resting against the shoulder of the foot. The plows are secured to their seats upon standards. One plow is thus low, so as to pass beneath the soil, cutting off the weeds and grass, but leaving the surface of the ground almost entirely undisturbed, and throwing no soil around the plants. The other plow, from the greater hight of its rear end and the greater flare of its wings, throws the soil around the plants. By this construction, the plows being made wide, a single plow is enabled to do the work of two or more small plows.

Improved Locomotive Smoke Stack.

John V. Bishop, Atlanta, Ga.—The ordinary funnel-shaped stack is reenforced in the upper portion with a lining to sustain the wear of the hard particles of coal which are projected against it in being deflected from the direct escape. It is made removable. The cover has the ordinary short discharge tube extending below to conduct the smoke from the interior to the holes in its sides, with which are arranged short tubes to receive the cinders rounding off from the top of the stack toward the discharge passages, and prevent them from being carried through the holes with the currents of smoke and steam. By this means the holes may be made much larger than they otherwise could be, and the escape of the cinders is prevented. In the space between the top and the upper end of pipe are vertical curved tangential plates for imparting a spiral motion to the escaping vapors which tends to increase the draft by preventing them from being thrown directly against the wall of the stack, by which they are abruptly stopped.

Improved Railway Joint Stiffener.

Horace Harding, Tuscaloosa, Ala.—This invention relates to means whereby the rails may be held down securely at the ends, and consists in a bar held to the tie that supports rail joint, parallel to the rail and at same distance from it. It is cheap, easily applied, and thoroughly effective for the purpose intended.

Improved Fiber Disintegrator.

A. Berthet and P. Laberie, New Orleans, La.—This invention consists of a platform having two horizontal rollers, arranged one obliquely above the other and each carrying upon its surface oblique sectional blades. A double grooved wheel of perpendicular axis presents its periphery close to the point of contact of the wheels at each end. A belt passing around both wheels has intermediate regulating pulleys. The plant is fed into the groove and held by the band, then drawn by the roller blades and finally dropped on the side of the wheel opposite the feeder.

Improved Stuff Regulator for Paper Machines.

David Hamel, Holyoke, Mass.—This invention consists of a tank, a float, and valves or gates, so contrived that, by passing the stuff of which paper is made through it, as said stuff goes from the main holding tank or reservoir to the moving screen upon which it is spread for forming it into sheets, the flow will be regulated according to the proportion of pulp to water, so that the sheets will be uniform in thickness throughout their length. As the stream thrown by the pump is constantly the same, the variations in the hight of the float are caused by the variations in the thickness or consistency of the stuff; and said float being connected to the valves the latter self-actingly regulates the quantity spread upon the screen with great uniformity. They are used to shut off all the flow to the apron, and cause it all to go back to the tank, or to shut off the return to the tank entirely and cause it all to flow to the apron. For allowing the stuff to flow both ways, they are adjusted on the half stroke.

Improved Automatic Lubricator for Car Axle Journals.

Joseph G. Johnson, Elkton, Md.—This invention consists in an open-ended oiler frame arranged to slide and be supported on shelves in axle box and over an oil reservoir forming part of axle box. The oiler can thus be examined and supplied easily with wick without removing the reservoir.

Improved Automatic Water Meter.

Francisco De Paula Bellido, New York city.—The body of the meter is divided into two compartments, the upper being the smaller. The water enters the latter division; and to the valve plug of the pipe is connected a faucet, the handle of which communicates with a float. By this construction, as the water rises in the chamber, it raises the float, and this closes the faucet, stopping the inflow of water. A fine wire gauze screen shuts off a part of the chamber, in the bottom of which is formed the discharge orifice through which the liquid escapes from the chamber and flows into the lower compartment. The bucket that receives the water has its ends made in the form of isosceles triangles, with the third sides longer than the others. The side edges of the bottom plate of the bucket are bent upward a little, and to the outer sides of the flanges thus formed are attached small boxes into which water is admitted from the bucket through slots. The bucket is divided into two compartments, and to the bottom is attached a shaft, the ends of which work in bearings in the lower ends of bars. The bucket is provided with supports so that when either compartment is turned downward, the bucket will remain in that position until the upper compartment has been filled with water, the weight of which will tilt the bucket and discharge the said water into the compartment. By suitable construction, by adjusting the set screws, the amount of water required to tilt the bucket may be regulated with the greatest accuracy. The inflow of water into the boxes insures the prompt tilting of the bucket when the exact amount of water has been received. To one end of the bucket, a little at one side of its pivoting point, is pivoted the lower end of a connecting rod, the upper end of which is connected with the operating mechanism of an ordinary register, attached so that it can be conveniently seen; and it is covered with a case, so that it cannot be tampered with. By this arrangement each movement of the bucket, and consequently, the exact amount of water passing through the meter, will be accurately measured and registered. When the water in the lower chamber has reached the depth for which a float therein has been adjusted, the said float rises, which forces the plug into a connecting pipe, preventing the flow of any more water from the upper into the lower chamber until the water has been drawn out of the latter.

Improved Pantaloons Stretcher.

John D. Ryan, New York city.—This invention has for its object to furnish a device for stretching pantaloons to remove the bagging at the knees and the wrinkles in the other parts caused by wear, so that the pantaloons may be made perfectly smooth. There are two rods, of a length about equal to the length of the legs of the pantaloons to be operated upon, the upper ends of which are secured to the ends of two lower arms of a three-armed block. Spring rings are passed through slots in the lower part of the rods, several slots being formed in said rods, so that the rings may be adjusted according to the length of the legs of the pantaloons. The rings are held in place by spring catches, similar to the spring catch of an umbrella runner. In the upper arm of the three-armed block is formed a screw hole to receive the screw, which is made with a cross head for convenience in operating it, and the upper end of which is swivelled to a nut which receives the lower end of a rod, which carries an open spring ring, which is made of such a size as to fit the waist of the pantaloons. The rings are designed to be covered with cloth, so that the bottoms of the pantaloon legs and the waistband may be conveniently pinned to them; then, by turning out the swiveled screw, the pantaloons may be stretched.

Improved Loom Shuttle.

Nathan D. Chapman, Rollingsford, N. H., assignor to himself and Horatio H. Warren, of same place.—This invention relates to split shuttle spindles, and it consists of a twist of about half a turn in the two parts to the left near the point, by which the pressure of the cap on said parts along the middle portion swells them out at the twist, so as to bind the cap at the point to effectually prevent it from being thrown off by the shocks to which it is subject in the loom. When the point of the cap has been woven off the reaction of the two parts of the spindle along the middle is sufficient to hold the remaining portion.

Improved Apparatus for Burning Hydrocarbons.

Charles H. Cushing, Tidioute, Pa.—A heavy circular iron pan has a raised outer rim, and a less raised inner rim, around a small central orifice through which the steam or air blast is admitted from a suitable conduit pipe. The oil or other fluid is admitted through an orifice in the outer rim, and its supply regulated by means of a stopcock of the oil conducting pipe. The oil will flow from the orifice over the pan and fill the same to the hight of the inner rim over which the surplus will flow, to be thence carried up by the steam or air blast coming through the orifice. The fluid is thereby divided into fine particles and thrown, intermixed with steam or air, against the top and bottom of the boiler, ready for almost instantaneous combustion.

Combined Carpet Bag Looper and Button Hole Cutter.

George W. Morris and William Lenhart, Corry, Pa.—This invention relates to the manufacture of rag carpets, clothing, etc., and consists of a device for looping the strips of rags together in the process of preparing the rags for the loom, and for cutting button holes. The knife is pointed and double edged at the top, and an adjusting bar is jointed thereto near the upper end. An arm is attached to and extends laterally from the blade, curved to correspond with the arc of a circle, and having a series of holes therein. By a pin which enters these holes, the bar may be adjusted and confined near to or at a distance from the blade. The operator (with a strip of rag in each hand) laps the end of the left hand rag over the end of the right hand rag, and then forces the looper through them. He next puts the back end of the under or right hand rag through the eye. The rags are then detached from the looper with the left hand, and with the right hand he pulls the end of the under or right hand rag through the slits made, which completes the operation.

Improved Beer and Ale Faucet.

John Deasey, Fall River, Mass.—A tube has a screw thread on one end to screw into the tap hole in the barrel, and also a packing cap on the other end, and a cock attached to one side near the end having the cap. A wooden rod in said tube extends from the inner end through the cap. A collar on this rod bears against a ring of packing to prevent leaking at the hole in the cap. A spring inside of the tube bears against the inner end of the collar to press it against the packing. To apply this faucet, the plug with which the tap hole is closed is first driven by a rod and hammer about as far as it can be without letting the beer escape. The faucet is then screwed in up to the plug, and the plug is driven entirely in by a blow on the projection of the rod, and the faucet is screwed up tight.

Improved Manufacture of Sulphuric Acid.

Joseph Saunders, Brooklyn, N. Y.—This invention consists of hollow glass balls, of about 6 inches diameter, for sulphuric acid condensing towers, known as "Gay-Lussac's towers," to be used in substitution of the coke earthen balls, and other like substances, which are objectionable, because they become disintegrated and crumble to pieces in a short time, whereas glass is indestructible by the acid.

Improved Churn.

George G. Buchanan, Cotton Plant, Miss.—The upper end of the dasher shaft is secured to the lower end of a short metallic tube, into the upper end of which is detachably secured a metallic shaft which revolves in bearings in a cross bar attached to the middle horizontal bars of the churn frame. The shaft is supported by a collar which rests upon the upper side of the bar. The upper end of the shaft revolves in bearings. A small gear wheel is attached to this part of the shaft, and engages with a large gear wheel, to which is attached a horizontal shaft which is rotated by a hand crank attached to a cross bar secured to the frame, and to its outer end is secured the crank by means of which the apparatus is operated.

Improved Sash Fastener.

Orvellas H. Gilbert, Darien, Wis.—The lock consists of an inner and an outer plate, which inclose the operating parts, the bolt being shot through openings in the front and back edges. A spring is confined between the plates of the lock, the outer end of which enters a slot in the bolt. The finger piece is pivoted in the lock. Its long arm extends through the edge, and its short arm enters a recess in the lower edge of the bolt. A spring pawl enters a recess in the bolt and prevents its back motion. When the sash is locked, the bolt is shot into a recess of the casing, in which position it will remain until the pawl is raised out of the recess. To raise the pawl, a key is used, so that the bolt can be withdrawn by a down pressure on the long arm of the finger piece. When the bolt is withdrawn, the sash may be raised to any recess in the casing which will receive the bolt. Any upper recess will be so constructed that the bolt will not throw a full stroke, and consequently will not lock, as it is unnecessary to lock the sash, except when it is down or very near down. It may be locked so as to leave an opening to admit air but exclude burglars.

Improved Fire Escape for Safe.

Charles Morgan, Philadelphia, Pa., assignor to himself and Frank Manning, of same place.—This invention is a device by means of which a safe may be automatically made to descend into a well upon the breaking out of a fire in any store of the building. The safe is placed between two or more guide posts between which it slides up and down, which posts lead down through the various stories of the building to a well in the ground below all draft. To the sides of the posts in the story where the safe is to be located, are attached ratchet bars, and to the sides of the safe are pivoted spring pawls in such positions that their engaging ends may take hold of the teeth of the ratchet bars and support the safe. Spring hammers are attached to the sides of the safe in such positions that when released they may strike against the free ends of the pawls and withdraw their engaging ends from the ratchet bars. Lever catches are also arranged in connection with buttons, which may be turned down upon them and thus prevent the hammers from being accidentally released. Connected with the catch levers is a yoke to which is attached a cord, which passes over guide pulleys attached to the ceiling, and passes through the various stories of the building to the lower one, where its end is secured. If, now, a fire should break out in any story through which the cord passes, the said cord will be quickly burned off, releasing the catches and hammers which strike the pawls, withdrawing the engaging ends of said pawls from the ratchet bars, and allowing the safe to drop. The safe may be provided with a fire brick cover which when the safe has dropped to a place beneath the draft, will protect it from any fire even should the said safe be made of wood.

Improved Shank Laster.

William Hamilton Hanna, Chico, Cal.—This invention consists of a pair of nipper jaws, a screw-threaded shank, nut-bearing piece, and a strap, all so combined and arranged that, the bearing piece being placed against the sides of the last, the jaws engaged with the edge of the upper and the strap wound partly round the shank and fastened at the center of the heel or thereabout, the shank of the upper can be stretched up very powerfully to the last by turning the nut. The nut has a crank for the purpose, and the jaws can be shifted along the upper, and from side to side readily to stretch the upper in all parts without disconnecting the strap from the last.

Improved Testing Plug.

John Allin, Philadelphia, Pa.—The object of this invention is to furnish to coopers and others an improved plug for testing barrels and other air-tight cooper work or packages, by which the compressed air is automatically retained in the barrels, leaving both hands of the operator free to handle the barrel, examine it closely, and stop the leaks without allowing the air to escape. The invention consists of a conical tester, with a central hole provided with a check valve, by which the air remains compressed in the barrel until all the leaks are plugged. The valve seat is screwed to the end of the plug, and admits the free passage of the air to the barrel. The blowing of the air into the barrel is rendered less fatiguing by the immediate closing of the valve.

Improved Hasp for Butter Tubs, etc.

Henry C. Carter, New York city.—The ordinary fastenings of hasps consist of a stick or wire passed through a fixed staple, and such fastenings, in the process of transportation, become unlocked. This improvement is claimed to overcome this difficulty, as the weight of the metal in the staple below the pivot constantly tends to keep the staple in the locked position. As a further security against the unlocking of the hasp, the plate of the latter is made with a slight convexity, so that it will form a spring, and thus tend to press outward against the contiguous surface of the staple, and prevent the latter from displacement. The hasp plate has also a slight recess, and the lower extremity of the pivoted staple has a projection which falls into the depression when the staple is turned into the locked position.

Improved Car Coupling.

William A. Cochran, Flat Rock, Ind., assignor to himself and James T. Burch, same place.—The coupling pins are pivoted in mortises in the drawheads so that they can turn to a position parallel with the latter, but hang vertically when in their normal position. The link is of the common old-fashioned kind, and passes into the drawheads in recesses, which are at right angles with the mortises, but also parallel with the drawheads. The draft of the link is on the pivots and against the ends of the mortises. A block, of either wood or metal, is made to fit into the mortises, and to fill the space between the pin and the end of the mortise and hold the pin in a vertical position. A notch in the block, which receives the end of the link serves to hold the link in a horizontal position in the drawhead, which is at rest, so that it will readily enter the approaching drawhead. In coupling, the end of the link strikes the loose pin, and pushes it back to nearly a horizontal position, when it drops into the link by its own gravity, and the cars are coupled.

Improved Billiard Table.

Samuel H. Waldie, Belmont, Tex.—The object of this invention is to construct a billiard table, in combination with a Jenny Lind table, so that either game may be played thereon, to the great convenience of parties in smaller places, without additional expense. It consists in providing the billiard tables with a false bar at one end, which covers the apertures for the balls used in the so called Jenny Lind table, which bar can be taken up and arranged as the head board, having the requisite numbers painted on the under side.

Improved Combined Picture Frame and Exhibiter.

Benjamin Anyan, Fitchville, Ohio.—The object of this invention is to construct a picture frame in such a manner that a series of pictures may be combined and exhibited consecutively therein to be used as a cheap and convenient method of framing lithographs, photographs, etc., which combines the advantages of a picture frame with a photograph album or other collection. The invention consists in providing the back of the frame with brackets, between which rollers are supported, on which the pictures, mounted and stitched in the shape of a long strip, are rolled up and carried by suitable guide rollers along the glass of the frame for exhibition, by turning the cranks of the picture rollers.

Improved Railroad Switch.

Charles W. Spayd, Wilkesbarre, Pa.—In this case, the lantern-carrying rod, which is arranged between two parallel rods or bars that form the switch lever and revolves on its own axis, has an arm or finger for holding it in a position to exhibit the signal. The signal cannot be displayed if the switch rails are not in proper position, which tends to prevent accidents. The invention also consists in the use of a locking key with the two-part switch lever for locking it in the vertical or inclined position and preventing rotation of the signal rod except when the lever is moved.

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Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

ANSWERS TO CORRESPONDENTS

C. H. G. should use the best glue and make it as thick as possible.—J. E. H. Jr. will find instructions on the subject of the engineer's trade on p. 393, vol. 29.—J. H. P. can solder brass to iron with the preparation described on p. 251, vol. 28.—J. F. A. will find a recipe for harness dressing on p. 82, vol. 28.—J. N. F. can combine caoutchouc with glue by dissolving both in ether, free from alcohol. Bichromate of potash can be combined with glue by dissolving both in water.—J. S. T. does not give sufficient data to explain his meaning.—S. A. B. will find full particulars as to the canal boat reward on pp. 96 and 400, vol. 28.—W. T. C. can make a book slate with the blackboard composition described on p. 299, vol. 28.—N. M. should harden his reamers by the process described on p. 315, vol. 29.—S. can waterproof his leather by using a drying oil.

C. W. asks what we mean by the lap and lead of an engine. A. The lap of a valve is the amount the face of the valve is widened beyond what is necessary to cover the port. The lead is the amount the steam or exhaust port is open when the piston is at the end of the stroke.

M. S. asks: 1. What kind of packing is best for the cylinder of a 10 horse portable engine, speed 160 per minute, using very bad water at times? What is the best for the piston rod? 2. What kind of paint will stand the heat of the engine? A. 1. The simplest form of metallic packing will answer, if your cylinder is smooth and truly bored. For the piston rod, if it is round and smooth, any of the various kinds of packing in common use will answer well. 2. There is a black varnish, made from petroleum, that is frequently used for iron work exposed to high temperatures.

W. I. B. asks: 1 What is the analysis of Turkey umber? 2. What is the analysis of *terra di Siena*? 3. On page 324 of your volume XXIX, I find an article on wooden railroads. Is there any such road now in use? If so, where? A. 1. It is an argillaceous brown hematite, containing sesquioxide of iron, silica, water, alumina, and manganic oxide. 2. It contains sesquioxide of iron, alumina, silica, water, lime, and magnesia. 3. There are quite a number of wooden railroads in Canada. You will find details of their descriptions and localities on p. 34, vol. 27.

L. B. asks: How large a boiler is necessary to run a one horse steam pump one hour, by compressing the air at once; and how large a cylinder is necessary to supply the above boiler, the engine running at fifty revolutions per minute? Is there any better way of running a momentum power than this? A. In the use of compressed air in the manner proposed, the pressure would be constantly diminishing, and there would be much difficulty in equalizing the power developed. We think such machines have been devised, however, and, if so, a notice in our "Business and Personal" columns would bring you into communication with the inventors.

J. S. D. asks: If the crown sheet of a boiler is 9 feet long, 4½ feet wide, and 1½ feet high between crown sheet and wagon top, how many square inches are there, and how many tuns pressure are there on the crown sheet at 130 lbs. to the square inch? A. As we understand your question, the crown sheet is curved. Measure its width in inches by a tape line following the curve; multiply this by the length in inches, and by 130, and divide by 2,0 0, which will give you the pressure in tuns.

J. P. asks: 1. How can I make a porous cup for a galvanic battery? Will plaster of Paris be suitable? 2. How can I make a plug of carbon? 3. Is iron wire suitable for the poles of a battery? If not, what kind should I use? 4. What sized wire is best for the above battery? 5. What proportion of acid and water should I use for the exciting fluid? 6. How long will the exciting fluid last before it must be renewed? 7. What is the best mode of cleaning the carbon and zinc, and how often should they be cleaned? 8. How many cells 10 inches high x 6 diameter, with zinc cylinders and carbon plugs, will it take to make a good electrical light? 9. What is the most suitable way of fastening carbon points on the poles of batteries? 10. Is nitric acid the best to fill the porous cup with, and how long will it last before it must be renewed? A. 1. The cup may be made of any porous earthenware. 2. The carbon is generally prepared from coke and soft coal, mixed together and heated in a finely powdered state, being made compact by a concentrated solution of sugar. 3. Yes. 4. This you can only tell by experiment. It should be so large that it does not become excessively heated. 5. This also will be best determined by experiment. 6. It depends entirely upon the work the battery has to perform. 7. The zinc should be covered with an amalgam of mercury. 8. From forty to fifty. 9. Force them into a socket. We advise you to get some good work on the subject of electricity, such as Noad's "Text Book."

J. F. McE. asks: What are the merits of an inverted direct-acting vertical engine, and in what points is it superior to a common horizontal engine? A. Its advantage consists in the small horizontal space occupied. Where space is not a matter of importance, a horizontal engine is ordinarily quite as good.

J. A. asks: Is there any preparation for smoking meat without fire? A. The peculiar compound which gives meat its flavor when smoked is creosote. The flavor imparted by smoking can be imitated by immersing the meat, for a longer or shorter time, in water, brine or vinegar containing creosote in solution. This was probably the secret you mention.

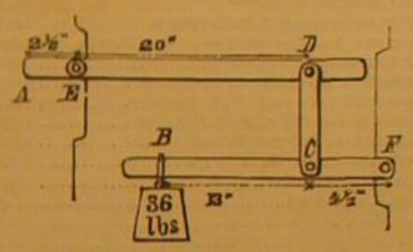
V. S. asks: Which city has the largest population in the world? A. London, England.

E. H. B. asks: Are there not more explosions of upright boilers than horizontal ones? Are not upright boilers made stronger, in proportion to their size, than any other kind? Are there not fewer explosions, proportionally, in locomotives than other boilers? A. We think we can answer yes, in general, to all these questions.

F. E. W. says. 1. I have a boiler which was blown off as usual, when the steam was up, of course, and nothing more was done to it. To preserve it, I have been told to get up steam with the boiler full of water and about a gallon of oil, and then blow it off. Is this necessary, or is there a better way? 2. What will renew the color of blue woolen cloth that has been damaged by strong saleratus water? A. We do not think this plan will be very efficacious. If the boiler can be kept dry, that will be the best way to preserve it. 2. Possibly you can restore the color by the use of lemon juice.

F. W. C. says: I would like an answer to the following questions, that is, if your journal is to be continued, a point on which I feel dubious, as you have incurred the wrath of J. O'K. Murray. I have a stream furnishing 400 cubic feet of water per minute, and a fall of 100 feet in a fourth of a mile. I am using 42 feet of this fall on a turbine but I want more power. Will it be safe and practicable to use 100 feet head on a turbine, or would a water engine be better? I never knew a wheel to have so great a head, and am fearful that the strain would be too great on its bearings. Can you tell me whether water engines are used in this country? A. We think you can use all the head of water with perfect safety. By inserting a notice in our "Business and Personal" columns, you will hear of a number of water engines.

W. McL. asks: What power will the weight (36 lbs.) in the accompanying engraving exert at A? E and F are the fulcra of the compound lever. A. The solution is as follows: $36 \times 13 \times 20 =$ weight balanced at $A \times 4{\cdot}5 \times 2{\cdot}5$; hence weight balanced at A = 832 pounds. It may simplify the question to look at it in another way.



If the point B falls one foot, the point C will fall $4{\cdot}5 \div 13 = \frac{5}{13}$ of a foot, and in so doing will raise the point A $(2{\cdot}5 \div 20) \times \frac{5}{13} = \frac{25}{260}$ of a foot. But by the principle of virtual velocities, the power and weight are inversely proportional to the distance moved; hence one pound at B will balance $1 \div \frac{25}{260} = \frac{260}{25}$ pounds at A, and 36 pounds at B will balance $36 \times \frac{260}{25} = 832$ pounds at A.

L. W. says: 1. Please give a formula for determining time from an observed altitude of the sun. 2. What is the best practical mode of polishing a set of drawing instruments by hand? A. 1. The apparent time = $\frac{1}{15}$ the hour angle, and the error of the watch or clock = $\frac{1}{15}$ the hour angle + the equation of time − the indication of the watch at the time of observation. The true altitude of the sun = the observed altitude of the lower limb − correction for refraction + apparent semidiameter of the sun + the sun's parallax in altitude. The hour angle is thus calculated: Make S = [270° − (true altitude + sun's declination + latitude)] ÷ 2. Then the hour angle = twice the arc whose sine is $\left[\pm \sqrt{\frac{\cos.(S + \text{latitude}) \times \cos.(S + \text{sun's declination})}{+(\cos.\text{latitude} \times \cos.\text{sun's declination})}}\right]$. 2. Use rottenstone and oil.

G. H. B. asks: Will you give me the correct mode of a fire test for coal oil? A. There are instruments made in this city, for the purpose of testing oil. They consist essentially of copper vessels containing thermometers, so that the oil can be heated to the desired temperature, and the test for ignition be applied. You will find a description of a method lately invented in France, on page 358, vol. 29.

C. B. asks: Will you please tell me how many grains of coal it will require, burned in an ordinary locomotive boiler, to melt one pound of snow or ice? It is proposed to melt the snow in streets by superheated steam to be discharged upon the snow. I want to make approximate estimate of the cost of the fuel necessary to do the work. A. This question can only be determined theoretically. The latent heat of liquefaction of ice is about 144° Fah.; and one pound of coal, burned in an ordinary boiler, will develope about 10,657 units of heat. Hence, if the steam acts with perfect efficiency, to melt one pound of ice will require the consumption of about 98 grains of coal.

S. S. C. asks: 1. Is the oxyhydrogen light expensive, difficult or dangerous to produce and manage for magic lantern exhibitions? 2. How does the oxy-calcium light compare with it in these particulars? 3. What has been the usual method of preparing the lime for the oxycalcium light? 4. Would the ingredients for lime cylinders, mentioned in the SCIENTIFIC AMERICAN, for oxyhydrogen lights, answer for oxycalcium as well? A. The two lights are the same. The light is quite suitable for the purpose you mention. Ordinary chalk will answer very well.

G. L. C. says: 1. I propose propelling by steam a boat 16 feet long x 5⅛ feet beam, and intend to use a propelling and steering oar fastened to stern of boat by a clamp hinged as a universal joint. The engine and boiler attached to said oar or propeller are to be made very light. The engine is to be connected by a rubber eduction pipe. Will this be feasible? 2. What style of engine is best for lightness? 3. Is there any flexible material better for this purpose than rubber? 4. About how large should I make the boiler? How thick should copper be to stand 100 lbs. pressure? 5. Is the three cylinder engine patented? If not, would it be right for me to make one for my own use without consulting the builder? 6. Has the moon any influence on the earth's vegetation or animal creation, such as planting corn and other produce, cutting the hair, weaning children, etc.? A. 1. Your plan is probably feasible, but not a very good one. 2. An upright engine will answer your purpose very well. 3. We think not. 4. Your cheapest and most satisfactory plan will be to buy the machinery from a reputable dealer. 5. It is patented. You can build one, if it is not patented in this country. 6. We think not.

W. F. asks: 1 How can I make a simple battery for use in plating jewelry, spoons, etc. either with gold or silver? 2. Can a person get a patent on the emblem of a secret society, to be used on the death of a member? Will the Office recognize such a thing? A. 1. Read description of the Tom Thumb battery in SCIENTIFIC AMERICAN of December 6 1873. 2. You can patent any new ornamental design or emblem See our advertisement about patents in another column.

A. C. M asks. How can I best make gas for working an engine? What is the maximum pressure per square inch that I can obtain? A. There are several machines in the market for the manufacture of gas from naphtha and other light hydrocarbons without the aid of fire. By the use of a pump you could compress the gas until it attained any desired tension.

J. S. M. asks: 1. Would it damage the plates of a boiler to open the blow-off cock before hauling the fire, and let the water be going out while the fires were being hauled, getting the fire all out before the crown sheet became bare? 2. Would it do any harm then to pump in cold water in a half an hour afterwards? 3. When the throttle is closed and the steam is allowed to go down, is it the best plan, when steam is again being raised, to let the throttle be open until the steam works the water out of the pipe? If this is not done, and steam is raised, when the throttle is opened, there is almost always a cracking and shaking of the pipe. I suppose the condensed water is the cause of this; but I should think that, when the water finds an opening it would pass out easily without any noise. Why is it that it does not? 4. Would it be a good plan, when a boiler foams badly, to lead a pipe from the delivery of the pump to the top of the boiler, so as to pump some water to quiet it? A. 1. This is not advisable. 2. It is best to let the boiler become quite cool before pumping in water. 3. Yes. The noise in the pipes is caused by the water striking against them, the steam having first condensed and formed a vacuum. 4. The objection to this plan is that the water would strike against the braces, and might break or strain them.

G. C. J. asks: Would it not be handy if the makers of metal-turning lathes would try a lathe before they send it out of the shop; and when it turns accurately straight, mark the tail stock, and have a scale say 2 inches, 1 inch on each side of the mark? I think it would save time and trouble in a shop. The scale would be handy in turning tapers. A. We have seen lathes marked in this manner. It is hardly necessary however as any good mechanic can readily adjust the tool.

C. W. M. asks why it is that the frame of a building, or rather the shape of the frame can be plainly discovered through weatherboarding. A building has had three coats of paint, and the weatherboarding is half inch thick. At a distance of twenty-five yards I can easily count every post in the building. A. It is probably owing to the unequal transmission of heat through the different parts of the building, so that some portions are drier than others.

E. D. P. asks: Is there any better substance for cores than common sand? I want something that will dissolve or burn up, and leave the hole in the casting perfect. A. This would be a great desideratum if it could be discovered. Anything that would burn up, however, would prevent the formation of a perfect casting. The only plan would be to use some substance that could be dissolved by a liquid, after the casting was made. We need hardly say that the discovery of such a material seems to be very doubtful.

J. F. W. asks: How can I straighten vulcanite set squares, which have become warped and twisted by exposure to the sun or fire? A. We think your best plan will be to get new ones.

W. C. L. asks: Of what is red shellac varnish made? Will it do for outdoor work, such as wagons and other vehicles? A. Red shellac varnish may be made by dissolving 8 ozs of the common red lac in 1 quart of alcohol. The best shellac is of a pale color Shellac varnish is used for pictures, metal, wood, etc. and particularly for toys. Copal varnish is the kind used for carriages, wagons, etc.

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

M. V. M.—Two of your specimens are galena sulphide of lead. The others are sandstone, more or less impregnated with oxide of iron. Galena is often argentiferous or contains sufficient silver to make its extraction profitable. The presence of silver in these ores however can only be accurately determined by a chemical analysis.

R. W. S.—No. 1, galena and iron pyrites 2, argentiferous galena. 3, galena and pyrites. 4, argentiferous galena. 5, pyrites and galena.

H. B.—The specimen you send is bituminous shale It very frequently accompanies coal, and is considered, when found alone, a strong indication of the existence of coal in the vicinity. It often contains mica and iron pyrites.

C. H. D.—Your specimen is iron pyrites, a sulphide of iron, a very common and abundant mineral.

R. W. B. sends a specimen of a fiber, which he states is the product of an insect resembling a spider. He asks as to its value for manufacturing purposes. A. Efforts have frequently been made to utilize material like sample enclosed, but generally without success.

F. C. K.—The water from a coal mine shows the presence of oxides of iron in suspension, and the sulphate of iron and a little free sulphuric acid in solution. The scale is chiefly oxide of iron, containing some sulphate hardened by heat. The presence of these substances shows that the coal contains iron pyrites from the decomposition of which they have been produced. Iron pyrites, or sulphide of iron, when exposed to air and moisture is apt to decompose, the sulphur oxydizing to sulphuric acid, which combines with the oxide of iron, also forming, producing sulphate of iron. This salt contains generally a little free acid, which has evidently been the chief cause of the corrosion of the iron pumps. Pumps made of brass, or better, a composition of copper and tin, will obviate this difficulty. To fit this water for boiler use, the acid must be neutralized, the iron precipitated, and the water filtered. To effect this, the cheapest way is to add a solution of common carbonate of soda, which will precipitate the iron in the state of carbonate. The water must then be filtered. It will then be free from suspended oxide of iron, free acid, and sulphate of iron in solution, but will contain, instead sulphate of soda in solution which, being quite soluble, will not be so liable to form scale as the ordinary salts contained in water. We would advise condensing the escaping steam to avoid the expense of purifying every charge of water to the boiler.

W. J. F. asks what is the composition of the brass used in the government engine work.—P. C. asks for a description of a ditching machine suitable for cutting trenches for irrigation.—L. Z. asks how to destroy slugs. Salt will not do it.—W. H. C asks whether the structure of our bodies is such as to render natural the choice of one hand or foot over the other.—G. F. I. asks how snapping gum (a species of candy) is made.

COMMUNICATIONS RECEIVED.

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

On a Telescope of Unlimited Power. By J. L. and by J. T.

On Engines and Boilers. By H. McM.

On Pisciculture. By C.

On the Canal Navigation Problem. By W. B. D.

On an Accidental Discovery. By W. H. R.

On Adjusting Journal Boxes. By W. L. C.

On Dreams. By J. L. W.

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On Magic Squares. By E. B., and by J. E. W.

On the Nebular Hypothesis. By J. S. L.

On Trees as Historians. By G. P.

On Antiquity of the Earth. By H. V. M.

On a Theory of the Tides. By J. N. V.

Also enquiries from the following:

M. F.—L. F.—E. C. H.—J. McI.—A.—S. W. C.

Correspondents in different parts of the country ask: Who makes small hay presses? Who sells stoves that burn naphtha as fuel? Who makes bars of steel to be used instead of bells? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal" which is specially devoted to such enquiries.

[OFFICIAL.]

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December 2, 1873,

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APPLICATIONS FOR EXTENSIONS.

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

27,357.—TABLE CUTLERY.—J. W. Gardner. Feb. 18.

27,392.—FOLDING AND PASTING MACHINE.—G. K. Snow. February 18.

27,405.—STEAM & FIRE REGULATOR.—J. Woodruff. Feb. 18.

EXTENSION GRANTED.

26,339.—WATER WHEEL.—J. P. Collins.

DISCLAIMER.

143,201.—SEAL LOCK.—J. E. Thomas, Buffalo, N. Y.

DESIGNS PATENTED.

7,005.—BUCKLE.—J. R. Smith, Waterbury, Conn.

7,006.—PENCIL CASE.—E. Todd, Brooklyn, N. Y.

7,007 to 7,014.—STOVES.—N. S. Vedder *et al.*, Troy, N. Y.

7,015.—CLOCK CASE.—G. H. Blakesley, Bristol, Conn.

7,016.—STATUARY.—J. Rogers, New York city.

7,017.—FAN.—W. A. Smith, Niagara Falls, N. Y.

TRADE MARKS REGISTERED.

1,545.—DRY GOODS.—Emery & Co., New York city.

1,546.—HARDWARE, ETC.—T. Hessenbruch, Phila., Pa.

1,547 to 1,562.—WATCHES.—National Watch Co., Elgin, Ill.

1,563.—LINIMENT.—I. Vallier, New York city.

1,564.—MEDICAL COMPOUND.—Moyer & Co., Phila., Pa.

SCHEDULE OF PATENT FEES.

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On application for Design (7 years)	$15
On application for Design (14 years)	$30

[Specially reported for the Scientific American.]

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA ON DECEMBER 10, 1873.

2,921.—W. A. Gibbs, Gilwell Park, Essex county, Eng., and A. Borwick, Lloyd's, London, Eng. Improvement on apparatus and arrangements for drying, called "Gibbs & Borwick's Improvement on Apparatus for Drying." Dec. 10, 1873.

2,922.—M. A. Wigle, Kingsville, Essex county, Ontario. Composition of matter to be used for blacking and giving a polish to and softening and rendering impervious to wet the leather of boots and shoes, called "Wigle's Improved Boot Blacking." Dec. 10, 1873.

2,923.—H. P. Huntoon, Cambridge, Mass., U. S., assignee of J. R. Brown, Cambridge, Mass., U. S. Improvement on pipe tongs, called "The Brown Pipe Tongs." Dec. 10, 1873.

2,924.—A. Wood, Worcester, Mass., U. S. Improvement on bolt cutting machines, called "Wood's Bolt Cutter." Dec. 10, 1873.

2,925.—A. A. Wilder, Detroit, Wayne county, Mich. Improvements on machine for forging and slotting track bolts, called "Wilder's Track Bolt Forging and Slotting Machine." Dec. 10, 1873.

2,926.—S. Switzer, Sydenham, Frontenac county, Ontario, and S. O. McGuin. Improvement on rail car axle oilers, called "Switzer's & McGuin's Axle Oiler." Dec. 10, 1873.

2,927.—C. Burgess, Portsmouth, Scioto county, O., U. S. Improvement on the manufacture of iron and steel, called "Burgess' Manufacture of Iron and Steel." Dec. 10, 1873.

2,928.—G. B. Izzard, Hamilton, Ontario. Improvement on bed bottoms, called "Izzard's Adjustable Bed Bottom." Dec. 10, 1873.

2,929.—E. C. Fales, Foxborough, Norfolk county, Mass., U. S. Improved machine for blocking hats, bonnets, etc., called "Fales' Hat Blocking Machine." Dec. 10, 1873.

2,930.—H. Hebert, Montreal, P. Q. Improvement on boilers for locomotive and stationary engines, called "Hebert's Improved Engine Boiler." Dec. 10, 1873.

2,931.—G. Hibberd, Wheeling, Ohio county, W. Va., U. S. Improvement on pumps, called "Hibberd's Pump." Dec. 10, 1873.

2,932.—D. Maxell, Paris, Brant county, Ontario. Improvement on straw cutting machines for reversing, stopping, and reducing the motion of the feed rollers, called "Maxwell's Change, Stop, and Reverse Motion Straw Cutter." Dec. 10, 1873.

HOW TO OBTAIN
Patents and Caveats
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50 CASH GIFTS,	1,000 each	50,000
80 CASH GIFTS,	500 each	40,000
100 CASH GIFTS,	400 each	40,000
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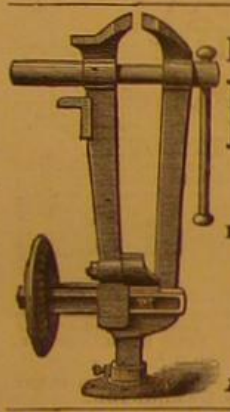

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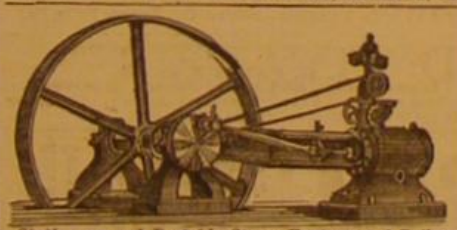

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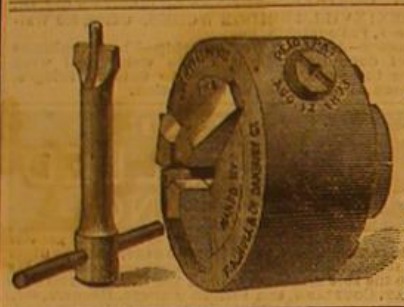

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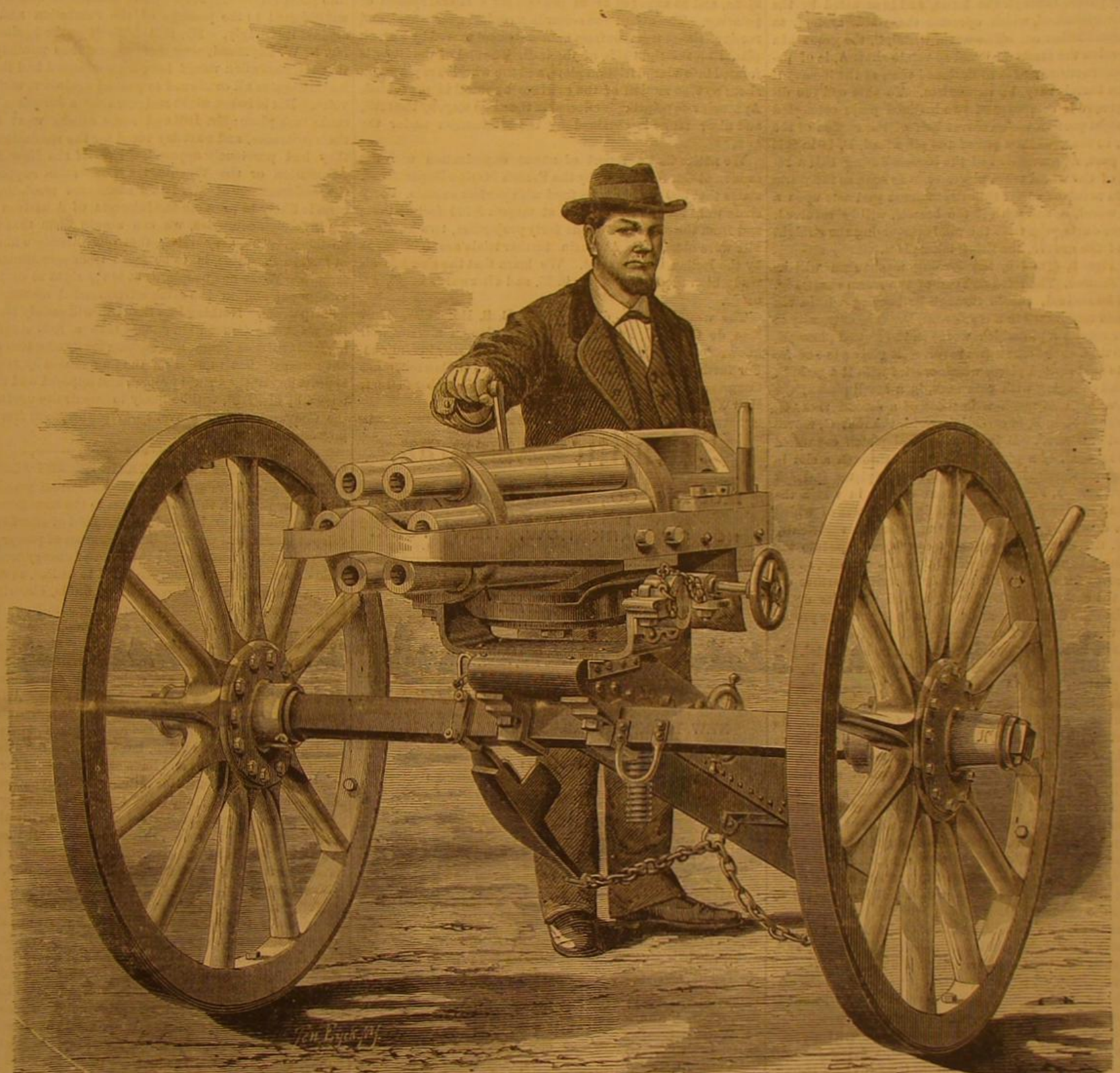

THE HOTCHKISS MITRAILLEUSE.

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It may be presumed that our readers are familiar with the nature and use of the mitrailleuse as an offensive arm. Various forms of the weapon have already been represented in these columns, and the respective merits of the Gatling, the Taylor, the Sigl, and other kindred guns have been fully described. While all of these deadly arms will doubtless bear their full share in the determination of future wars, few, we believe, will prove more formidable than the weapon illustrated in the engravings hereto annexed. It is not a battery of musket barrels, but, as its name indicates, a bundle of rifled cannons which throw explosive shells, or other projectiles, weighing 23·5 ounces, and this at the rate, as experiment has shown, of sixty shots in forty-eight seconds. No demonstration is needed to point out the fearful execution of which such an arm is capable.

Fig. 2.

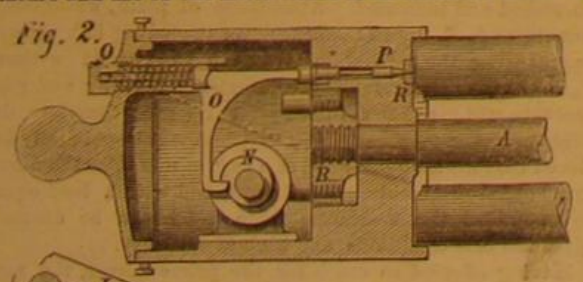
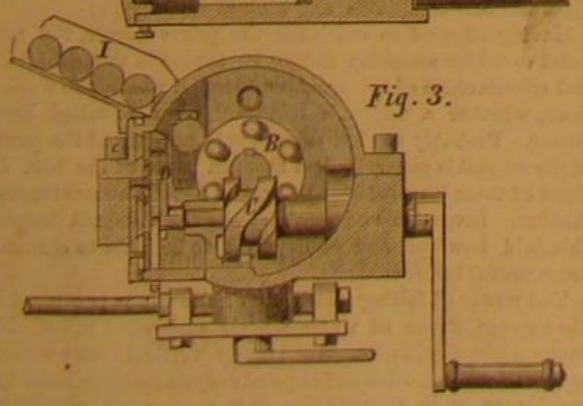


Fig. 3.



The cannon, in exterior form, resembles the Gatling gun, but its mechanism, as will be seen as we progress, is essentially different. The working portions may be divided into two distinct parts: First, the barrels with their shaft and frame; and, second, the breech with the firing and charging apparatus. Fig. 1 affords a general perspective view of the gun, from which it will be seen that the barrels are six in number. These are made of cast steel, and are mounted between two disks which are rigidly secured to a central shaft (A in the sectional view, Fig. 2), which goes through the front of the breech. To the latter is attached the frame, which extends alongside the barrels and supports the shaft, A, at its outer end. It is clear that if the central shaft be suitably rotated, it will carry the barrels around with it. Attached to the interior part of the frame is a turning table which connects the cannon to a saddle with trunnions fixed on the carriage, so that, without displacing the latter, a cer-

Fig. 4

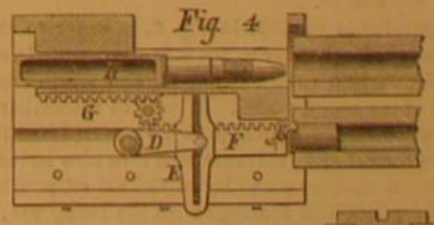


Fig 6

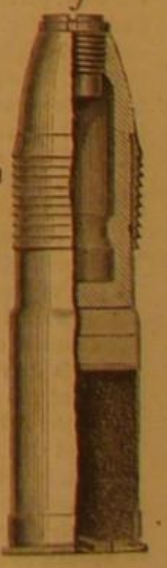
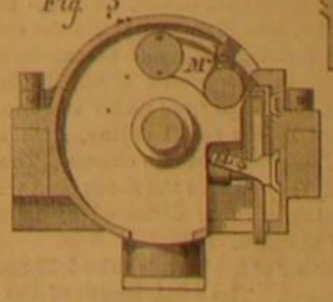


Fig. 7

Fig. 5



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tain amount of lateral motion, as well as of elevation, may be given to the gun. The breech is composed of a block, containing the mechanism and closed at the rear end by a cover, shown in Fig. 2, which is fixed by two set screws, so that it may be easily removed and ready access thus afforded to the interior portions.

Beginning our explanation with the revolving mechanism, B, in Fig. 3, is a pin wheel keyed inside the breech to the end of the shaft, A, and carrying six studs upon its rear face, arranged parallel to each other. C is a worm wheel which is mounted on a shaft at right angles to shaft A, that is, transverse the breech. The left hand end of the worm shaft turns in a bearing within the breech, while its other extremity passes through the latter, and is actuated by the crank, the motion of which operates the whole system, as will be seen further on. The worm wheel, C, the grooves in which receive the studs on B and so rotate shaft A, is of peculiar construction, and is so designed that, at the instant of firing, the barrels may be motionless. To this end the directing groove is composed of two inclined parts connected by a straight portion which covers half of the section of the cylinder, so that, while a pin of the pin wheel, B, is in this straight part, no movement of the barrels during half a revolution of the wheel takes place. But as soon as the worm wheel has revolved so far that the inclined part acts upon a pin, the wheel, B, and with it the barrels, will be revolved. Of course, during the time the pin is traversing the straight portion of the groove, the firing takes place.

From Figs. 3, 4, and 5, the loading mechanism will be readily followed. The left hand end of the worm shaft, Fig. 3, it will be noticed, passes through its bearing within the breech, and terminates in a crank arm, D. The extremity of the latter carries a pin which works in the slotted piece, E, Fig. 4, so that, as the crank arm revolves, it gives a to-and-fro motion to said slotted piece, which carries with it a rack, F. Above, and engaging with this rack, is a small pinion, the teeth of which also mesh with those of a second rack, G, so that, as the rack, F, is carried forward, the rack, G, moves back, and *vice versâ*. H is a cylindrical piston connected with the rack, G, by a pin which travels through a slot in the bottom of the conducting trough, so that piston and rack work together. I, Fig. 3 is the feed trough in which the cartridges are placed, as shown, and in the bottom of which is a little door, J, Fig. 5. When the piston is sufficiently retracted, this door falls open and a cartridge drops into the conducting trough by its own gravity. Subsequently, as the piston moves forward, in the manner described further on, to drive the charge into the barrel, a stud upon its upper side pushes the door shut, and thus holds it until the proper time for the reception of another cartridge arrives.

As shown in Fig. 4, the crank arm, D, is horizontal. It arrives at this position just as a pin upon the wheel, B, enters the straight part of the worm; and of course the racks, as depicted in the last mentioned figure, are drawn respectively forward and backward to their fullest extent. As above noted, the little door, J, is now free to open, and hence a cartridge drops in before the piston. The racks also, in the position shown, remain at rest for a moment, and this is effected by giving the slot in E, Fig. 4, a circular shape, concentric to the shaft of the crank. The object of this is that at this moment, the barrels arriving at the end of their motion, a spent cartridge in one becomes engaged with the large double hook, K, Fig. 4, of the extractor, which is secured to the lower rack, F, and hence, if the motion of the racks were not thus interrupted, time would not be afforded to complete the engagement.

The crank arm, D, we will suppose, continuing its revolution, passes the circular portion of the slotted piece, E, and, consequently moving the latter, starts the racks in opposite directions. Rack, F, pulling on the extractor, drags the cartridge shell out of the lower barrel and to the rear, until it meets an ejector, L, Fig. 5, against which the cylinder strikes, is detached and falls to the ground through the opening shown in the breech block. Rack G, moving forward and carrying with it the piston, during the next half revolution of the worm wheel introduces the cartridge into its barrel; the latter, it will be remembered, necessarily stands still. The cartridge is, however, not driven in all the way, but its head is in view of an inclined plane, M, Fig. 5, which is cut into the metal of the breech, on which it slides when carried around by the movement of the barrels. This completes the introduction of the charge.

The firing apparatus is omitted in Fig. 3, in order to render other parts more clearly shown, but it is represented very plainly in Fig. 2. N is a cam secured on the worm shaft and to the right of the worm wheel. It will be remembered that we have supposed the cartridge to be inserted and the barrels to be revolving; hence, this cam will now also be turning, and in such a manner as to be in the act of pushing back the long arm, O, which connects with the firing pin, P. The action of the spiral spring, shown at Q, keeps the arm, O, pressed up against the cam so that, as the pin is forced back, it compresses the spring and, in fact, cocks the piece. The barrel, with its charge, now arrives opposite the end of the pin, the head of the cartridge being at this moment in face of a steel plate fixed in the breech block, R, Fig. 2. The shoulder of the cam now slips from under the arm, the pin, P, is driven forward by the spiral spring, strikes the primer of the cartridge, and explodes the charge. The object of the steel plate, R, is to receive the shock, and we are informed that, on becoming worn or deranged by repeated firing, it may be readily changed.

We understand the caliber of the barrels to be 1·57 inches, and their length 38·1 inches. The total length of the gun is about 4·89 feet, and its weight, inclusive of saddle, 968 lbs.

Figs. 6 and 7 represent, respectively, the form of fixed ammunition used and the percussion fuse. The total weight of the charged cartridge and shell is 26·3 ounces, and of the charge alone, 2·8 ounces, and the length is 7·2 inches. The fuse, Fig. 7, consists of a case which, in its under part, contains a lead plunger, S, with a brass envelope. The plunger holds the fulminate, and has a little powder chamber at T. It is fastened by a safety plug of lead in the under hole of the fuse, and it is closed by a plug which has the point against which the plunger drops at a sudden stop of of the projectile.

The elevating screw of the gun is so made that the head is connected to a bearing, movable on an axis near the trunnions, and so annexed as to provide for a lateral system of pointing. The nut of the screw is a conical gear wheel, and receives the movement from another wheel moved by a crank placed on the right side of the trail. The end of the latter is formed into a large friction plate, and the wheels are placed on shoes so that motion of the carriage by recoil is prevented. Approximate pointing is effected in the same way, by the trail, and nicer range is obtained by the mechanism under the gun.

We notice that a report of recent experiments with the cannon at Garve, France, by the French Marine Department, states that 500 rounds were fired with perfect success. Forty shots were fired in 30 seconds at targets 5,760 feet distant; and from the explosion of the forty projectiles, two hundred hits were obtained. At Turin, further trials are to be made by the Italian Government. We learn that the gun has already been fired sixty shots in 55, and afterwards in 48, seconds.

The weapon is the device of Mr. B. B. Hotchkiss, of 27 Rue de Choiseul, Paris, France, a gentleman already well known for his rifle projectiles and other military inventions. For further information address, care of C. C. Dawson, office Congress and Empire Spring Company, 94 Chambers street, New York city.

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NEW PATENT CONVENTIONS.

Messrs. Thacher, Hill, and Blake, Committee of the Vienna International Patent Congress, have, in accordance with their official authority, issued a call, addressed to all who are interested in the effort to secure better patent protection for Americans in foreign countries, for a Convention, to be held in the city of Washington. The Committee say that: "Our friends abroad greatly need the information and aid which we can readily furnish, *for we are the foremost nation in the world in the liberality and success of our patent system.*"

This characteristic assemblage of American Patent Saints is called for January 15, 1874, for the purpose of discussing this topic, so says the call, and if thought desirable, of organizing a United States Patent Association. We hope the attendance will be full, the proceedings harmonious, and the results practical. This Convention is to have the aid of another Convention, recently organized at Boston, called the New England Association of Inventors and Patent Owners. The objects of this association, so far as we can gather from the reports of the proceedings, are to render mutual aid and benefit to the members in the management of their patents, to secure the extension of their several patent monopolies, compel the payment of fair prices for patents by railway companies, and in other ways "to promote the general prosperity of the country."

Among the prominent members of this new association is Mr. Hamilton A. Hill, who also figures as one of the Committee of the Vienna Congress, and as one of the callers of the Washington Convention. He offered a couple of resolutions, one of which was that the association should be represented at Washington by delegates; the other: "That this Convention heartily endorses the action of the Congress lately held at Vienna on the subject of patents." Both resolutions were adopted. We congratulate Mr. Hill in having thus succeeded in getting himself endorsed by the New England Association. Possibly he may have equally good luck before the Washington Convention.

It is well known to our readers that the resolutions adopted at the Vienna Patent Congress contained hardly a single point or suggestion for change in the existing laws of the leading continental governments, except this, namely: That the laws ought to provide that the inventor shall be compelled to sell his invention and rights under the patent, at such prices as government officers shall dictate. This is not the exact wording of the resolution, which was framed in the German idiom, but we give its real meaning, translated into plain English. Most of the Americans who were present objected to the passage of the resolution and argued against it strongly. Mr. Hill himself spoke against it, and Mr. R. W. Raymond, who was present, has publicly stated that the resolution would have been defeated had the American delegates all continued to protest against it with united voice. But between night and morning a defection in their ranks took place; Mr. Hill and some others went back on their comrades, and next day voted for the resolution, which they had previously opposed. Now if the New England Association or the Washington Convention supposes that the endorsement of Mr. Hill's obnoxious resolution at Vienna is likely to promote the interests of American inventors in foreign countries, we can assure them that they are mistaken. The very thing that our inventors most need, in foreign countries, is to be freed from government interference. What our people want is the right to control their foreign patents, in the same untrammeled manner as their home patents. Nothing less than this will satisfy them. On this point the Convention should take a firm stand, pledging itself to its advocacy, and seeking for its adoption throughout Europe. But to start off the Convention by resolutions approvatory of the absurd project, first opposed and then supported by Mr. Hill, will be likely to impair the usefulness of the Convention, and prevent our countrymen from taking interest in its proceedings.

THE PRIME MOVERS AND THEIR RECENT PROGRESS.

The prime movers are those machines from which we obtain power through their adaptation to the transformation of some available natural force into that kind of effort which develops mechanical power. These sources of power are generally classified, according to the form of energy which they yield or which the machines are fitted to utilize, as muscular power, the weight and movement of fluids, electricity, and heat. Thus, men and animals are prime movers, utilizing muscular power; water wheels and wind mills utilize the fluids water and air; electrical engines make useful the power of the voltaic battery; and gas, air, and steam engines —heat engines, as they are collectively called—transform the force of heat motion into mechanical force. All of these prime movers have received a certain degree of development; and some of them, as the heat engines generally, and particularly the steam engine, have occupied the attention of man for many centuries and have afforded a field for the display of his highest scientific attainments, inventive genius, and mechanical skill; and they today are doing by far the greater part of the unintellectual work of civilization. Indeed, they indirectly assist, to a wonderful and inestimable extent, even intellectual progress, by furnishing the material aids essential to its existence and continuance.

Muscular power has its origin in heat developed by combustion, probably, as truly as does the power obtained from the generally termed heat engines; and the animal system is simply a machine or apparatus in which a certain quantity of oxydizable material is consumed and a certain quantity of power is developed by its consumption. The animal system is compelled to furnish heat sufficient to keep its several parts in working order, and to furnish supplies also to that strange and wonderful organ the brain. It is, therefore, impossible to state how efficient the animal system is as a prime mover, simply, but it is supposed to be far more efficient than any machine yet constructed by man. Man can do little to improve the efficiency of the animal mechanism, but he can do something. Whether the organism to be used as a prime mover be that of a man or of a beast, the proper treatment by which to obtain maximum efficiency is that by which the natural strength of *physique* and constitution is cherished and increased. Abundance of plain, wholesome, nutritious food, regular work, never exceeding but always approaching the maximum that can be attained without more than moderate fatigue, comfortable housing and general care will give the animal system its most complete development and its greatest effectiveness. It is generally believed that working one third of a day, at one third the maximum speed attainable without load, and with a load equal to one third the maximum force which can be exerted, gives the best conditions and highest efficiency.

Having effected so much for the prime mover, the next point to which attention should be turned is the simplicity and effectiveness of the machine through which the work is done, whether a wagon, a treadmill, or a so-called horse power. Probably not less than twenty per cent of the power of the animal is generally lost here, in some of the best designs of these forms of apparatus, and usually occurs through friction. Invention and mechanical skill have not deserted this field, however, and we hope yet to be able to chronicle some useful improvements.

The power of falling water and of the winds is utilized by the various forms of water wheels and wind mills. Not many years ago, awkward and costly vertical water wheels, with their slow motion and expensive systems of transmitting machinery, were thought the only proper and economical

forms of water engines. They still remain, as a class, unexcelled in economical efficiency, but they have found rivals in the smaller, quickly working, and far cheaper and more satisfactory turbines,and have been almost completely driven from the field.

The power of prime movers is measured by horse power. Watt found that the strongest London draft horses were capable of doing work equivalent to raising 33,000 pounds one foot high per minute,and he took this as the unit of power for the steam engine. The horse is not usually capable of doing so great a quantity of work. Rankine gave 26,000 foot pounds as the figure for a mean of several experiments, and it is probable that 25,000 foot pounds is a fair minute's average work for a good animal. It would require five or six men to do the work of a strong horse. Watt's estimate has become, by general consent among engineers, the standard of power measurement for all purposes.

The weight of water flowing per minute, over a weir or dam, being multiplied by the hight of available fall, gives a product in foot pounds per minute, which, divided by 33,000, gives the horse power of the stream. Of this power, a certain proportion is always lost through the inefficiency of the machinery of the prime mover which is intended to utilize it. The best overshot and high breast water wheels yield as a maximum but little over seventy-five horse power where the available power of the fall is one hundred. The best turbines have about the same efficiency as the vertical wheels when precisely proportioned to their work. In all wheels, a loss greater than twenty per cent is met with when running on "part gate." There is, therefore, room for improvement in water wheels to the extent of twenty per cent or more. These losses are to be lessened by more skillfully proportioning the wheels, and especially by some arrangement which will allow them to work efficiently with varying gate. The prime defects at present exist in the method of adjusting the wheel to do its work with different loads. Hardly less important is the problem of effectively connecting the governor to the wheel gate. Much has been done in these directions, but much remains to be done. Some wheels will do nearly as good work at part gate as at full gate, but usually this efficiency is attained by the sacrifice of simplicity and of maximum economy. A wheel which will invariably yield seventy-five per cent of the power of the fall under which it works, and do this under all loads, is yet to be brought into the market. The high tide of progress has culminated in the successful competition of the small, lively, and cheap turbine with the older forms of wheel, which are now nearly driven out of use. By far the most important work in cheapening the construction of turbine wheels and in making them efficient has been done by American mechanics.

The windmill is largely used on our western prairies and to a considerable extent elsewhere. The improvements lately made on this motor have been principally in the structure and arrangement of the vanes, making them self-regulating, and in so constructing the apparatus that it shall keep itself pointed toward the wind. Abroad, nothing seems to have been done, but our own inventors have accomplished some good work in this field, the extent and importance of which are not generally appreciated. We have but little information as to the efficiency of windmills. They are probably less effective than water wheels, and their improvement remains a promising task for ingenious mechanics.

The force derivable from electricity has long engaged the attention of most active minds, but we cannot yet chronicle any really well settled and important advance towards its utilization. Indeed we can hardly anticipate its employment to any considerable extent until new methods of generating the force itself are discovered. The available power to be obtained by the consumption of zinc, which is the metal consumed in the voltaic battery, is estimated, by various authorities, at from one half to one sixth that derivable from an equal weight of coal, and the great difference in price between zinc and coal, pound for pound, makes the difference in cost of power vastly in favor of coal. A quarter of a century or more ago, many attempts were made, some upon a large scale, to utilize electric force in the production of mechanical power, but with no success. Our countryman Page, who in 1850 obtained power from a small engine at a cost, as he stated, of about a cent per horse power per hour was the most successful; but even he finally failed, and no one has since been more successful. Attempts are still made and are almost daily brought to our notice; and occasionally a charlatan or a self-deceiver deludes credulous listeners, by the claim of wonderful results. We hope that we may find such a claim well founded, in some time to come, but we fear that it will be very far in the future, unless some fortunate man shall discover a method of evolving electricity, in place of heat, from the oxidation of coal. That done, the problem would be far less difficult of solution, and we should look hopefully for a splendid development of this field, which would have then become most promising.

PROGRESS OF THE CENTENNIAL.

With the object of enlisting the cöoperation and interest of the people of New York in the coming Centennial,a delegation from the Board of Finance of that enterprise recently met with the members of the Chamber of Commerce of this city. The Philadelphia committee deprecated any feeling of sectional rivalry and urged, with much earnestness,the view that the exhibition was a national affair, and that it deserved the hearty support of the whole country. The New York merchants replied in similar strain, cordial expressions of cöoperation were exchanged, and a committee of seven was appointed to solicit aid from the people of the State. As regards progress, we find it stated that the Board of Finance has confined its operations principally to Pennsylvania, in which State $3,500,000 have been subscribed by citizens and corporations. California has promised her full quota, and efforts have been begun in order to raise funds in Delaware and Maryland. The work of construction is to be rapidly pushed during the coming spring. A temporary building covering from 35 to 40 acres is to be erected, and the permanent structure will be commenced at the same time. The former edifice is to cost from two to three million dollars, and the latter, half a million. The machinery, horticultural, and agricultural halls, are each to cost $500,000, and it is believed that the preparation of the ground, sewage, etc., will use up the remainder of the $10,000,000 required.

The prospects of foreign participation are very encouraging. At the assembling of the German Parliament, Prince Bismarck recommended the acceptance of the invitations and also urged the appointment of a plenipotentiary to reside in Philadelphia during the Exposition, and of a commissioner for each State of the empire. Belgium has promptly signified her intention to contribute, and the republic of Ecuador has made an appropriation for the purpose, and already has a resident commissioner in Philadelphia. Official notifications of intended participation have also been received, by the Government, from Mexico and Hayti. Professor W. P. Blake, special agent for the centennial at the late Vienna exhibition, says in his report that he has received assurances of freindly interest from the Emperor of Austria and other high officials. He has already obtained contributions for a permanent museum, consisting of Swedish iron ores, and a valuable collection of terra cotta work, samples of ozokerit, etc. China and Japan, it is considered, will be well represented, and the Turkish merchants are to erect a grand bazar, coffee houses,bath, and, in some convenient portion of the grounds, a complete Turkish village.

We hope capitalists, merchants, manufacturers, inventors, and every other class of our citizens will take an active interest in promoting the success of this great patriotic Centennial exhibition.

EXPERT ENGINEERING.

We are constantly in receipt of inquiries as to what are the requisite qualifications for an engineer. This word as it is frequently employed is somewhat of a misnomer. An engineer, in the broadest signification of the term, is an expert in engineering, one who is practically acquainted with the construction and management of heat engines: who is thoroughly versed in the physical laws which relate to the formation and use of steam and other motive powers: who can design machinery, and adapt it to the various purposes for which it is intended. But in common parlance, every one who has control of an engine or boiler is known as an engineer. From this fact, much misunderstanding frequently results. The proprietor of a factory, for instance, sees no difference between the person who takes care of his engine and the consulting engineer who offers his services in expert cases, except, perhaps, that he looks upon the former as a practical man, and therefore one who is always certain to think and act correctly, while he considers the latter a theoretical engineer, whose opinions are entirely too visionary to be of any value. We think we have not overstated the comparison that is usually made between what are known as practical and theoretical men. But it may be worth while to look into the matter a little, and see whether the popular estimate is a just one. The purely practical man, as we understand it, is one who knows nothing but what he has acquired by actual practice; and things that he has not seen and handled, as it were, he will not believe. Now the engineer who is understood to be theoretical has ordinarily enjoyed quite as much practice as the other, but he has labored more understandingly, investigating the principles of the work in which he is engaged, and endeavoring by the application of these principles to effect changes and improvements. There is little doubt that the intellect of man is his most valuable possession, and that the cultivation of this faculty will give him greater rewards than he can hope to acquire by manual labor. It is true, however, that his theories, if unsupported by facts, are little better than idle dreams, so far as their value to the community is concerned. James Watt, in making his splendid inventions relating to the steam engine, carried theory and practice hand in hand. Starting with a rude model, he determined practically what it would do, and reasoned out what it ought to do if it were a perfect machine,and then turned his attention to making it fulfil the conditions called for by his theoretical investigation. Surely the result justified all his experiments and hypothesis.

Professor Rankine, lately deceased, and perhaps the most remarkable engineer that the world has ever known, united, in a most happy degree, the use of theory and practice. The result of his labors, cut short by an early death, can hardly be appreciated as yet; but in giving to the world the first accurate theory of the action of heat engines, he has enabled future experimenters and inventors to work with a clear knowledge of the nature of the problems which they wish to solve.

We hope we have succeeded in demonstrating to our readers that theory and practice are not naturally antagonistic, and that the professions of engineer and engine driver, both honorable ones, are quite distinct, the former comprising all that is contained in the latter, and embracing additional details.

If we have induced the owner of steam power to alter his opinion of the expert engineer, perhaps we may persuade him that he can occasionally employ the services of this expert with profit to himself. If every time that steam was raised in his boiler a large quantity continually escaped through some opening that was plainly visible, he would not hesitate a moment to have the leak repaired. We are able to state, from our own knowledge, that this state of affairs practically exists in many places where steam power is used, with the important exception that the leak is not visible to the ordinary observer. To find this leak is the task of the engineer, and surely the owner will be amply repaid if he succeeds, for a trifling amount, in having repairs made which will save him thousands of dollars yearly. The Royal Agricultural Society of England, at their yearly exhibitions, are accustomed to test the engines that are entered for competition. An investigation of the results obtained from year to year shows a most extraordinary improvement in the engines, as regards economy and workmanship, and there is little doubt that the effect of these tests has been most beneficial to the users of steam power In this country, comparatively few reports of tests have been made public, and we are lamentably ignorant in regard to the performance of machinery made even by our best manufacturers. This is a matter in which every user of steam power is directly interested, and we hazard little in saying that all owners of steam engines would find it profitable to have tests made by reliable experts at least once a year. From examinations that we are continually making in the city, and by letters that we frequently receive from abroad, we are convinced that there are many steam engines which stand in need of professional assistance. The steam engine indicator has been likened to the stethoscope of the physician, but it should be remembered that either, in unskillful hands, will be productive of but little benefit. There are many cases, besides, in which other tests than those made with the indicator are called for; but so far as our experience goes, the skillful engineer is generally able to find the trouble and devise a remedy, when his services are called into requisition.. Those who are accustomed to read that portion of our paper devoted to questions and answers have doubtless noticed that we receive many letters in relation to the power that can be transmitted by a belt. It is a very common practice in letting power to calculate the amount furnished from the width and speed of the driving belt. But this is a very uncertain estimate, as in some cases the belt will transmit more and in others less than the rated power. If a few tests were made of the bulk of a pound of sugar, and the article were ever afterwards sold by guess work, the bulk furnished being based, by the seller's eye, on the amount previously determined by experiment, we venture to assert that neither dealer nor purchaser would be satisfied. And yet this is just the course pursued in circumstances where the amount of power can be as accurately determined as the quantity of sugar to be furnished for a pound. Cases have come to our knowledge in which the amount of power actually furnished varied as much as two hundred per cent from that given by calculation.

Some years ago, we heard of a bridge contract being let, in which it was stipulated that none of the material was to be strained, when subjected to the maximum load, to more than one sixth of its ultimate strength. When the structure was completed, a simple calculation showed that the maximum load brought a strain equal to one third of the ultimate resistance. The bridge commissioners performed a simple sum in arithmetic for the benefit of the constructor, worked somewhat in this manner: If a tun of iron costs D dollars, and it would require W pounds to give a factor of safety of six, and the price of the bridge is to be P dollars, if constructed according to specifications, what should its price be if it contains only half as much iron, so as to give a factor of three? Payment for the bridge was made according to the solution of this question, to the intense disgust of the contractor. A similar sum might be worked out with considerable profit to the purchasers of many steam engines and boilers, who find that their machines fall far short of the power at which they were rated by their makers.

This article has already extended beyond our proposed limits, and we have merely touched upon the benefits that users of steam power can obtain from reliable expert assistance.

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We take great care to send our paper with regularity to every one of our subscribers. All of our employees in the mailing department are under injunctions to write each address plainly and to fold each paper nicely. If any of our subscribers fail to receive their papers regularly or observe any faults in the folding or addressing, we shall feel obliged if they will notify us, by postal card or letter, in order that we may promptly correct the matter. Do not hesitate to complain, and repeat the complaint, if necessary, until correction is made. When the address is not legibly written, we should be glad to receive back the portion of wrapper containing the faulty writing.

The Value of the Scientific American.

One of our esteemed subscribers, in lately writing to us about the renewal of his paper for the next year, says that he has taken the SCIENTIFIC AMERICAN regularly for the past twenty-five years, and has the volumes for that long period, all bound. He was recently offered a farm of one hundred and sixty acres of land, free and clear, in exchange for these volumes, but declined the trade. He has derived great benefit from the volumes, and holds them to be of more value to him than many hundred acres of farming land.

One Hundred and Fifty Thousand.

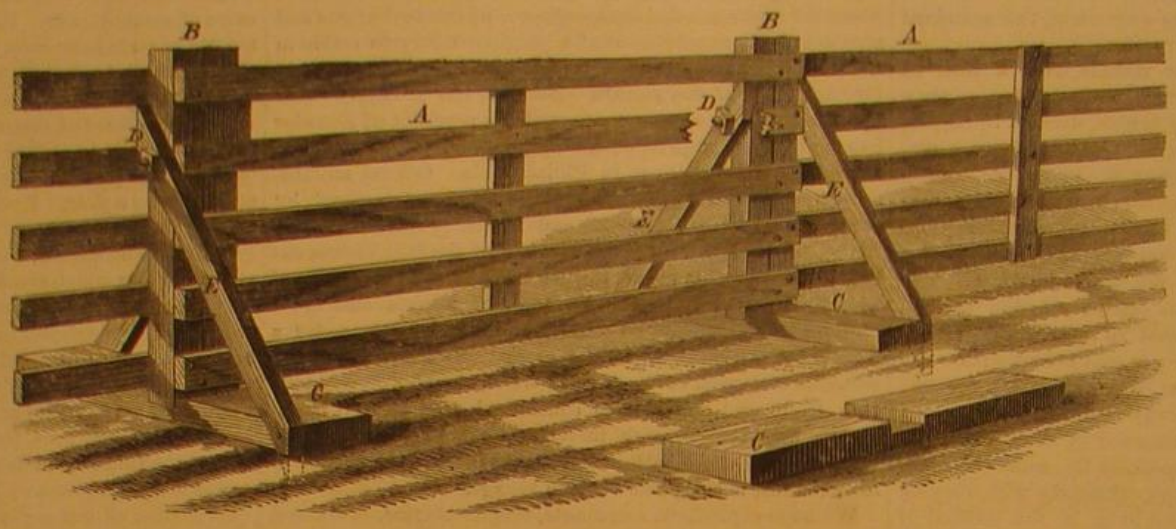
The demand for our special number of the SCIENTIFIC AMERICAN has induced the publication of a second edition. Advertisers who were promised the circulation of 60,000 have derived the benefit of 150,000 without extra charge.

IMPROVED PORTABLE FENCE.

The invention herewith illustrated is an improvement in portable fences for farm or other purposes, which, it is claimed, is durable, substantial, and requires very little labor to construct or set up in place.

The panels, composed of rails, A, and posts, B, are fastened together by nails or in any suitable manner. The posts may be placed both on one side, or one on each side of every panel. C are the bed pieces, one of which is shown separately in the foreground, in the upper side of each of which a gain is cut to receive the bottom ends of the posts. The latter stand up in the gain in contact with each other, as, indicated in the engraving, and are fastened together by a bolt and nut, D, the former of which is made of suitable length, so as to allow of proper separation of the posts at top or bottom, in case the fence be extended over undulating ground. The same bolt serves to secure the upper ends of the braces, E, which continue below the bed piece and enter the earth, as shown by the dotted lines. By removing the bolt, the panels, as well as the braces and bed pieces, are left free and may be readily removed. If desired, the braces may be fastened to the bed pieces in any suitable manner.

This device appears to be a convenient and economical arrangement, which can doubtless be employed in a variety of places by farmers and others.



PORTER'S IMPROVED PORTABLE FENCE.

Patented through the Scientific American Patent Agency, by Samuel S. Porter, of Broad Ford, Fayette county, Pa., who may be addressed for further information.

Hawley's Kiln.

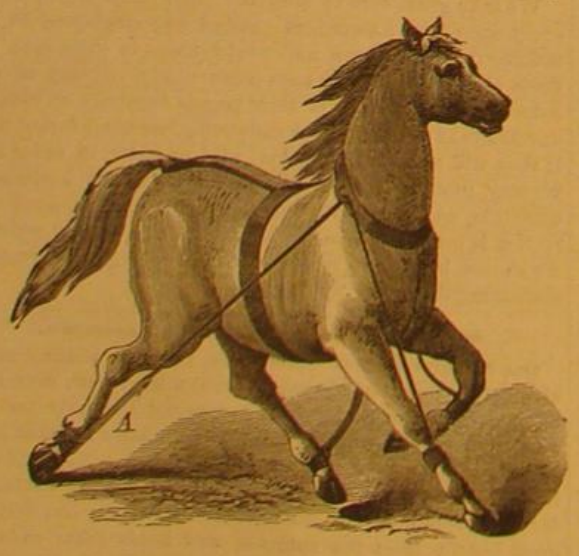
We learn that some very important features have been added to the Hawley kiln (for burning brick, tile, pottery, etc.) since our illustrated descriptions published April 27, 1872; one of which consists in utilizing the heat to a room ahead, while burning, thus drying off the compartment in advance of the already burning chamber. This effects a saving of the surplus heat, which would otherwise escape up the chimney during the process of burning, and after the contents of the burning chamber have been thoroughly dried off and heated through.

Again, in utilizing the heat contained in the incandescent mass remaining in the already burned chamber, the cooling off process is carried on from above downwards, in the same direction pursued during the process of burning (instead of by reversing the current of air as previously described); thus exposing the contents of the oven alike throughout, both in burning and cooling.

IMPROVED TROTTING GEAR.

Mr. Henry Schmalhausen, of Bridgeport, Ill., has recently patented an elastic trotting gear for horses, the object of which is to enable the animal to trot faster, and raise his feet higher, and also to prevent him from balking, kicking, backing, or rearing.

The apparatus consists of an elastic strap so constructed as to be adjustable in length, and which is passed and plays easily through the hame ring which guides the lines. The ends of the strap are attached to bolstered bands, which may be readily buckled, one to the fore and the other to the corresponding hind leg. The gear may be so applied that the knee joint will be raised to a level with the shoulder joint, which throws the fore leg on the forward step into nearly a



horizontal position. By shortening or lengthening the adjustable portion, A, any degree of elevation, from a low to a high step, it is stated, may be obtained. The device is claimed to be especially useful for the breaking of colts, as it will develope the formation of the joints, produce a free action of the legs, and give increased strength to the muscles and ligaments.

Focal Differences in the Eyes.

A writer in *Science Gossip* speaks of the difficulty which some persons experience in the use of binocular microscopes, owing to a focal difference in the eyes. In a case mentioned one eye was far sighted, while the other was near sighted. For reading purposes, this person wears a pair of spectacles in which the one glass is made for the far sight, while the other is a plain glass, the left eye being near sighted, and consequently requiring no aid from spectacles with which to read. Instances are cited of persons who, while employing both eyes for ordinary vision, usually employ only one in reading. If any difference of the kind exists between the visual powers of a pair of eyes, it may be readily detected. Hold up a piece of card before one eye, so as to cut off its field of view, and then look at some object before you with the other. Then gradually bring the card before the other eye, and view the same object. If the object is seen with the same distinctness in each case, then your eyes are perfect as regards the balance of their foci; if not, then there is focal difference more or less decided. It would no doubt be advisable to take account of this very frequent difference of focus, in selecting a pair of spectacles.

IMPROVED ATOMIZER.

The ingenious little arrangement represented in our illustration is designed to distribute perfumes in the form of spray. Its simple and inexpensive construction renders it applicable to the stopper of every perfume bottle, so that the purchaser, instead of buying vaporizer and liquid separately, as heretofore, is now enabled to purchase both together at a cost very slightly increased above that of the extract singly.

There is a hollow collapsible bulb attached to the top of the hollow stopper, by stretching its mouth over a groove in the latter. Extending up from the liquid is a tube, A, the end of which is bent at right angles and terminates in a small nozzle which is surrounded by a hollow projection, B, of the stopper. It will be observed that there is an opening between the stopper and interior of the bottle at B, so that, on compressing the bulb, air is forced down upon the liquid, which is thereby caused to rise up through the tube, A. A small part of the air pressure only, however, serves this purpose, and hence the greater portion escapes through the projection, B, surrounding the fluid, escaping from the nozzle of A, with an annular jet of air which converges at a point a little beyond the two nozzles. The effect of this is to break the liquid up into spray or vapor and also to distribute it much more effectually than the similar apparatus depending upon a cross jet to draw up and expel the fluid.

The invention, which we have recently had occasion to examine, seems to us a desirable article which might form a profitable addition to the stock of druggists generally.

Patented September 23, 1873, by Mr. John N. Gerard, 139 William street, New York city.

The Phœnix Post not an European Invention.

Professor W. P. Blake, in a recent report upon the iron and steel department at the Vienna show, published in the *Tribune*, mentions as novelties a series of girders over 60 feet long, and hollow iron posts of the same length, and a foot or more in diameter, made of four flanged pieces riveted together. Mr. John Griffen writes to correct the impression given that these posts or girders are of foreign invention; as he very truly says, they are nothing more than the well known Phœnix wrought iron column, invented and patented by Mr. Samuel J. Reeves, President of the Phœnix Iron Company, in 1862. Mr. Griffen says that, during the interval since its invention, this column or post has been largely manufactured at the Phœnix Iron Works, and many thousand tuns of them have gone into the construction of wrought iron bridges, viaducts, depots, warehouses, and other structures in various parts of the United States, Canada, Nova Scotia, and in South and Central America. All the top chords and posts of the trusses in the International Bridge over the Niagara river, near Buffalo, are made of Phœnix columns. The same can be said of the Intercolonial and all the new bridges on the Grand Trunk Railway in Canada, the Augusta bridge in Maine, the Girard avenue bridge over the Schuylkill, the New River and Greenbrier bridges in Virginia, the three wrought iron bridges at Rock Island, Ill., and scores of others. Many important viaducts are composed almost entirely of these columns—as the Lyman and Rapallo viaducts in Connecticut; the Lyon Brook, Deep Gorge, and Blockhouse in New York; Bullock Run and Bank Lick in Kentucky; the Agua Venugas in Peru. Many of these structures are of great length and depth, the last mentioned being 580 feet long, and crossing a gorge 252 feet deep, over which the Lima and Arroya railroad is carried. The overhead Greenwich street railway, in New York city, rests on a continuous line of these columns, though not by any means a good type, owing to their flaring tops and bottoms, made to suit the peculiar notions of the contractor of the railway.

To this, we may add that the proposed 1,000 feet tower, which Messrs. Clarke, Reeves & Co. have designed, and which is in progress of engraving for these columns, will form one of the most remarkable applications of the celebrated Phœnix posts.

Railroad Tunnel at Richmond.

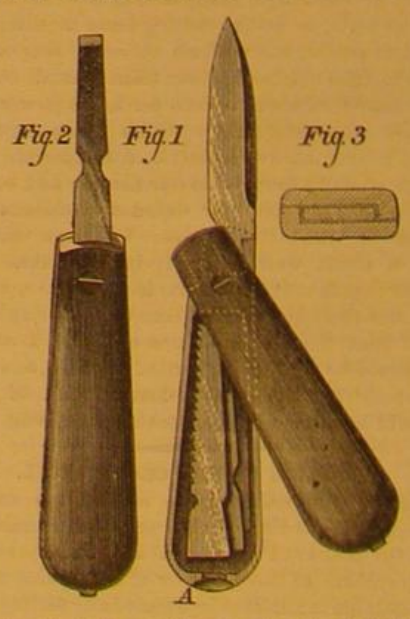
The Chesapeake and Ohio Railroad Company have, for two years, been trying to tunnel through Church Hill, in the eastern part of Richmond, but the work has been attended with unexpected impediments. It was supposed it could be completed for $300,000, as there were no rocks, and the contract was let at that price. The tunnel runs 80 or 90 feet below the surface, through a slippery blue clay, which has the habit of caving in at the most unseasonable times in the most disagreeable manner. The contractors long ago gave up, and the railroad company was compelled to take the work. Six or seven men have been killed, while the repeated cavings have undermined many houses over the line, which is three quarters of a mile long, and is not yet open.

With one of the tunneling machines, such as were used in boring the experimental section of the Broadway Underground Railway, in this city, it would seem as if the above tunnel might have been executed in a very short time, with perfect security against caving.

IMPROVED TOOL HOLDER.

This is a useful little device, by means of which a number of different implements, such as fine saws, knife blades, awls, screwdrivers, gimlets, etc., may be carried in a single receptacle no larger than and resembling in form an ordinary penknife handle, and readily set firmly in place as desired for use.

The handle has a cover, pivoted, as shown in Fig. 1, which may be easily swung open, or, when closed, is held by a



spring catch, A, in the position in Fig. 2. In both cover and box, just outside the pivot, is formed a jaw, so that, when the parts are closed together, a dovetail socket is made, which receives the correspondingly shaped ends of the tools. Fig. 3 is a transverse section of this portion, and shows the shape of the jaws. This invention was patented February 11, 1873, by Mr. Levi L. Lamb, of Chelsea, Mass.

SCIENTIFIC AND PRACTICAL INFORMATION.

RESEARCHES IN SANTONINE

MM. Cannezzaro and Sestini note their investigations of santonic acid, which is much more energetic and more strongly characterized than santonine. It is obtained by the combination of one molecule of water with one molecule of santonine by the prolonged action of hot alkaline solutions. The formula is $C^{15}H^{20}O=C^{15}H^{18}O^3+H^2O$. The acid is a colorless substance unalterable by light, little soluble in water at ordinary temperature, but readily dissolved in boiling water, becoming on cooling deposited in the form of fine prismatic crystals. It is very soluble in ether and alcohol, and moderately so in chloroform and acetic acid. It melts between 353·8° and 357·4° Fah., differing from santonine, which melts at 370° Fah. The reddish violet color, which characterizes the latter substance when treated with alcohol and caustic potash, is not noted in santonic acid. It gives quite a strong acid reaction, and decomposes carbonates dissolved in tepid water with a brisk effervescence.

The same authors give the name santonates to the metallic derivatives from the acid, and consider that the term santonites should be applied to the compounds that M. Heldet has obtained by treating santonine with metallic hydrates or carbonates. Santonate of soda is made by a warm dissolution of santonic acid and carbonate of soda. The salt is deliquescent, and very soluble in water and in alcohol. The formula is $C^{15}H^{19}NaO^4$. The santonate of baryta is prepared by saturating a solution of santonic acid by hydrate of baryta. Santonate of silver is made by heating santonate of baryta to redness in nitrate of silver. This salt is amorphous and quite soluble in water.

THE REFINING OF COTTON SEED OIL.

Dr. Dotch communicates to the SCIENTIFIC AMERICAN the following method and proportions for refining cotton seed oil: 100 gallons of the crude oil are placed in a tank, and 3 gallons of caustic potash lye, of 45° Baumé, are gradually added and well stirred for several hours; or the same quantity of oil is treated with about 6 gallons of soda lye of 25° or 30° Baumé, and heated for an hour or more to about 200 or 240° Fah. under perpetual stirring, and left to settle. The clear yellow oil is then separated from the brown soap stock, and this dark soap sediment is placed into bags, where the remainder of the oil will drain off; and the sediment has a marketable value of 3 or 4 cents a pound for soap makers. The potash lye has to be made in iron pots, but the oil and lye may be mixed in wooden tanks.

TO REMOVE GREASE SPOTS.

In the removal of grease from clothing with benzol or turpentine, people most generally make the mistake of wetting the cloth with the turpentine and then rubbing it with a sponge or piece of cloth. In this way the fat gets dissolved, but spread over a greater space and not removed; the benzol or turpentine evaporates, and the fat covers now a greater surface than before. The only way to radically remove grease spots is to place soft blotting paper beneath and on top of the grease spot, which spot has first been thoroughly saturated with the benzol and then well pressed. The fat gets now dissolved and absorbed by the paper, and entirely removed from the clothing.

FELTING RABBITS' HAIR.

These hairs were formerly treated with a solution of mercury in nitric acid for the purpose of enhancing their felting properties. A mixture of nitric acid and treacle is proposed as a substitute.

THE DEPILATION OF HIDES WITH CHARCOAL.

Andersen discovered that pulverized charcoal applied to sheepskins produces the depilation of the hair. Charcoal, as is well known, has the property to take up large quantities of oxygen from the atmospheric air, and the oxygen in this form seems to exert a chemical influence on the fatty substance present in the neighborhood of the glands of the hair roots. An oxidation takes place in the pores of the skin, which destroys the glands and loosens the hair. Finely powdered charcoal is mixed with sufficient water to make a thin paste, and the hides immersed for 4 or 5 days and well turned over in the meantime, when the hair can be taken off at once. Hides treated with charcoal do not require further treatment, as is the case now with the lime process: and after being washed with water, they are ready for tanning. This will be a great advantage to the tanning trade, as leather treated in this way possesses more toughness, solidity, and flexibility. The other advantages of this treatment are great saving in time and labor, each hide weighs ½ to 1 pound more, and has less spots, the work is more pleasant and healthy, the splitting with the machine is more easily accomplished, and the cost price is the same as with lime, as the charcoal can be used over again. Animal or vegetable coal can be used in any quantity, having no deleterious property whatsoever; and for each hide 6 or 10 pounds, with the necessary quantity of water, are sufficient. The temperature should be 61° or 70° Fah., and can easily be maintained by introducing steam into the vats. The tanning process is facilitated, as no lime is left behind to neutralize the tannic acid.

A Handy Device for Teamsters.

In a short time, winter will have so far set in that our country roads will become well blocked with snow and mud, rendering the hauling of heavy machinery, wood, stone, or other large loads, no small burden upon ordinary teams. A great deal of labor and hard tugging may be saved if every wagon or truck is provided with 100 feet of stout rope and a single pulley. A snatch block is the best arranged with a strong hook, and the usual construction for slipping the tight of the rope under the strap to the sheave instead of waiting to reeve the line through on end. If a wagon gets stuck in heavy mud or in the snow, the driver has only to fasten his block to the tongue, reeve the rope through it, and attach one end to a tree or post and let his team pull on the other. Their work is of course just halved, or rather they bring twice as much power to bear in dragging the wagon clear. There are plenty of other applications of this simple device, which will readily suggest themselves. With a couple of skids for an inclined plane, heavy logs could be easily drawn on a sleigh by the unhitched team. Another case where it is likely to be useful is when loaded sleighs attempt to cross a wooden bridge. Although the horses draw the load very easily over the snow, they are often unable to start it over the generally denuded wooden flooring of the bridge, and hence would be materially aided by the tackle hitched on as we have described.

METALINE.

The accompanying engravings and description are designed to call the attention of our readers to a substance which is now offered as an absolute substitute for every kind of lubricant, compound or simple, now in use; which is claimed (and the assertion is based on experiments, so far as they have extended) to be practically indestructible, and which once applied to a machine is to render the apparatus for ever independent of the dash pot or oil can. We may state, at the outset, that the material appears to present this difference from oil, that, while the latter serves as a screen between the surfaces, keeping them apart and preventing interlocking, the present antifriction composition gives evidence of producing like results by filling up the microscopic cavities and leveling the minute projections of the parts in contact, producing uniform and highly polished faces. That the friction is reduced to a less percentage than one sixtieth of the weight, we are not at present, in the absence of positive proof, prepared to assert; and hence, save so far as is indicated in the general law that hard lubricants diminish the resistance most, we are unable to institute a direct comparison, in point of theoretical reduction of friction alone, between this and other anti-attrition compounds of softer nature. It may be added, however, that numerous cases are submitted by the manufacturers, in which it is shown that metaline has been practically employed with a marked advantage in instances where oil has proved inefficient; so that at least it may be said that the new substance has claimed for it, and to all appearances on substantial grounds, advantages which may render it, for a number of obvious reasons, an invention of no ordinary importance.

Fig. 1

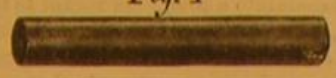


Fig. 2

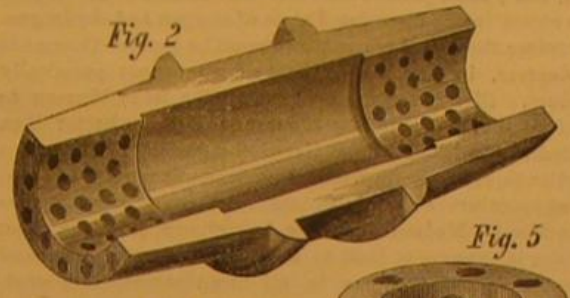


Fig. 5

Fig. 6

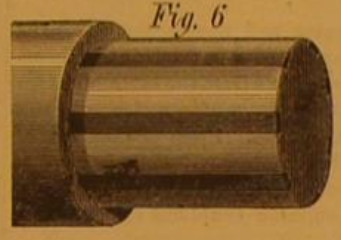


Fig. 3

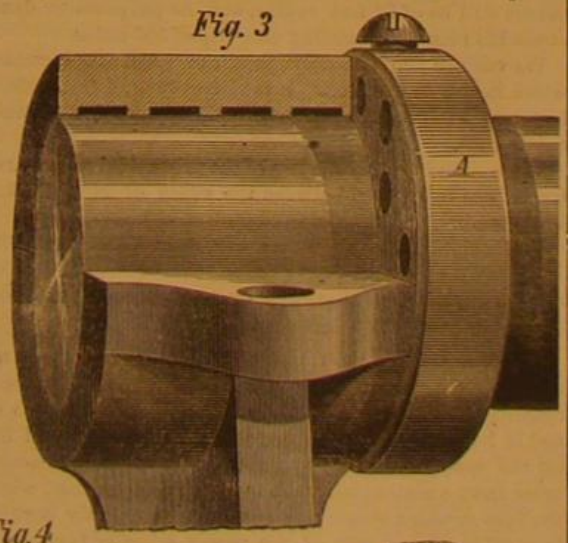


Fig. 4

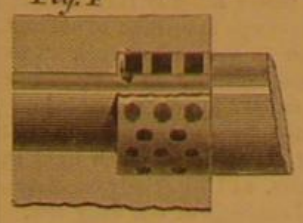
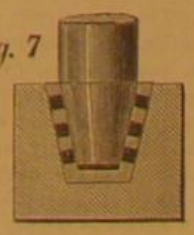


Fig. 7



Metaline, for such is the name of the body under consideration, is a dark colored soft material resembling, though not necessarily containing, plumbago in certain forms. The basis is a white and brittle alloy, to which, when ground into an impalpable powder, is added the other components in quantities in direct proportion to the degree of hardness desired. The mixture completed, the substance, still in a dry powder, is placed in suitable molds, in which, under a pressure of hundreds of tuns per square inch, it is made into small cylinders, one of which is shown in Fig. 1. The remainder of our engravings represent the various modes in which the metaline is applied. The general plan, as shown in Fig. 2, is to bore into the inner periphery of the box a series of shallow cavities, into which little plugs of metaline are fitted. The two parts of the bearing are brought together, set upon end, and a reamer, forced down through the opening, pares off the projecting and irregular portions of the plugs, leaving the interior surface perfectly true and smooth.

In Fig. 3 is represented a bearing, part of which is cut away to show the manner of introducing the metaline, in section. At A, in the same figure, is a collar, which revolves with the shaft and of course rubs against the edge of the box; the manner of providing against friction by a similar arrangement of metaline disks, as already described, is here indicated, the plugs being inserted directly in the sides of the collar. Fig. 4 shows how the metaline is applied in cases where the inner periphery of the bearing is inaccessible. A collar, Fig. 5, of suitable size, is made and fitted with disks as represented, and inserted in the bearing, which is suitably enlarged to receive it. This proceeding is applicable to very small shafts, as mill spindles, etc. In certain cases where it might be preferable to avoid altering the bearing, the shaft is slotted and the metaline forced in under strong pressure, in the positions depicted in Fig. 6. Lastly, Fig. 7 represents a step for a mill spindle or any upright swiftly rotating shaft, notably of the kind used in supporting the cutter heads in woodworking machinery. Here a conical cup of brass is fitted with plugs as shown, and secured in a suitable cavity in the heavier portion. The mode of application must necessarily vary greatly with the construction of the machine, and other attending circumstances; and we may add that many varieties are made, to adapt the material to different speeds, pressures, weights, etc.

At the workshops of the company in this city, various kinds of experimental machines are now in motion, and, among others, there is a mill spindle, rotated at the rate of 8,000 revolutions per minute. The shaft is of steel, and the bearing is of similar metal, fitted as closely as can be done. Metaline is introduced in slots in the shaft. We examined the apparatus carefully and could detect no heating. Four sewing machines are also continuously running at full speed, the needle bars of some at the rate of 1,200 revolutions per minute. No oil or other lubricant but metaline is in use, and there is clearly no cutting or heating. A five horse power Baxter engine we also found running, at the rate of about 150 revolutions, without a drop of oil, and we were informed that it had been in daily use since May 1. Our attention was also called to the countershafting in the machine shop, the journals of which had been cut down to a length equal to one diameter of the shaft, as shown in our engravings, Figs. 2 and 3; and such indeed was the case with all the journals to which the metaline had been applied. We need not point out the saving of expense and material thus effected. Since January, 1870, the substance has been in use on a slotting machine, in the works of Todd & Rafferty, of Paterson, N. J. It has never been renewed, and according to the engineer, the bearing always cut with oil. The pins of the drawbridges of the Central Railroad of New Jersey, over the Passaic and Hackensack rivers, were fitted with metaline three years ago, and, as we are informed, now exhibit no signs of wear. Specimens of brasses and also of shafting shown to us, which ran for a continuous period with the lubricant, appeared to be perfectly smooth and polished like a mirror; while judging from our examination of machinery which had been in actual motion for several months, there seemed to be no working up of the substance; and so far from there being any dirt in the bearings, the revolving shafts barely soiled a white handkerchief.

Lack of space forbids our entering in greater detail into the applications of this invention. Doubtless the simple assertion that to all appearances it both obviates the use of oil and completely prevents the wearing away of rubbing parts, will at once suggest to the reader its infinitude of adaptations. It is the invention of Dr. Stuart Gwynne, and was devised some three years ago, when it was introduced in the localities above noted and in various other places in this country and in England, and was also made the subject of a commendatory report, now before us, of Chief Engineer Clark Fisher, United States Navy, to the Secretary of the Navy. By direction of the latter official, certain gunboats were to be fitted up for trial; but the burning of the company's factory, together with difficulties between interested parties, resulted in the temporary withdrawal of metaline from the market. At the present time it is again offered to the public in improved form, and is manufactured by the American Metaline Company, No. 61 Warren street, in this city. Our readers can examine the experimental machinery for themselves at the above mentioned address, or may obtain further information by letter.

COATINGS of lead oxide and salts on pottery are apt to dissolve off in acid liquids, thereby threatening the health of those who use them. Several successive coatings with a solution of sodic silicate and then exposure to a bright red heat in a furnace, prevent the trouble.

Correspondence.

Concerning a Telescope of Unlimited Power.

To the Editor of the Scientific American:

In connection with D.'s communication, on page 368 of your volume XXIX., it may be observed that the mercury, revolving in the manner described, will have a stability due to its motion, above that belonging to it while in a state of rest. The same principle applies alike to the motions of atoms and of suns, and a very striking illustration is afforded by the rigidity imparted to a stream of water issuing from an orifice under great pressure. (See Mr. Emerson's communication, page 340 of your volume XXIX).

From lack of necessary data, the writer is unable to state the exact stability of mercury due to different velocities; but after a rough estimate, it is safe to say that, if the basin of 20 feet diameter be made to revolve at the rate of 200 revolutions per minute (which speed is practicable), the mercury near the circumference of the basin will have a stability greater than lead. Now, unfortunately, the velocity at the center of the vessel will be 0, and consequently the stability at the center will be only that due to mercury in a state of rest. It is possible that we may dispense with a portion of the center of the mirror; perhaps some one will be kind enough to tell us how much, if any, may be dispensed with, without seriously impairing its efficiency.

The great amount of power required to operate the necessary machinery would preclude the possibility of using weights for imparting motion, and the next best thing that we have is an accurately balanced water wheel, imparting its motion through friction wheels. After reducing the possibility of friction to a minimum by accurate balancing, etc., we may obviate still further difficulties arising from vibrations and inequalities of motion by floating the vessel, containing the mercury destined to act as a reflector, in another vessel also containing mercury. The motion would then be imparted through the mercury in the outer vessel by friction to the mercury in the inner vessel. The consequences of this arrangement are obvious.

In regard to the plane mirrors, will some one well acquainted with the principles involved be kind enough to inform us if it is necessary that they should be quite as large as the parabolic reflector?

The oxidation of the mercury would be an item requiring attention. It might be prevented by covering the metal, while at rest, with a suitable oil, which would separate itself from the mercury while in motion. JOHN LINTON.

Baltimore, Md.

Heat and its Origin.

To the Editor of the Scientific American:

The origin of the heat developed during combustion has hitherto been a profound mystery. In the beginning of this century, it was suggested that a portion of the specific or of the latent heat of the bodies consumed was set free during the process of combustion; but this idea was soon overthrown, as it was found that the products of combustion often possess more specific heat, and almost more latent heat, than the bodies themselves did before burning, that is, before chemically combining under evolution of heat. Hence arises the question: Whence comes all this intense heat of combustion, and the subsequent great amount of latent heat, when the resultant substance in the end possesses more specific heat than its elements before combination? It is curious to remark that, in this case, the most eminent physicists concluded that combustion must be an electric phenomenon. That ignorant persons, knowing nothing of electricity, attributed the so called spirit rappings and similar manifestations to its agency may be readily comprehended; but that scientists who have studied its laws should use this word as a pretext for explaining fire, solar heat, volcanoes, and even earthquakes, seems almost incredible. Physics form a positive science, which does not admit of vague suggestions, and a phenomenon cannot be ascribed to the work of electricity unless it is clearly shown that the well known laws and properties of electricity, when applied, explain every peculiar phase of the same. Notwithstanding that the laws of heat and electricity have been thoroughly investigated we are as yet not sure of their ultimate nature; one thing only appears certain, namely, that both are not peculiar fluids penetrating matter, but mere motions of the molecules or atoms of ponderable matter. Therefore, it is inappropriate to speak of imponderable matter, on account of the contradiction in terms, as the first property of matter is to be ponderable; we may have imponderable forces, or, better, caloric and electric forces. The so-called ether, which fills the planetary space and propagates heat and light, is probably ponderable matter; it is an atmosphere surpassing hydrogen in brightness more than hydrogen surpasses platinum, and of so small a gravitating force that millions of years will elapse before it is condensed on the planets. In fact, the spectroscope shows that, in the atmosphere of the planets and even of the sun, the materials of our earth's atmosphere are present, including water or its elements. Recent investigations of the sun and other heavenly bodies, by means of this wonderful apparatus, have besides revealed the fact that all matter may be in a more than gaseous condition, incandescent gas of so high a temperature that the elements are dissociated, that is, that all chemical affinities are destroyed, and each element exists separately in its uncombined condition, notwithstanding that it is intermingled with others. A descent from this exceedingly high temperature to that in which the chemical affinities can manifest themselves results in the combination of the gases. The chemical affinities of the different elementary substances manifest themselves only between a comparatively limited range of temperature, below and above which they do not operate. Even as at an extreme cold no combinations can take place, so at the extreme heat, of say 8,000° Fahrenheit, not only no combustions take place, but all compounds are separated into their ultimate elements. On cooling and reaching 4,000° or 3,000° or thereabouts, the volatilized substances or gases will again combine; the chemical affinities come into play, and combustion will ensue, the heat of which will again originate partial new dissociations. This is what continually appears to take place in the sun. It has been proved that the work of dissociation is strictly analogous to that of evaporation. In imparting to a liquid, water, for instance, the property of gaseous elasticity, steam, a definite quantity of calorific energy is manifested in the newly acquired expansive power, and therefore is not displayed as temperature; in other words, heat is made latent when changing water into steam. In like manner a still larger amount of temperature is converted into the force necessary to separate the vapors into their component gases; here a greater quantity of heat is made latent, and this is that which is set free and appears in combustion when the gases combine by burning, just as latent heat is freed when gases condense into a liquid, and again when the liquid cools into a solid. In regard to the temperature of the sun, we know now that those substances most prominent on our earth exist there in a state of vapor. Iron, lime, soda, potash, etc., are there in that condition, and also steam in the dissociated state of oxygen and hydrogen. Therefore the actual temperature must be several thousands of degrees, in fact, such a heat as we cannot practically produce. Direct measurement caused Sir Isaac Newton to conclude that the sun was thousands of times hotter than melted iron, while Sir John Herschel supposed that it was a solid or liquid body, radiating from its surface only, and that its temperature ought to exceed thirteen million degrees Fahrenheit. Modern discovery has shown, however, that the sun is gaseous at least to a depth of several thousand miles, and that the gas is all incandescent, luminous, and hot.

Moreover, incandescent gases and flames are perfectly transparent for light and heat from lower strata, and therefore the solar rays not only come to us from the surface, but we receive the accumulated rays from layers of incandescent gases several thousand miles in thickness. From the effects of these gases, the surface of the sun is continually being disturbed in a manner compared to which the more violent hurricanes, thunderstorms, and volcanic eruptions on our earth sink into utter insignificance. X.

The Prismoidal Railway.

To the Editor of the Scientific American:

Observing in your journal of December 13, 1873, an article, copied from the *Public Ledger*, referring to Crew's prismoidal railway, we beg to call your attention to an error which we will thank you to have corrected. The error lay in the statement that "the track upon which the trial was made, contained 36 feet lumber and 18 pounds of iron to the lineal foot;" it should read "lineal yard." We beg further to inform you that, by consent of the President of the Atlanta and West End Street Railway Company, Atlanta, Ga., for whom the locomotive was built, Mr. E. Crew, the patentee, has been allowed its use in order to demonstrate its power and the principle of his railway on a track of 500 feet circumference, now building at the Chestnut street rink in our city, which he has rented for that purpose; where, in the course of a couple of weeks, he intends to bring it directly before the attention of railroad men and corporations. The prism of this trial railway is 24 inches wide at base, with 18 inches hight to top of cone, with an 18 lbs. rail on its apex. The curves will be of 37 feet radius, and he purposes to demonstrate his principle, starting on a trip of 500 miles.

We enclose you a photograph of the "Atlanta" locomotive which is now at the rink. It is 11 feet long, 4 feet wide, and has two 24 inch drivers, with cylinders 5 × 8, and weighs only 4 tuns.

We contend that, by the use of the prismoidal railway, rapid transit can be insured between the cities of New York and Philadelphia, and the time reduced to 1½ hours.

Philadelphia, Pa. GEO. W. GRICE & CO.

The Relative Efficiency of Engines and Boilers.

To the Editor of the Scientific American:

The question of the relative economic efficiency of modern engines as compared with that of boilers, as they are now constructed, is being agitated among engineers in this city, and it has occurred to me that it is a subject that will interest the readers of your valuable journal. The discussion arose from a statement, made by one engineer, that, whereas the best modern steam engines have frequently developed from 75 to 85 per cent of the power actually furnished by the boiler, the boiler does not develope more than 15 per cent of the power actually contained in the carbon fuel. This was objected to, the reverse being claimed as being nearer the truth. Discussion on this subject in your valuable journal would be highly appreciated by the public, who well know that you are desirous of obtaining as much light as possible on all scientific subjects, and especially on steam, which enters so largely into all concerns of our daily life.

Boston, Mass. CONSULTING ENGINEER.

REMARKS BY THE EDITOR:—The subject here suggested is one of interest, and we invite correspondents to give their views.

THE Parisian pharmaceutists have contrived to incorporate cod liver oil with bread. Each pound of bread contains a little more than two ounces of the oil.

ALUMINA, FROM THE CLAY TO THE SAPPHIRE.

READ BEFORE THE POLYTECHNIC CLUB OF THE AMERICAN INSTITUTE, ON DECEMBER 18, 1873, BY DR. L. FEUCHTWANGER.—PART I.

Alumina is the oxide of the metal aluminum. It occurs in nature as corundum, which is an extremely hard mineral, ranking next to the diamond, its specific gravity being 4·0. It consists of 53 per cent aluminum and 47 oxygen. The precious gems sapphire and ruby are the representatives of pure alumina, the first of a blue and the other of pink or rose red color. If they possess a stellated opalescence, when viewed in the direction of the vertical axis, resembling a star, they are called star sapphires or rubies, which were known to Theophrastus and Pliny in the first century. The mineral corundum occurs in very fine crystals of the blue and red colors in many localities of the United States, such as New York furnishes at Amity, New Jersey at Newton, Pennsylvania at Unionville, and North Carolina. At Franklin, an extensive quarry of the crystals is now mined, one crystal weighing 300 tuns. Georgia gives red sapphires, of which California and Canada both furnish fine specimens. The minerals gibbsite and diaspore are hydrates of alumina; but the mineral emery, which stands near corundum in hardness and is the most useful material in the arts, containing the alumina and magnesia in about equal proportions, was originally brought from Asia Minor, but is now extensively mined at Chester, in Massachusetts. Alumina is also contained in a vast number of minerals. Clay is the result of the decomposition of aluminous minerals, and is, strictly speaking, a mixture of silex or flint, with at least one fourth of alumina, and has a peculiar earthy odor when breathed upon; and the mineral shale, which differs but little from clay, is extremely infusible and insoluble, and is also the companion of the silicated minerals: any earth which possesses sufficient ductility, when kneaded up with water, to be fashioned like paste by the hand, is called clay. These clays vary greatly in their composition, and are nothing more than mud derived from the decomposition or wearing down of rocks, as we see by the rain drop impressions, ripple marks, or mud cracks, which bear marks and evidence of exposure above the water, indicating plainly the long time which was required for the decomposition of the felspathic rocks, mostly contained in granite, and of granitic and gneissoid rocks and porphyry. In some regions where these rocks have decomposed on a large scale, the resulting clay remains in vast beds of kaolin mixed with pure quartz or silex, and sometimes with oxide of iron from some of the other minerals present, such as we find extensive beds of in the tertiary formation, as in New Jersey, Virginia, and South Carolina.

Before proceeding further to state what function the component parts of granite, which are the quartz, felspar and mica, occupy in the aluminous silicates, let me say a few words on the classification of rocks according to their origin and age, meaning the earth's crust, of which but a small portion is accessible to human observation. All rocks are divided into four great classes according to their different origin. The first are the aqueous; second, volcanic; third, the plutonic; and fourth, the metamorphic. Each of these four distinct classes has originated at many successive periods. It was formerly supposed that all granites, together with the crystaline or metamorphic strata, were first formed, and were called, therefore, primitive rocks, and that the aqueous and volcanic rocks were afterwards superimposed, and would rank, therefore, as secondary in the order of time. The aqueous rocks are also called the sedimentary or fossiliferous, and cover a larger part of the earth's surface than any others; they consist chiefly of mechanical deposits, such as pebbles, sand and mud, but are partly of chemical and some of organic origin, especially the limestones; they are called the stratified rocks, meaning strata which have been produced by the action of water. We have adopted these names of formations, such as the stratified and unstratified, fresh water and marine, aqueous and volcanic, ancient and modern, metaliferous and non-metaliferous formations.

The volcanic rocks are those which have been produced at or near the surface, whether in ancient or modern times—not by water, but by the action of fire or subterranean heat. These rocks are, for the most part, unstratified, and are devoid of fossils; they are the results of volcanic action and of craters more or less perfect; they are composed of lava, sand and ashes, similar to those of active volcanoes; and streams of lava may be traced from high summits or cones into adjoining valleys; and earthquakes have produced erosions, fissures and ravines (whereby we can detect porous lava, sand and scoriæ), dikes or perpendicular walls of volcanic rock, such as are observed in the structure of Vesuvius, Etna, and other active volcanoes. The basaltic rocks, forming the rocks of Staffa and of Giants' Causeway, are all volcanic; they have in their mineral composition much resemblance to the lavas, which are known to have flowed from the craters of volcanoes.

The plutonic rocks, which comprise mostly the granites, etc., differ much from the aqueous and volcanic; they are, in common with the next class, highly crystaline and destitute of organic remains; the plutonic comprehend all the granites and certain porphyries, which are nearly allied in some of their characters to volcanic formations. The metamorphic rocks, however, are stratified and often slaty, and are called by some the crystaline schists, in which are included gneiss, micaceous schists, hornblende schists, statuary marble, the finest kinds of roofing slate, and others. All the various kinds of granites which constitute the plutonic family are supposed to be of igneous and aqueo-igneous origin, and have been formed under great pressure at a considerable depth in the earth, or under a certain weight of incumbent ocean. Like the lava of volcanoes, they have been melted

and afterwards cooled and crystalized, but with extreme slowness and under conditions different from those bodies cooling in the open air; they differ from volcanic rocks not alone by their crystaline structure but by the absence of tufa and breccias, which are the products of eruptions on the earth's surface or beneath seas of little and inconsiderable depth.

The metamorphic or stratified crystaline rocks form the fourth and last great division of rocks, comprising the gneiss, mica schist, clay slate, chloritic schist, marble and the like, the origin of which is more doubtful than that of the other three classes. They contain no pebbles or sand or scoriæ, and no traces of organic bodies, and are often as crystaline as granite, yet divided into beds corresponding to sedimentary formations, and may be called stratified. The materials of these strata were originally deposited from water in the usual form of sediment, but were subsequently so altered by subterranean heat as to assume a new texture. It may be proved that fossiliferous strata have exchanged an earthy for a highly crystaline structure, even at some distance from their contact with granite; hard clays containing vegetable or other remains have been turned into slate, called the mica schist or hornblende schist, and every vestige of the organic bodies has been obliterated.

All the crystaline rocks are of very different ages, sometimes newer than the strata called secondary, and we must nfer that some peculiarity must exist which is equally attributable to granite and gneiss, or in other words to the plutonic and altered rocks, which are distinguished from the volcanic and the unaltered sedimentary rocks; and that the granite and gneiss and the other crystaline formations are hypoaqueous, or rocks which have not assumed their fossil forms and structure at the surface, and occupy the lowest place in the order of superposition.

The composition of granite, as already stated, being quartz, mica and felspar, the two last named ingredients contain the alumina in the form of silicate of alumina in nearly equal proportions, and some contain also some alkaline ingredients; likewise mica consists of a silicate of alumina and another alkali, differing somewhat from those contained in the felspar; we have, for instance, the anorthite, a lime felspar, the labradorite, a lime and soda felspar, the oligoclase, a soda lime felspar, the albite, a soda felspar, the orthoclase, a potash felspar; while the mica group, such as the phlogopite, biotite, muscovite, lepidolite, and others contain about twenty per cent of alumina, and about thirty per cent magnesia in their compositions. Felspar, like adularia, amazonstone and labradorite, when polished, form ornamental minerals; the garnet, likewise a silicate of alumina, when cut and polished, forms a gem; so is the lapis lazuli a silicate of alumina, an ornamental stone furnishing the natural ultramarine blue colors. The turquoise, one of the genus, is of blue color, but is a phosphate instead of a silicate of alumina, while another interesting mineral, called wavellite, contains this alumina. The beryl and emerald are silicates of alumina with barilla, the latter colored with oxide of chrome; and the first, when cut and polished, has the name of aqua marina, and is a fine gem.

A vast number of minerals composed of alumina and silica are found in nature, which find much useful application in the arts and manufactures; the mineral cryolite from Greenland, which is an aluminate but not combined with silica, is a fluoride of aluminum and sodium, is exported to many parts of the world and furnishes the material for alumina compounds.

Common slate, fuller's earth, pumicestone, marl, loam, ocher, umber, and sienna are more or less clays or silicates of aluminum, the three latter being colored by oxides of iron and manganese.

The topaz, a beautiful gem, is a silicate and fluoride of alumina. The great family of zeolites, which are composed of hydrous silicates and represent a very interesting class of minerals, are all chemical compounds of alumina with silica; most of them contain also a considerable portion of water, and lime, soda and potash.

Clay, which is found in nature in very extensive deposits, and if of very fine quality and texture is called kaolin: and the other varieties, such as common pipe clay fire clay, Stourbridge, marl, or loam clay, and claystone: is of the same chemical composition as regards the silicate of alumina; some contain more iron, and some contain lime and the alkalies soda and potash; all, however, owe their existence to the decomposition of the granitic rock which, through many causes, either chemical or mechanical, or through the action of atmospheric air for many ages, has gradually become disintegrated; and as Brogniard found in France the granitic rock in such a condition, he called it *"la maladie du granite."* The rock may gradually wear down either by variation of temperature or glacial action, or by congelation of water within the rock, gradually producing a split and expansion. In a chemical point, water itself may produce a powerful metamorphosis; as it contains carbonic acid, it would probably act upon the alkalies in the felspar of the decomposing granitic rock, while the silicate of alumina and the free silex would subsequently be separated by the action of water; the former, being so much lighter, would soon be washed away from the heavier silex, and after separation the clay is deposited. Very striking demonstrations of the decomposing granitic rocks may be seen in New York city, particularly in the upper part; there is a ledge of granitic rock extending from east to west, beginning at 31st street west to 60th street north; the Croton aqueduct in 42d street and Fifth avenue has been built from a granite quarried near 48th street and Tenth avenue; while on the east side, above 50th street, the gneiss rock caps the granite.

INSIDE A CHURCH ORGAN.

It is questionable whether any more magnificent specimen of human mechanical skill exists than the grand organ. The builder must unite, in his single person, the three capacities of artist, of scientist, and of workman: of the first, in order that he may possess the delicacy of ear to appreciate minute shades or variations of musical sound; of the second, that he may know and investigate the principles of acoustics which govern the productions of melodious vibrations, and the theories to be followed in constructing the apparatus from which the same may be elicited; and lastly of the skilled artificer, in order that he may contrive and invent devices for rendering the harmonies, latent in his assemblage of pipes, levers, and keys, responsive to the touch of the musician. It may seem almost a shattering of one's favorite mental idols to break down the divinity which, as the king of instruments, hedges around the organ: indeed, the dry details of levers, springs, and bellows, seem inappropriate and incongruous in connection with those grand tones which peal forth in the solemn chords which excite our reverential feelings as we kneel in the sanctuary; but Science is utterly destitute of sentiment. With imperturbable calmness she mercilessly resolves the daintiest melodies of Mendelssohn or Schumann, or the most majestic of choruses of Handel or Beethoven, into mere vibrations of the air, prolonged through certain intervals and in certain tubes, or leads us off from the reverie into which we fall over some exquisite harmony of the great tone masters into abstruse calculations as to the percentage of power due to the food absorbed by the organist *plus* the blower, which, converted into heat, is reconverted into motion by muscular action, which is again communicated to levers, etc., and which ultimately reappears in the shape of sound, and is again converted into motion when vibrating the auditory nerves

We recently spent a pleasant half hour inside an organ. We climbed ladders and mounted platforms, and enjoyed the novel sensation of standing in a small grove of tubes, where big pipes were the large trees, and the little ones, the under brush; and looking back it seems as if we investigated enough levers, springs, and rods to establish a moderate sized piano manufactory. We puzzled over the arrangement of pedals, couplers, and stops, and became hugely impressed with the skill which enables a single mortal of ordinary construction to play on so many things at once; and finally discovering some novel and really ingenious appliances which, the builder informed us, were not furnished to organs in general, we obtained through the kindness and courtesy of that gentleman the following interesting particulars:

Let us premise by observing that the instrument which formed the object of our visit is located in the church of the Holy Communion, corner of 20th street and Sixth avenue, and that it has just been completed by Mr. Hilborne L. Roosevelt, of No. 40 West 18th street, in this city. Mr. Roosevelt is one of the youngest of American organ builders; but if we may judge from the magnificent tone and almost perfect mechanism, coupled with devices of no mean inventive skill, which we find in his latest production, we may fairly assume that he has reached a foremost place in his arduous profession. His plan is to combine the best points of all schools, English, German, and French; and hence the brief sketch which we give of the arrangement of the organ in question may perhaps be considered as including many of the latest improvements of the manufacture.

Every one knows that if power be communicated indirectly, the necessary mechanism for turning corners, etc., necessitates a certain amount of frictional loss and resistance, greater, of course, than if the force was applied directly from the motor. Add to this the fact that the latter is weak, and, moreover, acts at a disadvantage, and an outline may be gleaned of the difficulty of actuating the multitudinous valves and levers of an organ, by compound levers connecting with key boards, say forty feet off, governed by the fingers of the organist. There is both a strong resistance to digital pressure, necessitating great exertion on the part of the performer, and also there exists an appreciable lapse of time between the touching of the key and the evolution of sound. The improvement which avoids this trouble is called the "pneumatic lever," and its effect is such that the keys are as easily manipulated, even with the full power of the instrument in action, as those of an ordinary pianoforte, while the interval of time between touch and sound, is barely $\frac{1}{4}$ second, which is of course practically inappreciable. In the church above noted, the organist's seat is on the ground floor, while the instrument is in a gallery. The levers from the inner extremities of the keys pass down under the flooring to a box directly beneath the loft. Here, arranged in framework, is a series of little bellows, one for each key of the organ; and in one end of each of which is a valve, operated by a lever leading from the key board. This is so adjusted that, on pressing down a key, compressed air enters the corresponding small bellows and inflates it. As the bellows enlarges, it pulls upon a lever that opens the valve connecting with the proper pipe. It will be noted that no pressure is needed on the key, except such as is necessary to lift the small bellows valve, which is of course a very inconsiderable amount.

This set, or rather these sets, of bellows, for there are two, one belonging to each bank of keys, must not be confounded with the main bellows which supplies the air blast. This apparatus is situated in the loft near the organ, and is operated by man power, forcing a powerful current of air, not directly to the pipes, but into another bellows which serves as a regulator, securing a constant, instead of an intermittent, blast, and thus preventing the disagreeable, wheezy, and unequal tooting sound often noticeable in old and imperfect instruments. The blast is finally driven into a reservoir, whence it emerges into the pipes in the manner presently to be described.

Each key board, and there may be several, belongs to an entirely separate organ, so two or more instruments may, by ingenious inter-adjustment, be combined in one and the same case. In the organ in question, there are two key boards proper, though the pedals, worked by the feet, may be termed a third; and there is another called the electro-melody, so that in fact, with two key boards and one set of pedals, the player performs upon four separate and distinct organs at will, any combination of that number, or all together. The pedal organ is merely an assemblage of low pitched pipes; and on its mechanism, it is unnecessary to dwell. The great organ is the lowest bank of keys, which connect, as before noted, with pneumatic levers. Just above the receptacle for the wind is the wind chest, which may be likened to a long shallow box, divided by numerous longitudinal partitions, making troughs. In these partitions are set the pipes, each longitudinal row of which is called a register. The lower ends of each set communicate with a compartment of the chest, and the apertures are closed by spring valves. Now, if there were but one set of pipes, each key would through the pneumatic lever, communicate with one of those valves, and hence would necessarily sound but a single tube; but there are, as we have already stated, many rows of pipes, and hence one key not only works one valve, but several, ranged in a transverse line directly across the wind chest. That is, while a single key may sound first a fundamental note belonging to a chord which is found in one register, it may open simultaneously valves belonging to tubes in other registers parallel thereto, so as to admit air, and thus produce notes having certain harmonic relation to the key note; so that in fact by a single pressure of the finger, if we so desire, we may produce a chord or portion thereof, instead of a single note, as on a piano. Each trough in the wind chest of course belongs to one set of pipes, and has its own valve, so that the organist, by means of handles near his key board, called "stops," may admit the blast into one or any number of the channels, and thus sound any register or registers he may desire. The total compass of each register, in the great organ portion of the instrument we are describing, is 58 pipes, and there are twelve stops, allowing a selection of any of that number of registers. But these latter all differ in quality of tone; for instance, one is a harmonic flute, another a trumpet, a third a clarion; in fact each has its own voice, due to the construction of the pipes. The pedal stops are arranged in similar manner, and number five in all, while the swell organ, which is operated by the second or higher key board, has a similar number of pipes, with a set of eight stops peculiar to itself. The swell organ must here be explained, as used for *diminuendo* or *crescendo* effects. It consists in mechanism similar to that already described, but enclosed in a tight box, the sides of which are made like Venetian blinds. By opening these shutters, more or less, the organist can allow the whole sound to emerge, or can confine it, and so deaden it in the closed case. The electro-melody organ is an entirely novel invention of Mr. Roosevelt, of which it would be hardly possible to convey a clear idea without engravings. It is, as we have stated, a separate little organ by itself, and is designed to carry the notes of a melody or air, in a tone easily heard above the accompaniment, and so prove very useful in congregational singing. It is connected to the upper half of the key boards, and with a Leclanché battery. Each key, on being pressed, establishes a current which magnetizes an electro-magnet and so opens the valve of the proper pipe. The peculiar point, however, lies in devices which prevent any but the upper or melody note being heard. Thus, if we strike the chord C E G C, the upper C alone could be heard, if we allowed that note to rise, then only the G, and thus throw out any number of tones. This invention is highly ingenious, and though really very simple, quite difficult to solve at first sight.

There are many other appliances which we may briefly notice in conclusion. Among them are four couplers, by which the pedal, great, and swell organs are connected, as may be desired, by a mere pressure of the finger of the organist on a button just above his key board. There are besides, five combination pedals, for drawing out the full power of the instrument, or full or part power of each integral portion. Then there is the usual tremolo arrangement, and various other refinements, which, though interesting to the musician, might fail to be appreciated by the general reader.

One of the most interesting applications of electro-magnetism, it may be remarked, is to the church organ, and we are aware of instances of its use to much larger extent than in the electro-melodic sub-organ noted above. In fact, one of the principal churches in this city has two complete organs, one being on each side of the chancel, and entirely distinct from the other. A single keyboard communicates directly with one, but operates the other by the electric current and magnets acting on the valves; so that if desired, the choir may be divided, half on each side, and yet both parties be enabled to sing in correct unison with the instrument. There are other points relating to organ improvements and manufacture, which space prevents our here dwelling upon, and to which we shall allude at an early date.

The Balloon Advertising Dodge Rejected.

The Commissioner of Patents has rejected an application for a patent for the broad idea of attaching advertisements to balloons, for the reason that a balloon is a common object, upon which every person has the right to stick or paint advertisements if he wishes. In order to support a patent, the applicant must have invented something. It is not invention merely to put advertisements on balloons.

BARROW IN FURNESS, LANCASHIRE, ENGLAND.

The enormous development of the iron trade, which has taken place in the last twenty years, has been as noticeable in England as in this country. In this time the whole district of Middlesbrough has come into existence as an iron field, the works in the neighborhood of Glasgow have been increased with astonishing rapidity; and on the west coast of Lancashire, a new town has lately sprung up, which, from the extent and quality of its production, is as remarkable as either of the other industrial centers.

The Cumberland iron ores, which abound in the neighborhood of Barrow, had been but little worked previously to the establishment of Mr. Bessemer's system; but they are now found to be the mineral particularly adapted for the production of Bessemer metal, or "low steel," as it is sometimes called. This fact, and the enterprise of many local manufacturers, aided by the capital of two territorial magnates, have created a town, which, in 1847, had a population of 325, which commenced its corporate existence only in 1867, and now has 30,000 inhabitants and produces 5,000 tuns of metal, chiefly steel, weekly. On the opposite page we give a birdseye view of this interesting and important town.

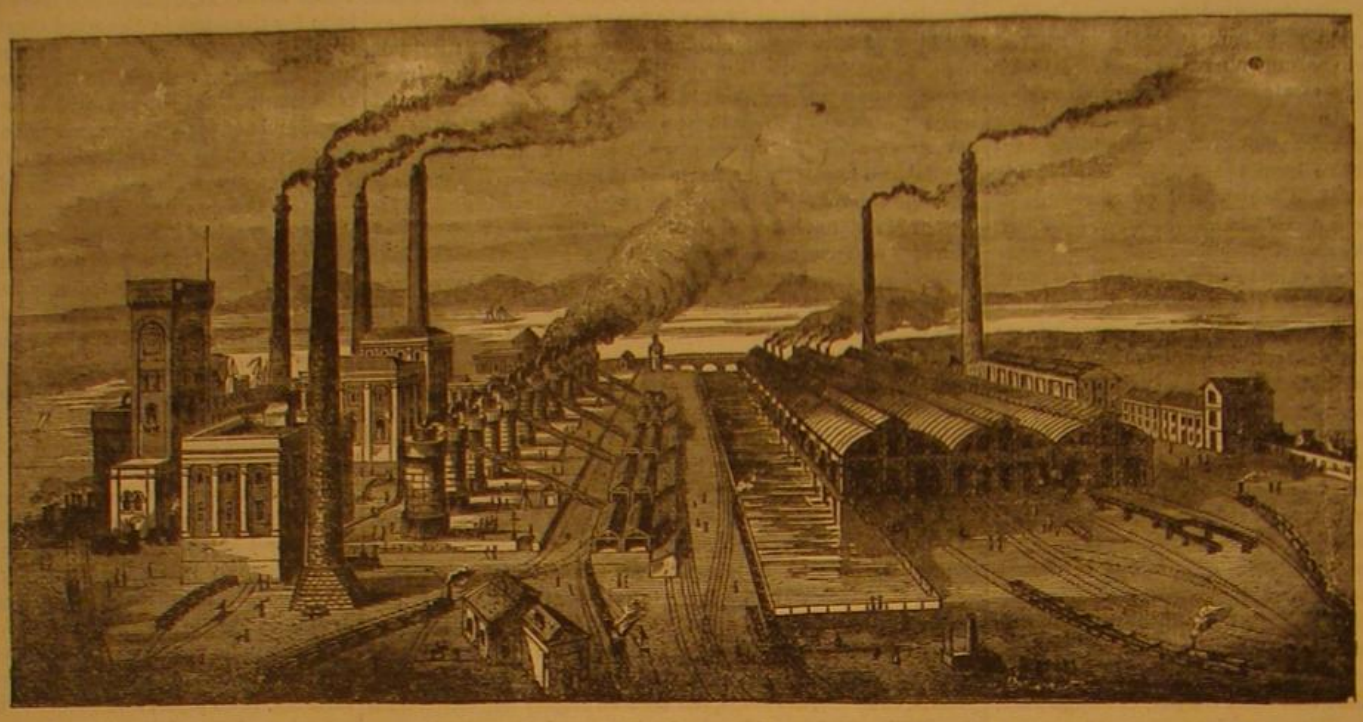


Fig. 1.—BARROW HEMATITE STEEL WORKS.

In 1864, Mr. James Ramsden, manager and secretary of the Furness Railway Company, projected and formed the Barrow Steel Company, which erected large works for the purpose of converting the produce of those furnaces into Bessemer steel, and then manufacturing the valuable material into rails, axles, tyres, and the other hundred forms in which Bessemer steel is now used. It very soon after became apparent that the two operations of smelting the ore and converting it into steel were so nearly allied in interest as well as in locality that an amalgamation was proposed between these works and those owned by Messrs. Schneider and Hannay, and was effected in 1866 under the title of The Barrow Hematite Steel Company (Limited). The Duke of Devonshire became chairman, and Mr. Ramsden managing director, and it was virtually only an offshoot of the original enterprise of the railway company. They now possess twelve blast furnaces complete, and in connection with these one of the largest Bessemer steel works in the world. These twelve furnaces stand close to the sea shore, being arranged in one straight line, but forming two groups of different sizes. The slag is tilted direct into the sea, and has already given a large increase of land on the sea side, upon which whole series of stores, workshops, and other accessory buildings, have been erected. For the present weekly production, the quantities of 10,000 tuns of ore and limestone and about 5,000 tuns of coke are needed. What would poor Dud Dudley (asks the *Practical Magazine*, from which we extract the engravings), who first introduced the use of coal for smelting purposes into England, have said to this, when, scarcely more than 200 years ago, he writes complainingly: "Some of the now going Furnaces with Charcole do make two or three Tun of Pigg or cast iron in 24 hours. . . . which quantity of cast iron, with pit cole and Sea cole at one Furnace I desire not but am contented with half the proportion!"

The Barrow steel works, shown in our Fig. 1, are the largest Bessemer steel works in Great Britain; and the company own several productive mines. It is believed that their profit in 1872 was not much under $3,750,000.

At the time Mr. Ramsden was first mooting the idea of the steel works, his mind was engaged also on an undertaking of but little less magnitude and utility, namely, the formation of such docks as should make Barrow altogether unrivalled as a seaport town on the large seaboard between Liverpool and the Clyde. The construction of two large docks was commenced in 1864. They were formed simply by inclosing the channel separating the town from Barrow Island by an extensive quay, forming the dock wall on the main land side. The cost of actual formation was, owing to the natural facilities of the site, only $1,000,000. All these enterprises had given an immense impetus to the growth of the town. Private enterprise has not been slow in utilizing the advantages of the new docks. There is a line of ocean steamships from Barrow to Montreal, and another between Barrow and Rotterdam. Timber is imported at the rate of one hundred cargoes annually.

The Devonshire dock is thirty acres in extent, the Buccleugh dock thirty-three, and outside of this latter there is a splendid timber pond. The entrances are sixty feet in width, and the depth of water maintained twenty-two feet. The stone quays are one and a half miles in extent; the wharves adjoining, one hundred acres, while there are at least ten miles of railway sidings. Cranes and capstans worked by hydraulic power were supplied by Sir William Armstrong, and the original warehouses, having a floor area of 17,000 square yards, have more recently been augmented by the erection of a gigantic warehouse by the side of the Devonshire dock, divided into two blocks, each block five stories in hight, and each possessing a floor area of 5,000 square yards, the two being separated by a glass-covered transit shed.

It was thought that some employment should be afforded to the numbers of women and children who congregated idly and uselessly in a town where employment had only been provided for the male members of the community. With a view of opening another branch of industry, Mr. Ramsden, towards the close of 1869, matured plans for the Barrow Flax and Jute Company (see Fig. 2), having for its object the erection of works at Barrow for the purpose of spinning and weaving flax and jute, and the manufacture of coarse cloths, sacking, bagging, wrapperings, etc. The scheme was soon successful, and at present the mills, employing some fifteen hundred hands, form one of the most conspicuous architectural ornaments of the town. Business reacts upon business, one trade upon another, and the establishment of this manufactory has now a very beneficial effect upon the commercial interests of the port. The company have for some time regularly imported their own jute direct from India, and are about to establish a regular service from Calcutta. Dundee must look to it, or it will needs have to take ashes with its sackcloth.

Fig. 2.—BARROW FLAX AND JUTE MILLS.

The year in which the jute mills were regularly opened for business also saw the establishment of another large industry, scarcely inferior to the steel works in outlay or ambition. This was the Barrow in-Furness Iron Shipbuilding Company; and in this, as in all the other enterprises, Mr. Ramsden was the leading and directing spirit. The company secured a large tract of land on Old Barrow Island, admirably adapted for launching purposes; while on the Devonshire dock side, the site was immediately connected with the railway system. There is here accommodation for the construction of from twelve to fifteen vessels at one time. A graving dock is now in process of completion, which will afford the company the means of making repairs in a more substantial manner than was hitherto possible. These works already employ more than two thousand hands, and will, when in full movement, demand at least six or seven thousand men. The company have already contracted with the Barrow-in-Furness Ocean Steamship Company for six first-class steamers, each of which will be about 400 feet in length, of 4,000 tuns burthen, and 500 horse power. They are also building five steamships for the Ducal line of steamers trading to India, Ceylon, and the East generally, the inauguration of which line has taken place so recently and so successfully. These vessels will be about 380 feet long, 38 feet beam, and 26 feet depth of hold, 500 horse power, and 4,000 tuns burthen.

Corn mills, rolling stock factories, railway shops, newspaper offices, theatres, bath houses, a yacht club, and other indications of rapidly increasing population and public spirit, have followed. The public baths were built by Mr Ramsden at his own expense, and presented to the town.

A stroll through the works and streets of Barrow gives one as true a picture as may be of a teeming hive of modern industry. "Not 'arms and the man,' but tools and the man, is the true epic of modern times!" says Mr. Carlyle; and here we have the very nursery of tooldom. Tall chimneys all around us, with their clouds of black, dense smoke; huge furnaces pouring out by day and night their wealth of fiery molten iron; the heavy thud of the steam hammer; the sharp, ringing clangor of conflicting metals; the perpetual puffing and whistling of the locomotives, and the rattling of the railway wagons laden with hematite and coal. These, and more than these, tell us something of the power and the achievements of the Age of Iron.

A New Exploration of the Libyan Desert.

Two baggage wagons recently passed through Leipsic *en route* to Trieste, the enormous hight and unusual appearance of which attracted general attention. They were destined for the expedition which has just begun the arduous labor of exploring the great Libyan desert. Among other odd fittings, the two vehicles carried some five hundred empty iron boxes, intended for water tanks. Each vessel is enameled inside and has a capacity of about fourteen gallons, so that a supply can be transported, sufficient to render the travelers independent of the casual finding of wells or springs.

The Viceroy of Egypt, it is understood, is to defray the expense of the expedition, and this in addition to the large sums, amounting to some $500,000 yearly, which he has given for some time past to aid the labors of Sir Samuel Baker, the German traveler Schweinfurth, and the zöologist Hoekel. As to results, it is probable that our geographical knowledge of the eastern portion of the Desert of Sahara will be materially increased, and that the characteristics of an untraveled portion of the globe, as large as the whole of central Europe, will be made known.

The party left Egypt during the beginning of December, starting for Tarafieh. The objective point is Koufra, in the center of the desert, which, it is expected, will be reached by the last of January.

Preserving Brickwork.

The exclusion of damp from brickwork has long been an important problem with builders. It is stated that one of the most effective methods of accomplishing this object is the following: Three quarters of a pound of mottled soap are dissolved in one gallon of boiling water, and the hot solution spread steadily with a flat brush over the outer surface of the brickwork, care being taken that it does not lather; this is allowed to dry for twenty-four hours, when a solution, formed of a quarter of a pound of alum dissolved in two gallons of water, is applied in a similar manner over the coating of soap. The soap and alum form an insoluble varnish, which the rain is unable to penetrate, and this cause of dampness is thus said to be effectually removed. The operation should be performed in dry settled weather.

Another method is to use eight parts of linseed oil and one part of sulphur, heated together to 278°, in an iron vessel.

Fig. 3.—BIRD'S EYE VIEW OF BARROW-IN-FURNESS, LANCASHIRE. ENGLAND.

THE NEW EXPLORATION OF THE AMAZON RIVER, BY PROFESSOR ORTON.—OVER THE ANDES.

No. 5.

ROUTES FROM THE AMAZONS TO THE PACIFIC.

Three routes are open to the traveler from the Marañon to the Pacific: 1st. Up the Huallága to Tingo Maria, a canoe voyage of a month or more, thence to Lima by mule *vid* Huanues and Cerro de Pasco. 2d. Up the Huallága from Yurimaguas to Chasuta by canoe, eight days, thence by mule to Moyobamba *vid* Tarspóto, one week. 3d. From Yurimaguas by canoe up the Parana-pura to Balsa Puerto, one week, thence on foot through the forest to Moyobamba, six days. From Moyobamba to Cajamorca, *vid* Chachapoyas, is a mule ride of twelve days; and a railway, nearly finished, comes up from the coast within one day of Cajamorca. The time here given is that of actual travel, but the delays in procuring canoes, peons, and mules more than double it.

We chose the Balsa Puerto route. Whichever route the traveller takes, he wishes he had taken another. We left Yurimaguas in a long canoe with five Indians, providing them with salt fish, plantains, and chicha, and ourselves with more civilized food, for a six days' journey. Descending the Huallága a short distance, we turned up the Parana-pura, one of its main affluents. The first day we had a comedy which might have been a tragedy. Our old "popo-ro" or steersman fell overboard, dead drunk; another Indian tumbled out twice for the same reason, and a third dropped down into a heap in the canoe. A cold bath and a long sleep brought them to, and we had for the rest of the voyage an efficient crew.

A POLAR EXPEDITION AT THE EQUATOR.

Paddles were of no use on the rapid Parana-pura, our Indians—four in front and the comical genius behind—poling the whole distance; and every night we camped on the sandy beaches, called "plaias," under palm booths. A few pueblos break the solitude of this river. At Lemón is the spacious residence of Mons. Jules Juan, built of chonta slats and surrounded with a great variety of tropical fruit trees. Here, too, on the edge of the forest, we found another Frenchman, who amuses himself in tracing correspondences between the Quichua and Sanscrit languages. He is the author of *Amérique Equatoriale*, published in Paris, in which he styles himself "Don Enrique Vte. Ouffroy de Thoron, *Ingénieur, Emir du Liban par acclamation générale en* 1840, *Ancien Commandant ou Chef des Maronites, et Chef d'Etat, Major Generale de l'armée Turco-Maronite sous le Grand Vizier Izzet Mahomet-Pacha, Vice Roi de Syrie et d'Egypte.*"

Ascending the tributary, Cachiyácu, we passed two large distilleries, provided with the finest apparatus we have seen in the country. On the sugar mills we saw the well known names of "Mirelees, Tait & Watson, New York." We arrived at Balsa Puerta, six days from Yurimaguas. This little village of four hundred Indians, dwelling in nailless bamboo huts, that went up without the sound of a hammer, is the chief port of Mayobamba. It manufactures nothing, and the state of society is expressed in fandangos by night and in street fights by day. During our stay, ten of the chief men sat down before forty-seven bottles of porter, and soon after we saw the drunken governor, Antonio Rios, knocked down twice before his own door. With such an official to aid us in obtaining peons to carry our baggage to Moyobamba, we were detained five days. The second day out, one of the Indians dropped his load and decamped, and two others afterward followed suit.

A TRAMP THROUGH THE FOREST.

Procuring others, we continued our toilsome journey on foot, picking our way through the thick forest, climbing over precipitous mountains, and wading across the furious Cachiyacu and its tributaries seventy-five times. The road, notwithstanding the expenditure of $200,000 upon it, is nothing but a foot path, and after a rain impassable; but it is the paradise of the botanist and entomologist. The geologist also finds employment, for he crosses the lofty Cerro de Icuto, consisting of saliferous red sandstone; while the streams bring down from some unknown source fragments of fossiliferous limestone, containing ammonites, brachiopods, etc. The sandstone appears to underlie immediately the Amazonian clay formation.

Nineteen days from Yurimaguas, we reached the city of Moyobamba. The situation of this city is surprisingly fine, built on an isolated plateau that stands in the midst of a luxuriant plain, through which winds the turbid Mayo, and around which rise picturesque mountains—the worthy beginnings of the Andes. With an altitude above the sea of 2,500 feet, and a mean annual temperature of 77°, the climate is delightful. Nature is so prodigal that anybody can get a living—except physicians. The oranges of Moyobamba are equal to the best Guayaquilian; while the coffee and cacao are praised in Lima. The ordinary ills, all due to imprudence, are intermittent fever, erysipelas, and worms. The only case of drunkenness we have seen was that of a priest. We visited two mineral springs in the vicinity. One is a hot spring, slightly ferruginous, the temperature of which we found to be 106°, that of the air being 75°. On the slope of the Cerro, about three miles from the city, is a copious sulphur spring, forming a little lake thirty feet in diameter, with a temperature or 84°. Were this brought down to the city, and respectable roads made to Huallága and to the coast, Moyobamba would become the Saratoga of the south. At present, the city is poorly supplied with water, all coming from a few feeble springs at the foot of the plateau. It is a novel sight to see the long procession of women, who are the water carriers of the city, descending and ascending the deep barrancas at eventide, with pitchers on their heads, while the young Lotharios lie in wait to make love to their Rebeccas.

Transportation to and from the city is difficult beyond description. Nearly all exports and imports come from or go to the east; and everything must be carried on the backs of Indians over the horrible Balsa Puerto road and in canoes on the Parana-pura. The Indians do not care for money; so that when a traveler or merchant wishes peons, he notifies the governor, through the sub prefect, who orders the police to seize such as they can find and compel them to bear the burdens. The route to the coast *vid* Chachapoyas and Caxamarca is traveled by mules, but these are difficult to hire. There are no duties on foreign goods entering Peru by the Amazons; but the freight is enormous, the loss on liquors being two hundred per cent and on other goods twenty-five. A box of flour from the United States weighing 80 lbs. sells for twenty-two soles, or thirty cents a pound; while a roll of bread weighing three ounces costs ten cents. English butter is worth one dollar a pound; Colgate's soap, of which 6,000 lbs. are used annually, brings 50 cents a pound, and iron, of which 500 lbs. are sold yearly, sells from twenty to forty cents a pound. Beef comes from Chachapoyas, and is sold for ten cents; cattle are kept in the surrounding chacaras, but neither for beef nor milk, but for the pleasure of owning them. A few sheep are raised, but solely for meat, not for wool. Of home productions, pork is worth twenty cents; lard, thirty cents; coffee, $2 an arroba; tiles, $50 a thousand; brown sugar ("chaucaca"), five cents, refined, twenty-five. There is not a plow in the whole province; but almost everything that is planted yields beautifully in three months. August is the usual time for planting. Coffee, cacao, rice, maize, mani (peanuts), oranges, pine apples, bananas, and sugar cane are grown, but only for home consumption. Grapes (a small black kind), sarsaparilla, vanilla, rubber, and copal, grow spontaneously, but are not gathered. Abundance of fine timber (especially cedar and "moyna") covers the slopes of the cerras, with plenty of water power at hand; but there is neither a saw mill nor a chimney west of Iquitos. The Moyabambinos, 9,000 in number, are content to dwell in mud hovels, tiled or thatched. Boards are cut out with Collins' axes, 10,000 of which are sold annually; the only fault found with them (by the merchants) is that they are too good and last too long. The value of a day's work, from six to six, is twenty cents and food, or $5 a month. There are seven foreign merchants in Moyobamba, of whom Mr. Sisly, the chief, has sold as much as $40,000 worth of goods in eight months. Trade at present is very dull, as the hat business has declined.

The Department of Loreto, of which Moyobamba is the capital, stretches from the eastern cordillera to Tabatinga, and has a population of 60,000. The main villages west of the Huallága are Tarapóto (8,000), Lámas (6,000), Chasúta (1,500), and Jevéros (1,000). The main exports are straw hats, tucuyo (coarse cotton cloth), salt, aguardente, tobacco, beans, coffee, and limestone. The tucuyo is made in Tarapóto for the Indians solely; and an imitation is now manufactured in England, which sells at the same price (twenty cents) and is preferred by the natives. It takes six days to spin one pound of cotton thread, and eight days to weave one yard of tucuyo. The principal salt mines are at Callana-yacu, near Chasuta, Pillnana, and Cachi-yacu, near Balsa Puerto. They are situated in red sandstone, along with gypsum, and supply the whole Marañon region. Aguardente is made wherever the sugar cane grows. The best tobacco comes from Jevéros; and limestone boulders from up the Huallága are shipped from Yurimaguas at $40 a tun.

MOYOBAMBA AND THE MANUFACTURE OF STRAW HATS.

But the great business of Moyobamba and the surrounding villages is the manufacture of "straw" hats. These are made of the same material as the so-called Panama hats of Ecuador and New Grenada. It is the undeveloped leaf of the "bombonáje" (*carludovica palmata* of science), which is a screw pine rather than a palm. The trunk of this plant is only a yard in hight, but the leaf stalks are two yards in length. The bark of these leaf stalks is woven into baskets, and the expanded leaves are used for thatching. It is the leaf before it has opened that is prepared for the manufacture of hats. It then consists of a bundle of plaits about two feet long and one inch in diameter. The green outside of this "cogollo" or bunch is stripped off; and then by an instrument called a "picadera," resembling a pair of compasses, with legs set half an inch or less apart, according to the fineness of the straw required, the leaflets are made into strips of uniform size with parallel sides. The cogollo is then boiled to toughen the fiber, and hung up in the sun to dry and whiten, when the leaflets run up into cordlike strands, which are then ready for use. The longest straw which can be procured from the bombonáje is twenty-seven and a half inches. It takes sixteen cagollos for an ordinary hat, and twenty-four for the finest; and a single hat is plaited in from four days to as many months, according to texture. We saw a fragment of one begun which, if finished, would bring $500 in Lima. Fortunes have been made in the hat trade; but a change of fashion in Brazil, Europe, and the United States has reduced the number exported from 100,000 to 50,000, and the price from $40 a dozen to $15.

But Moyobamba is as famous for its execrable roads as for its hats. The traveller who survives the journey from Moyobamba to the Amazons or the Pacific will remember the road longer than the city. Three regions intervene between the Great River and the Great Ocean: the Montaña, extending from the Huallága to Chachapoyas; the agricultural valley of the Upper Marañon; and the mining district between the western cordillera and the coast. The lower part of the Montaña is covered with a rich forest, but from Moyobamba westward the road, or rather mule path, for the most part winds over boggy valleys, bleak paramos, and barren mountains. The distance from Moyobamba to Chachapoyas is forty leagues; for one hundred miles of which on a stretch, there is not an inhabitant, so that the traveler must carry bedding and provisions and sleep in cheerless tambos.

CROSSING THE CORDILLERAS.

The highest point on the road is the Puna Piscognañuni (meaning "the place where the birds die"), rising 11,000 feet above the sea. Geologically, it consists mainly of black slate, in which we discovered hosts of ammonites. It is this range which divides the waters of the Upper Marañon from the affluents of the Huallága, and which, meeting the more westerly *sierra*, forms the terrible cataracts above the Pongo de Manseriche.

Ascending and descending many a rocky staircase and winding through a deep and picturesque ravine beside the rushing Ventilla, and between towering treeless mountains of red sandstone, the weary traveller suddenly and as gratefully finds himself in the city of Chachapoyas, of which I will speak in my next.

JAMES ORTON.

Improvement in Diving Apparatus.

An interesting series of experiments has been carried out in the Medway, off Chatham dockyard, by the officers and men of the Royal Engineers, under the direction of Major E. D. Malcolm, the head of the torpedo department of the School of Military Engineering, for the purpose of testing the merits of an invention by Mr. Maudlin Vinter, for enabling divers, when employed at any depth, to hold conversation with those at the surface of the water. Hitherto an insuperable difficulty has been experienced by divers, in being unable to communicate verbally with the attendants above, the principle usually adopted by divers when carrying on their operations being to give preconcerted signals by so many pulls on a single line. This, however, according to *Engineering*, appears to have at length been overcome by Mr. Vinter in the invention submitted by him to the Government. In the trials just completed in Chatham Harbor, Corporal Falconer, an experienced diver of the Royal Engineers, equipped in the Siebe and Gorman improved diving apparatus (which has gained the prize medal at Vienna), made the descent; and during the whole time he was under water was enabled, by means of the new apparatus, to converse freely with those above, every word spoken by him being distinctly heard and understood. Mr. Gorman, who was present during the experimental trials, stated that the invention would be further improved upon so as to facilitate its use in all diving operations connected with harbor works, and for laying stone blocks, etc., in connection with subaqueous operations. The apparatus can, it is stated, be easily applied to any description of diving dress. The value of the invention will be readily understood and appreciated by every one interested in the science of diving, from the simple fact of the great confidence a diver will gain from being, in his isolated position, enabled to speak directly to those in whose hands his life, for the time being, is literally placed.

Tilghman's Sand Blast.

Some new and interesting applications of this invention were lately described at a meeting of the students of the Polytechnic College, Philadelphia, Pa:

Samples of raised lettering on marble, also of ground uncolored and of stained glass ornamented by the process were exhibited. Samples of thick plate glass, perforated by the sand blast with well defined holes ¼ inch in diameter, were shown. The holes for the axles of the glass plates of electrical machines can be safely cut in this way.

The lettering of the block of marble had been done by first grinding and polishing one of its surfaces, attaching the stencils (letters of the size and shape required cut out of plate metal), and then blowing sand, by means of a jet of steam, on the surface, until, where unprotected by the stencils, it is cut away to the required depth, leaving the letters in bold relief. The stone to be cut is placed upon a small struck, and then removed backward and forward upon a horizontal table, directly under the nozzle through which the sand is blown. The nozzle, which stands vertically over the table, has the pipe for the sand, entering the upper end, passing in the line of its axis, towards its lower opening. The pipe from the steam boiler enters through the side of the nozzle near its upper end, so that, when in operation, steam surrounds the tube through which the sand runs. The latter is connected by a rubber pipe, with a box of sand set about it. The machine is in operation daily at the stone yard of Messrs. Struthers & Son, who are cutting by the sand blast the sculptured design on the blocks of Cleveland stone for the walls of the grand staircase leading from the entrance hall of the new building for the Philadelphia Academy of Fine Arts, now erecting on Broad street. The design on each stone is about 20 inches by 10 inches, representing foliage, and is cut to the depth of five eighths of an inch in ten minutes. When cutting glass, the sand is compelled by a current of air from a reservoir, kept under pressure by a small blowing engine. In such a case, the stencils need not be of metal. Rubber, and even thin muslin, will protect the glass.

ELECTRICAL GAS REGULATOR.—Mr P. Munzinger, gas engineer of the Pascal Iron Works, Philadelphia, Pa., has devised a system whereby the flow of gas from the works into the mains can be regulated and controlled automatically by establishing electrical connections between any point of the gas main and the works where the gas is manufactured.

DECISIONS OF THE COURTS.

United States Circuit Court---District of Massachusetts.

BENJAMIN J. GREELEY, COMPLAINANT IN EQUITY.

In the matter of Benjamin J. Greeley, for patent for IMPROVEMENT IN SUSPENDER STRAPS.—*Decided December* 14, 1873.

In two devices—each being a combined button hole and link—where the same elements, in the same relations, enter into the same combination, and operate in the same way separately, and as a combined device, the devices are the same.

Where the opening for receiving the button in each device was longer than the diameter of the button, the fact that in one the opening was elongated in a direction at right angles with the link, and in the other in a direction parallel with the link, was held to be a mere structural change.

Structural changes of form and proportion, although they improve the operation and produce a much better result, yet one of the *same kind*, are only different and better forms of embodying the same idea, and illustrate the difference between mechanical skill and inventive genius.

SHEPLEY, *J.*

This is an application for a patent for an alleged improvement in suspender straps. The application was filed in the Patent Office September 13, 1869, with two claims which were rejected. On December 16 they were withdrawn and two others presented in lieu of them. These were rejected and withdrawn, and on the 23d of February, 1870, the present claims were presented. These claims were rejected by the Examiner February 28, and, on appeal, by the Board of Examiners April 27, and by the Commissioner on appeal from the Board, September 17, 1870, and by the Supreme Court of the District of Columbia, on appeal from the Commissioner May 3, 1871.

The bill in equity in this case is filed under the provisions of the fifty-second section of the act of July 8, 1870, and is virtually an appeal from the decree of the Supreme Court of the District of Columbia rejecting the application for the patent.

The English patent of R. A. Brooman, granted in 1861, was cited in the references on the record.

The device of Greeley has, first, a link for attachment to the web; second, an enlarged body of the device for the insertion of the button; third, the loop at the bottom for retaining the button. Each one of these stands in the same relation to the others and performs the same function in Greeley's as in Brooman's device. The same elements enter in the same relations into the same combination, and they operate in the same way, separately, and as a combined device.

The Court held that the differences between the two devices are merely structural changes. Such structural changes of form and proportion, although they improve the operation without changing the mode of operation, and produce a much better result, but one of the same kind, are only different and better forms of embodying the same idea, and illustrate the difference between mechanical skill and inventive genius.

The complainant's device as a combined device is not a novel one, but possesses the same elements operating in the same way to produce the same result, and is not patentable.

Bill dismissed.

[*J. E. Maynadier*, for complainant.
Marcus S. Hopkins, for Commissioner of Patents.]

NEW BOOKS AND PUBLICATIONS.

THE WORKSHOP for December contains a continuation of the paper on the "Vienna Exhibition in Connection with Art Industry." There are a number of fine wood engravings, of original designs in silver ware, frescoing, etc., together with hints and short paragraphs useful to the decorative artist. This magazine deserves much praise for its excellent typography and the constant variety of beautiful representations of the best productions of European industrial artists which it sets before its readers. Each number contains a large sheet of working drawings, from which many of the handsomest designs may be reproduced. Published by E. Steiger, Nos. 22 and 24 Frankfort street, New York. Subscription price, $3.40 per year.

PURIFYING MIDDLINGS is a subject which is now attracting considerable attention among millers in this country. Mr. Allen, an acting assistant examiner in the Patent Office, has published a small book, giving photo engravings, and the claims of existing United States patents and a brief digest of some foreign patents. Price $25. Address all communications to DeWitt C. Allen, Room 97, Patent Office, Washington, D. C.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From November 28 to December 8, 1873, inclusive.

FINISHING FELTS.—J. F. Greene, Brooklyn, N. Y.
FLASH LIGHT SIGNAL.—Rev. J. C. Nobles, Elmira, N. Y., *et al.*
FORMING PIPE COUPLINGS.—M. Blakey, Etna, Pa.
GRINDING CYLINDERS, ETC.—J. M. Poole, Wilmington, Del.
HORSE COLLAR.—J. Heywood, Michigan.
HULLING MILL.—V. Winters, Dayton, Ohio, *et al.*
LAWN MOWER.—W. Sellers, Haverhill, Mass.
MEN'S DRAWERS.—J. J. Fitz Patrick, Philadelphia, Pa.
PRESERVING WOOD.—C. P. N. Weatherby (of New York city), London, Eng.
PRINTING PRESS.—J. T. Ashley, Brooklyn, N. Y.
PRINTING PRESS FEED.—J. T. Ashley, Brooklyn, N. Y.
ROLLING MACHINERY.—J. J. Williams, Pittsburgh, Pa.
SHIP'S ARMOR.—J. T. Parlour (of Brooklyn, N. Y.), London, England.
STITCHING BOOKS.—E. D. Averell, New York city.
STRETCHING HAT TIPS.—J. Sheldon (of N. Y. city), Edgley, Cheshire, Eng.
TUCKER.—Z. Bouillon, New Orleans, La.
WELDING IRON ETC.—J. Popping, New York city.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office; men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office; enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*.

This 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, Drawing, 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.

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Improved Extensible Brace for Supporting Trenches.

William Reilly, Newark, N. J.—This brace is designed as a substitute for the wood braces now used to stay the banks of deep cuts for sewers and the like and it consists of a couple of strong screws screwed into a center piece from opposite directions, and having a large head, which are screwed in opposite directions against the sides of the bank so as to be adjusted, as to length, for ditches differing considerably in width.

Improved Package for Granulated Tobacco.

Goldsborough Robinson, Louisville, Ky.—This invention relates to the material which is employed to form wrappers for smoking tobacco, and consists in the application of the leaves of corn shucks for that purpose. Around the usual jacket or packet in which the cut tobacco is placed, a series of leaves are wrapped spirally, the second binding the first and the third the second. They are folded over at the ends, provided with a tie ribbon, and then sealed at each end. The leaves of the corn shuck possess a water-repellent property and a flexibility which make them even preferable to paper, foil or cotton.

Improved Gas Cock.

Eugene M. Morris, Baltimore, Md.—This invention relates to the gas cock which conjoins the meter and service pipe of a building, and consists in novel means of insuring a perfect drip of the water which remains after the gas is shut off and which results from condensation of aqueous vapor. As soon as the valve is closed in order to shut off the gas, any liquid in the valve chamber immediately descends through a tube into the drip vessel, whence it can be drawn off at suitable intervals by the removal of the screw. By this device there is no opportunity afforded, to the matters held in solution by water, to remain in the valve chamber and make a deposit which will work in between the tube and bottom, or for the water in the bottom of the valve chamber to freeze about the tube.

Improved Plastering Machine.

Gustavus Stevens and James H. Watson, Tawas City, Mich.—This invention relates to plastering the walls of buildings, and consists in a machine so constructed and organized as to lay on and spread the mortar at one operation, thereby greatly economizing time, doing the work uniformly well, and greatly lessening the ordinary cost.

Improved Grain Cleaner.

William Houghton, Great Grimsby, England.—The grain is supplied to a first separator sieve, which retains all stones or matters larger than the grain, whence it passes on to the second separator, which removes loose dust and small seeds, both separators being mounted and operated from a crank, in the ordinary manner. The grain passing over the second separator is delivered through a chute into a spout, whence it meets an upward current of air, which, passing through it as it falls, removes any loose smut balls and other light impurities before the grain enters the scourer. The air current carries the impurities into the upper exhaust box, in which a curtain is placed, together with a damper, which may be closed, more or less, as required, to cause the heavier particles to be deposited in a box, while only the very light dust is carried on to the fan. The grain being fed to the scourer is subjected to the action of the beaters, which throw it off against the steel clothing of the cylinder, whereby the adhering smut is detached, the resulting dust being carried away by the air draft through the perforations in the cylinder to the fan by side passages. The grain gradually passes down through the scourer to the bottom, whence it escapes by the exit, which carries it into a second exhaust spout, where, as it falls, it is again subjected to a current of air, whereby the remaining impurities are separated and carried upward into a second exhaust box, in which the heavier particles, consisting principally of unsound grain, are deposited, the remainder passing on to the fan. There is a spout through which the grain is passed directly into the exit when it is desired only to separate and clean it without subjecting it to the action of the scourer, and a valve which closes the passage to the scourer and opens said spout.

Improved Machine for Riving Shingles.

Charles Shelmandine, Jefferson, N. Y.—The object of this invention is to provide a machine by which shingle, stave, and heading bolts can be rapidly and economically rived into blanks; and it consists of two or more sets of movable knives or blades, a set of stationary ones, and a movable table, and operating devices for the table and the movable knives, all combined and arranged so that a bolt put on the table under the knives will be forced against the stationary knives and split on the sides to remove the spalt; then a set of movable knives will move down and split the block into two or more pieces; and then the next set will operate in the same way, and complete the operation by successive actions, which are necessary in order that the knives will not bind in the block, as they would if the whole gang were forced through it simultaneously.

Improved Harvester Rake.

Edward Lippoldt, Brighton, Ill.—The main features of the rake, its form and manner of operation, do not differ from rakes already in use, and the invention applies exclusively to the rake arm, which is made to sweep over the apron of the machine in the usual manner. The common rake arm is ordinarily so rigid that it is very liable to be broken, and thereby occasion trouble and delay. This difficulty is remedied by making it in two parts and connecting the parts together by a hinge, a wing being attached to one part. A spring bar bears against the wing, and a bow spring rests against a projection in the hinge. When the arm is forced back by the strain upon it, it is forced against the power of the spring, and the back motion ceases when the spring becomes straightened, so that its center strikes the spring bar. When the pressure against the arm ceases, the spring bar throws it to its normal position.

Improved Safety Pocket Attachment.

Richard L. Russell, Brooklyn, N. Y., assignor to Joseph W. Robbins, who may be addressed for information concerning the purchase of rights, P. O Box 830, New York city.—This invention consists of a little spring-actuated hook combined with thin plates of metal, having a round notch in the edge so that a watch chain, dropping into the notch when the hook is pushed back, will be confined in said notch by the hook when let go. The plates are adapted to be sewn or otherwise fastened to the pocket lid of a vest or other side pocket, so that the chain will naturally drop into the notch when the watch is put in the pocket, and thus be secured. The watch cannot then be pulled out without attracting the notice of the owner. Any other object—say, a pocket book—may be secured the same way by being attached to the chain. The device is also useful for fastening the pantaloons pocket in connection with a short chain, the latter being connected to the pantaloons, by one end, at the top of the pocket, and the end with the button being fastened in the notch of the plate by the hook, said plate and hook being fastened in or on the lid of the pocket. A little projection of the hook rises up through or above the pocket lid sufficiently to apply the thumb or finger so as to push it back readily when it is desirable to release the chain to get the watch or to open the pocket.

Improved Fire Extinguishing Water Pipe Attachment.

Thomas Miller, New York city.—This invention consists in attaching climbing pins to the standing pipe of a building so as to make it available for a fire escape. They may either be tapped directly into the pipe, or into collars, clamped on.

Improved Refrigerator.

Erastus S. Root, Providence, R. I.—This invention is an improvement in the class of domestic refrigerators in which the food chambers are arranged around a central ice or cooling chamber. The improvement consists in the construction of the cooler, to be placed within the ordinary rectangular tin lined box, and which has a central space provided with shelves and surrounded by a concentric chamber which is filled with small lumps of ice. This chamber is partly surrounded at its upper half by the other segmental concentric chambers, which are also filled with lumps of ice. The inner chamber serves mainly to keep the central space cool, besides cooling with its lower surface the outer box, while the upper segmental chambers are more especially designed to keep the box at the required temperature.

Improved Railway Switch.

William A. Slingerland, New York city.—One pair of short tracks has switch rails pivoted at one end, and frogs placed at the other; and another pair of tracks has the switch rails at one end, and the frog rails at the other; while a third pair of tracks has switch rails at one end, and turned frog rails at the other. These three switch rails are all pivoted on the same stationary plate and a movable one in the usual manner. By placing these parts in this relation to each other, every train moving one way is compelled to take the middle rails, which always connect with the main or side track while a train moving in the opposite direction from either track will pass to frog rails or the turn in rails: hence, under no circumstances can a train, it is claimed, be accidently thrown from the track by the carelessness of the switch tender

Improved Adjustable Hat.

I. Ygnacio Canstano, San Antonio, Texas.—To the hat, of any approved pattern, is applied at the inside, near its connection with the brim, a band arranged in four parts of concave shape to correspond to the shape of the head, with interstices of suitable size separating the parts. It is slotted to be produced as light as possible, and covered with the perforated leather. Each part of band is provided with one or more band springs, of brass or other material, bent in U shape, which springs are attached with their other legs in suitable manner to the body of hat. A wedge-shaped piece of cork or other material is introduced between the legs of the band spring, which wedge is pushed up or down as it is desired to make the hat larger or smaller.

Improved Corn Coverer.

Joel A. Moore, Salem, N. J.—Suitable handles guide the coverer and control the thickness of the layer of earth to be placed over the seed. A front roller serves to loosen the earth and crush the clods. The hoes are rigidly applied to a lateral piece of the frame, made of oblong shape, and placed under suitable angle toward the longitudinal axis of the coverer, by means of which the earth is thrown over the corn to cover the same, forming, also, a ridge or elevation, which is then spread out level with the hind roller. The quantity of earth to be thrown by the hoes over the seed may be regulated as the soil or circumstances require it, the roller yielding freely to the pressure exerted on the handles.

Improved Refrigerator.

Richard Armiger, Baltimore, Md.—This invention is a refrigerator so constructed that the ice water can be utilized for cooling the provision chamber. The ice chamber is formed in one part of the top of an inner box, and the bottom of which is made inclined, so that the ice water may flow off as fast as the ice melts. The ice water tank is also placed in the upper part of the inner box, but at a lower level than the ice chamber, so that the ice water may be received and held in the said tank as it drips from the said ice chamber. In the space above the ice water tank is secured a pan in which articles to be kept cool are placed, and which is made detachable, to allow the water tank to be conveniently cleaned. In the space below the ice chamber and water tank are placed shelves of perforated sheet metal or wire rods, to receive the articles to be kept cool.

Improved Milk Cooler.

Charles A. Douglas, Franklin, N. Y.—This invention consists in protecting the metal water pan of a milk cooler by a paper, felt, or other non-conducting cover or envelope for the bottom and sides, to prevent the cold water running through it for cooling the milk pan from taking up the heat of the atmosphere from the outside, the said paper or other non-conducting cover being held up to it by any suitable frame or support.

Improved Bale Tie.

Landon Carter, Huntsville, Ala.—In connection with a block and a clip or socket piece, both attached to one end of the band, and having flanges bent inward over the latter, it is proposed to employ a wedge, which is cut away or shouldered on its under side to adapt it to be inserted in the clip or socket piece, so as to bend and clamp the free end of the band.

Improved Fly Trap.

Herman L. Chapman, Marcellus, Mich.—A tin casing forms two sides and the top of the trap, and is open at the bottom. Laterally connecting tin troughs are soldered to the sides of casing and contain soapsuds, in which the flies get killed. Feet of sufficient hight to admit the flies below the trough and the sides of the trap are provided at the bottom parts of troughs. The open sides of the trough along the trap are closed by sliding glass panes, which may be easily taken out and which fit closely to the sides of the troughs so that no fly can escape. The bait is placed inside the casing, the bottom opening of which is shaded more or less by the tin casing, so that the flies, after once being in the trap, do not crawl out the same way, but fly to the light toward the glass panes, and get drowned in the troughs.

Improved Flower Maker's Grass Cutting Machine.

Theophilus Millot and James Millot, New York city.—This invention consists of a cutting board and a shifting guide for it, combined with a cutting machine of the kind commonly used for cutting paper, so that the pack of cloth pieces to be slitted and cut off in bunches, being clamped to said board, may be led along under the cutting blade, in the ordinary way, for slitting, and then shifted laterally for cutting off the bunches of grass blades. The invention also consists of a point-trimming blade, arranged on a movable support, so that it can be operated to bevel the corner of the pack of the cloth pieces while said pack is in the position for the cutting off and slitting blade to act, and which said support is so arranged that, when the slitting blade moves down, an inclined plane thereon will move the point cutter out of the way.

Improved Balanced Slide Valve.

Charles H. Hutchinson, Concord, N. H.—On top of the valve is a short cylinder. The balancing part works steam-tight against the steam chest top, and said top works up and down within the cylinder. The part working against the steam chest face excludes the steam from the top of the valve and, therefore, relieves it of so much down pressure as is due to the area on said valve from which it excludes the steam. It is held up to said face by the steam pressure on shoulders.

Improved Tilting Stand for Carboys.

Abner W. Caverly, New York city.—This invention consists of a tilting or rocking stand for tilting carboys when pouring out the contents; the object being to enable the operator to turn the carboys both down and up with a gentle and regular motion, so that the acid will not be spilled or forcibly ejected by the swashing of it by the irregular and sudden motions common to the ordinary way of handling carboys. The stand, being left to itself, will remain upright with the carboy on it.

Improved Door Latch.

Frank Stowe, Huron, O.—A recess is cut into the ordinary bolt of a door latch, which is deeper near the projecting part of the same. A dog is provided with a socket having a rubber cushion, and at its lower end with a lug, which projects under the bolt, sliding along the recess as the bolt is moved in either direction. A band spring is applied, with one end secured to the outer plate of the latch, while its other end presses firmly on the dog and lug. The socket part of the dog slides between a casing of the cover plate and the side face plate of the latch. The rubber cushion projects beyond the casing and the door, when the bolt is drawn back by the knob and the lug locks the bolt in position inside of the face plate. On closing the door, the cushion strikes noiselessly against the jamb of the door, the dog forces the spring back, releasing the lug from the wider part of the recess causing it to slide along its narrower part, and allow, thereby, the bolt to lock into the catch plate without necessitating the forcing back of the bolt by the same. The grating noise incident to the friction of the bolt on the catch plate, as well as that caused by slamming the door, is almost entirely done away with.

Improved Game Table.

Robert R. Crawford, Wytheville, Va.—This invention is an improved game table, called the "Dexter Table," and which is between a bagatelle table and a ten pin alley, having some of the characteristics of each, and upon which various games may be played. In playing, the pins are placed upon numbered spots upon the forward end of the platforms, and a ball is placed upon the rear part of said platforms and struck with a cue, the object being to knock the pins from their places. Numbers placed at the sides of the spots from which the pins are knocked are added, and their sum is considered the number of points made.

Improved Adjustable Blackboard.

Peter W. Moeller, New York city.—This invention is a blackboard for use in schools and other places, so constructed that it may be raised and lowered to adjust it to the hight of the person using it, and according to the part of the board to be used. One part of the board, when filled, may be raised and the operation continued upon the other part. The invention consists in the combination of two blackboards and a suspension cord with a frame, grooved upon the inner surfaces of its side bars to receive the edges of the said blackboards, and in grooves of one of the side bars of the frame, made deeper in their lower parts to enable the boards to be removed and turned.

Improved Hand Cultivator.

Amos W. Ross, Northfield, Mass.—The two wheels revolve upon the journals of the axle, to which are secured the handles which are connected by a cross bar which serves to operate the machine. Guards are provided, designed to prevent the plants, when small, from being covered or injured by the soil thrown by the plows. The plows may be adjusted wider apart or closer together, or readily attached or detached as may be required. One plow is made with a projecting arm upon the upper part of one of its side edges, to smooth off the soil in forming the hills.

Improved Combined Stubble Shaver and Scraper.

Henry Von Phul, Jr., and James Mallon, Holly Wood, La.—This invention is for grubbing or shaving and scraping sugar cane stubbie. The vertical side frames are rounded up to adapt them to serve as runners, and have shoes attached to them, which, at the front ends of the frames, are extended upward, and are attached to the top bars of said frames. The knives are bolted to the horizontal arms of angular bars, and have an edge formed upon both of their side edges, so that when one edge becomes dull the knives may be detached and reversed. The bars are so formed that their horizontal arms may incline to the rearward to bring the knives into a good working position. Suitable construction enables the knives to be conveniently raised and lowered, as desired; and by another arrangement the knives and a scraper are raised and lowered at the same time and by the same operation. Guards are attached to the frames to overlap the inner ends of the knives and prevent them from becoming choked with stubble or other rubbish. A cutter is also provided, the shank of which is designed to split the ridge in advance of the knives and scraper to enable them to operate more easily and with better effect.

Improved Plow.

Richard A. Brown, Oakland, Miss.—The plow has a rear land side extension, and is secured to the foot of the standard, and the latter is connected with the beam by tenon and mortise (the former having a rounded shoulder), so that it may be adjusted in a vertical plane at a greater or less pitch or angle to the beam. A forward inclined brace rod is connected with the standard, and passes through the beam. A similar rod, having nearly the same inclination as the standard, is pivoted to the land side extension, and passes through the rear end of the beam. The upper ends of the brace rods are screw-threaded, and nuts are applied thereto, so that by adjusting them the lower end of the standard, and with it the plow, can be moved forward or back to vary the pitch of the latter, and thereby govern the depth to which it will enter the soil. By this arrangement of parts the pitch of the plow is readily varied; and it is so braced by the rod that only an ordinary screw bolt is requisite to secure it to the standard, and the latter does not require to be specially strong or of peculiar form. The implement is designed for use mainly as a furrowing and barring off plow.

Improved Spoke Setting Machine.

William R. Greene, Juda, Wis.—The main frame of the machine consists of a base frame and vertical standards, which are laterally connected by a top piece. Inclined braces carry laterally a detachable shaft, on which the hubs are keyed for spoke setting and other operations, and which is connected by suitable gearing with a treadle mechanism. The spoke setting mechanism consists of two vertical recessed guide pieces, in which slides a lateral setting frame, which is carried up and down by the action of a screw bolt, and actuated by suitable gear wheels. The setting frame consists of a strong top piece, with a socket for the screw bolt, sliding pieces and bifurcated clamps, which are pivoted to the lower ends of slide pieces. The clamps carry, in connection with a pin, a sleeve of cast iron, into which the spokes are firmly placed for setting into the hub. The side flanges of the sleeve are of wedge shape, and are embraced by the prongs of clamps, which rigidly hold the sleeve in position. The upper lug-shaped end of the sleeve is introduced into a recess and adjusted there to the inclination under which the spokes are to be set into the hub. The frame slides with the sleeve down toward the hub, which is adjusted in position for it, and sets each spoke with accuracy and dispatch. On the return of the frame horizontally projecting rods force the clamps upward, so that another spoke may be inserted. The spokes are then ready to be tenoned at their outer ends, which is accomplished by a suitably arranged burr. After all the spokes are tenoned at their outer ends, the fellies are put on, and the wheel is lastly turned by the treadle mechanism, and the sides of the fellies and the edge of the same produced as nearly round as possible.

Improved Carriage Wheel.

Henry Gwynn, Baltimore, Md.—This invention relates to the construction of carriage wheels, so that they may combine the requisite strength with less weight and cost. It consists in a journal box made of wood, in sections, with wedge-shaped projections and with suitable flanges.

Improved Tool Holder.

Lewis Reder, Wilmington, Del.—This invention relates to tool holders for lathes, and consists in combining therewith a washer and shoe having corresponding inclines.

Improved Spark Arrester.

Gustaf Swensen, Hackensack, N. J., assignor to himself and Peter Bogart Jr., of same place.—This invention relates to the arrangement of devices within the hood of the smoke stack, for directing the course of the air and products of combustion entering and passing through the same. Tapering pipes are attached, larger ends upward, to the opposite sides of the upper part of the stack, and are extended downward as close to the roadway as possible. The upper ends of the pipes and stack are covered with a hood, which is made in the form of a double cone. In the forward side of the lower part of the hood are formed two holes, in which are inserted two flaring tubes. Within the hood, and in front of the upper end of the stack and guide spout, is placed a plate to form a passage leading to the upper part of the hood. By this arrangement the tubes and the plate, as the locomotive moves forward, gather the air and discharge it through the upper end of the hood, so as to increase the draft through the smoke stack, and thus counteract any tendency of the guide spout to check the draft.

Improved Revolving Sample Case.

John F. Randolph, Edwardsburg, Mich.—This invention is an improved revolving show case formed of a polygonal base with vertical partitions arranged radially aronnd the shaft, and triangular removable trays, supported between said partitions in an inclined position by side and front strips.

Improved Process of Manufacturing Paper from Grains.

Charles V. Stehlin and Joseph Stehlin, New York city, and Heinrich A. Haan, Brooklyn, N. Y.—The object of this invention is to utilize the residue of the malt, after the process of brewing, for the purpose of producing the short fibers of the same and applying them to the manufacture of paper. The barley grains and hops, as received from the breweries, are thoroughly soaked in water to a mashy consistency and carried over a guide frame of wire gauze through rollers, which press and bruise them, and partly separate the starchy substances from the fibers. The fiberous parts are carried on over the guide frame. The starch dissolved in water passes through the wire gauze into suitable receptacles, and is carried off for condensation and extraction. The fiberous parts are submitted to a thorough mashing process, and then carried over a wire sieve, so that the watery solution of the starch may flow off. The hops are treated in a similar manner, with the exception of the rolling process, as the fibers of the hops are of such thin structure that the pressure of the rollers would injure them. The fibers thus obtained are macerated in a solution of caustic lyes. A pulpy mass is gradually obtained, which, after being bleached by chlorine, may be manufactured directly, or by mixture with other fibers, into the different sorts of paper as desired.

Improved Nut Lock.

William H. Bowman, London, O.—This invention is an edge-perforated washer, connected and turning only with the bolt, and projecting laterally beyond the nut or nuts, combined with pins to lock the latter.

Improved Fastener for Meeting Rails of Sashes.

Edward Burstow, Horsham, Eng.; office in New York, 651 Broadway.—This invention relates to the ordinary sash fastener which prevents the window from being opened, and consists in a hinged plate, combined with the sash fastener to turn down over the opening between the sashes whenever they are locked. This is the most perfect sash fastener that has come before this office for some time.

Improved Car Coupling.

Thomas Andress, Auroraville, Wis.—The invention consists in the arrangement of the coupling pins with spring slides, which are disconnected from the draw bars by suitable treadle mechanism, and produce the coupling of the links by the simultaneous action of rods attached to the drawbars and coupling links on intermediate pivoted levers.

Improved Car Coupling.

Samuel Reed, Liberty, Pa.—This invention consists of a drawbar or coupling box, with side parts hinged to the rear part, and connected firmly by a hook frame, which is detached by the coupling link in case of accident, and produces the giving way of the sides and the uncoupling of the link. The coupling pin is hinged to a frame, with lever, latch, and gate, of which the latter is struck by the link, carrying the pin down for coupling. For uncoupling, the lever is raised, which detaches the link.

Improved Plow.

William T. Shipp, Charles J. Peterson, and Robason L. McLurd, Brevard Station, N. C.—This invention is a plow adapted for ready adjustment to run at different depths in the soil, by changing the angle or inclination of the standard and shoe or shovel to the beam, also of the share or shovel to the standard.

Improved Vehicle.

Martin V. Nichols, Osage, Iowa.—The wheels and frames bear against superposed springs and are placed within the sides of the carriage body. They are incased upon the inner side, no part of the wheels being in sight, except the part that projects beneath the body of the carriage. The forward end of the carriage is supported upon a single small wheel, or two small wheels placed close together, and the ends of the journal of which rest upon a frame. To the frame is attached a spindle which enters a socket attached to the front platform of the car body, and in which is placed a coiled spring. To the forward end of the frame is jointed the tongue, and to its rear end are pivoted two guide rollers, between which passes the semicircular guide rod, the ends of which are attached to the forward end of the carriage body. In the upper forward part of the carriage body is a box containing an endless strip passing over rollers. The driver can readily adjust this strip; and as suitable names are printed upon it, he can thus enable the passengers to know what street will be crossed next.

Improved Wood Sawing Machine.

John Skinner, Stockwell, Ind.—This invention consists of a saw frame of a power sawing machine, suspended by a couple of swing bars, one of which is connected to an arm which is capable of rising and falling, and is provided with a lever by which the saw is lifted up and let down, as required, in the progress of the work. The lever is arranged to be manipulated by the operator while in the position for turning the crank. The invention also consists of a saw bench for receiving the piece cut off, arranged on a pivot and connected by an arm and rod with a hand lever, so that the attendant can throw off the piece by a quick movement of the lever while standing at the place for attending to the driving gear and the saw-adjusting lever.

Machine for Removing Snow and Ice from Roadways.

Charles G. Waterbury, New York city.—This invention consists of apparatus in a portable machine adapted to run along the roadway, so contrived that it will sprinkle the surface of the roadway with hydrocarbon substances, at the same time converting some of the said substances into vapor and burning it in a space above, and causing the flame to impinge upon the surface and burn the portion sprinkled thereon directly in contact with the snow and ice.

Improved Hominy Mill.

Jacob L. Toner, Edinburgh, Ind.—The corn is admitted to the mill through a hopper, and is immediately subjected to the action of the teeth of a rapidly revolving cylinder, whereby the hulls and hearts of the kernels are knocked off and separated from the corn. The kernels of corn are also broken more or less, and dust and meal are made from the fragments which are thrown, by centrifugal force of the revolving cylinder, through the perforations of the casing, leaving the hominy clean and free from dust.

Improved Subsoil Plow.

John R. Turner and Jacob Jacobs, Fredericktown, Mo.—This invention is a subsoil plow so constructed as to run easily and steadily through the hardest soil, and loosen it thoroughly. The standard curves forward as it projects downward, and is made thin, with its forward edge sharp, to enable it to pass readily through the ground. The base of the cutter is made with a bar extending to the rearward. Upon the under side of the bar is formed a notch or recess, into which is fitted the convex upper side of the shovel, which is securely bolted to said bar. With this construction, as the plow is drawn through the ground, the shovel loosens the soil and breaks it up, leaving it light and loose without removing it from its place.

Improved Folding Pail.

Abelliard Du Chateau and John D. Williams, Green Bay, Wis.—This invention consists of a folding pail composed of an india rubber or other suitable elastic tube for the body, a metal hoop or band at the top and bottom, a wood, rubber, or other suitable bottom, and brace rods connecting the top and bottom hoops. These rods are jointed to the hoops and jointed together, so that, when the pail is to be used, they can be extended to extend the tube, and will hold it in the extended condition. They can also be folded down so as to fold the tube into a small, flat, compact package for convenience in carrying it in a wagon for use in watering horses and the like. The brace rods are arranged on the outside of the tube, and connected to the upper hoop by the same connection by which the bail is attached, and so suspend the weight directly from the bail.

Improved Furnace for Desulphurizing Ores.

Edward C. Hegeler and Frederick W. Matthiesen, La Salle, Ill.—This invention relates to a new construction of the vertical shaft furnace for desulphurizing, calcining, and drying, in the same, ores or other substances, when in a fine or powdered state. Vertical series of inclined plates form troughs, from the bottom of the furnace to the top. When the inclined plate or trough at the bottom of the column is empty, the ore of the trough next above it flows down into it until it is filled, and this process takes place along the whole column of inclined plates or troughs to the top of the furnace, where the reservoir is placed. The removal of the ore from the bottom trough causes a simultaneous movement of the ore from each trough above to the one below, and a sliding of the ore takes place along the whole column to the top reservoir of the furnace, and from the reservoir into the uppermost trough, and this movement is arrested or made continuous, just as the bottom trough is allowed to remain full or be emptied. The inclined plates are also so constructed as to allow the passage of the ascending heated gases under and next to the column of ore, where the heat is applied most effectually in contact with the ore in the trough. Finally, the invention consists in a modification of the position of the plates with the use of conducts or pockets along the inner walls of the furnace for conveying the gases, from one horizontal passage to the other, around and over the several layers of ore.

Improved Fire Indicator and Alarm.

John Fawcett, East Boston, Mass.—This invention consists of a little cage of wire or perforated sheet metal containing a card of matches, or other easily ignitable substance, arranged under a string holding a trip lever, with which a wire is connected. The wire extends to the indicator and alarm in the office or occupied room of the building, and is attached to a wheel, which, when let free by the burning of the string in the aforesaid cage, is turned by a spring, and caused to trip the mechanism of an alarm apparatus, and at the same time present to the sight hole through the case the number of the room in which the cage is fired. Any number of the detectors can be arranged in a room, in different points, and connected with the indicator and alarm.

Improved Walk Edger.

Isaac V. Brower and Joseph C. Higgins, Millstone, N. J.—The object of this invention is to provide convenient means for edging walks in yards and lawns, cutting turf straight and square for that or other purposes; and it consists in an axle, at one end of which is an ordinary wheel which runs upon the surface of the walk. At the other end is a drum which runs upon the turf. A circular cutter, made of thin steel, is attached to the side of the drum, and a plowshare follows the cutter and reverses the sod as the latter is cut. A gage is attached to the plow beam for regulating the depth of the plow.

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ANSWERS TO CORRESPONDENTS

Two slight corrections are necessary to our answer about horizontal sun dials, on page 409 of vol. 29. In line 29, "W should be T U; and in line 58, for "from" read "upon."

J. B. H. can make green ink by dissolving binacetate of copper in water, or verdigris in vinegar; or better still, dissolve freshly precipitated hydrated oxide of chromium in ammonia, and add sufficient distilled water.—G. S. T. will find that drying kilns are described in our advertising columns.—J. N. C. is informed that our Index of patents contains a list of all the patents issued in each week.—G. B. can probably fasten paper to steel by painting the steel with metallic paint, letting it dry, and then using mucilage or glue.—B. D. can produce a crystallized appearance on tin plate by applying to it in a heated state some dilute *aqua regia* for a few seconds, then washing it with water, drying, and coating with lacquer.—C. E. W. proposes an impossibility.—D. C. does not send data sufficient to explain his meaning.

J. P. asks: Will your directions, on page 283, vol. 29, for making plastic rubber, do for sheet vulcanized rubber, and will it be flexible after it is finished? A. The vulcanized cannot be dissolved as easily as the pure rubber

E. J. M. asks: What is the proper solder and flux for soldering Britannia metal? A. 100 parts, by weight, of tin 1 one thousand six hundredth of copper, and 1 one thousand six hundredth of lead. Apply with sal ammoniac.

E. D. S. asks: Will a vessel, sinking in mid ocean, go to the bottom? If not, what is the reason? A. It depends on the weight of the vessel. Water is slightly compressible, and hence becomes heavier as the depth is increased. The vessel will continue to sink as long as its weight is greater than that of an equal bulk of water.

O. H. P. says: 1. I see that petroleum is recommended for removing scales in steam boilers? Is it any good? 2. What are the proper dimensions for a bolting reel to bolt 15 bushels per hour? A. 1. We do not recommend it. 2. We advise you to correspond with a manufacturer.

F. H. K. asks: How can I temper spiral springs of very thin steel wire? A. Heat over a charcoal fire and harden in oil.

J. T. D. asks: In re-boring a cylinder, is it best to make new heads? If not, how are the old ones best packed? Is it necessary to make a new piston? If an engine uses 60 lbs. of steam where it should take but 30, what am I to do? Shall I bush the exhaust? A. Ordinarily the old heads and piston can be used. It would probably be better to bush some of the leaks than to contract the exhaust.

C. A. B. asks: How are direct acting hydraulic elevators balanced so as to have the same power when 50 feet high as when 2 feet high? A. They are generally balanced by increasing the pressure, as by means of a pump.

C. T. H. asks: 1. Will cotton do as well as silk to wind the wires of an electro-magnet? 2. How can I prepare the impression of a medal in wax for plating with copper? I succeed with the medal itself, but not with the impression. A. 1. Cotton answers very well, but silk is considered the better. 2. The wax impression must be dusted with the finest plumbago and the wire made to connect with the plumbago surface.

G. F. A. J. asks: Is there any known chemical, or combination of chemicals, which would be effectual in counteracting the smell of wood alcohol when used for the manufacture of varnish? A. Wood alcohol is distilled from crude pyroligneous acid or wood spirit Berzelius recommends the crude spirit to be agitated with a fatty oil to remove empyreumatic matter, and then to rectify it, first from recently burnt charcoal and next with chloride of calcium.

C. A. C. says: 1. What is coal tar naphtha? 2. What is a good recipe for starch polish? 3. What cement is used in uniting glass brackets? A. 1. Coal tar naphtha is a mixture of various volatile hydrocarbons obtained from distilling coal tar. By repeated purification and fractional distillation, benzole, the chief and most important constituent of coal tar naphtha, is obtained. 2 Put a small piece of paraffin about the size of a hickory nut into a bowlful of starch. This is said to give a polish to the starched articles. 3. Soak isinglass in water and then dissolve it in alcohol 3 ozs., add the bottoms of mastic varnish (thick but clear) 1½ ozs.; mix well. Set the phial in boiling water when the cement is to be used.

R. S. B. says: If the moon looks larger when near the horizon because of the peculiar condition of the atmosphere, the angular size would be greater near the horizon: but with an accurate instrument, if any difference were found, it would be that the moon is larger when near the zenith. The cause, instead of being in the atmosphere, is in the eye, being an unconscious greater allowance for distance in one case than in the other. A. The moon at the zenith is 4,000 miles nearer to the earth than at horizon, one sixtieth of the whole distance.

C. M. B. asks: 1. Would a sheet of india rubber, pure or vulcanized, ⅛ inch thick, be impervious to mercury under a pressure varying from 5 to 15 lbs. per square inch, at a temperature of 110°? Would the nature of the rubber be in any way affected by being subjected to this action for several months? 2. When mercury is kept in an iron vessel, is the nature of either metal affected by the contact? A. 1 We do not think pure rubber will be affected. 2. Not under ordinary circumstances

A. B. H. asks: How can I dry glue in winter without having it frozen? Could you tell me the name of a work on the manufacture of glue and sand paper? A. Glue is dried on the large scale by exposing it to the air for 2 or 3 days, and, when sufficiently firm, completing the process by drying in a stove. See article on glue in Ure's "Dictionary."

W. McK. asks: Is there a premium offered by any railroad company for the invention of a railway gate to close fields, etc., through which they pass? A. No.

C. M. says: We use water from the water works, in a mill which has 150 feet or more fall from the reservoir, and we have a great deal of trouble with the pipes bursting from so great a pressure. Will the pressure be as great on the pipes if the gate or valve half way between the mill and reservoir is partly closed, supposing we are not drawing water below the gate? A. We think the pressure will be just the same, in this case. Your best plan will be to use a stronger pipe.

G. E. asks: Why do veneers, which seem firm and solid when first put on, peel off when they have lain a few weeks? The stock and veneer is perfectly dry, the glue is properly soaked and cooked; we think something is put into the glue stock, to cleanse it when the glue is manufactured, which destroys the life of the glue, or else the glue is adulterated to make it heavy. It has every appearance of being good glue. A. If the veneer and stock are as described, we know of no reason why glue properly prepared and applied should not adhere, unless it is of poor quality or has been adulterated. There is a prejudice among some workmen in favor of a dark colored glue, with somewhat of a strong odor. These properties, however, are indicative of impurity and bad preparation. The best glue is pale colored, hard and solid, and has a brilliant fracture. It should merely soften in cold water, not dissolve and the more it swells without dissolving the better generally it is. For use, it should be broken into small pieces, allowed to soak for some hours in cold water, and then put into a boiling water bath, but never boiled itself. It is often injured by the use of too much lime in its preparation, and too long boiling, and can be adulterated with lime and phosphate of lime.

M. W. H. asks: Would any given load require more pounds pressure to push it 60 miles per hour than it would 30 miles, provided there were no resistance from the atmosphere? 2. How many pounds pressure (*minus* resistance of the atmosphere) will it require to propel a light car, weighing a tun, on a smooth level track? 3. If steam be confined, what will be its pressure at 300°, at 400° and at 500° Fah.? 4. What speed should the rim of a 6 inch circular saw (driven by foot power) run, to saw the fastest? 5. The fast motion of my foot lathe will not saw as fast as the slow motion; why is this? A. 1. Yes, under the circumstances stated. 2. About 8 lbs. 3. You will find rules, by which you can answer this question, on page 81, volume 29. 4. 9,000 feet per minute is the speed generally recommended for the rims of circular saws of all sizes. This would give about 6,000 revolutions per minute as the speed for your saw. 5. We cannot tell, from your meager statement, why you do not get good results by increasing the speed.

P. T. R. asks: 1. May any one make copies in white metal of United States and continental copper coins, and of all kinds of ancient coins and medals, and be on the safe side of the law? 2. What is the best method of making copies of coins and medals in soft metal? 3. May any one make copies of any kind of medals that do not show on their face that they are copyrighted? A. 1. We do not think there is any law against making such copies. Much expense is required to enable one to make fine castings of coins and medals. 2. A fusible alloy, which melts at a low temperature, is used. This can be made by melting together 8 ozs. bismuth, 3 ozs. tin, 5 ozs. lead. To obtain a sharp casting, the alloy should first be poured into a box, of the size of the coin, and the latter is to be pressed upon it just before it solidifies. 3. Unless the fact that an article is copyrighted is marked thereon, the owner has no claim against an infringer.

R. H. W. A. asks: 1. How can I cement glass to metal? 2. How can I dissolve enamel, used in enameling jewelry, so that when applied it will harden? 3. How can I remove tin solder from gold or silver? 4. How can I amalgamate the zinc plates in a Smee's voltaic battery? A. 1. Mix together equal weights of white lead and red lead, for the cement required. 2. Metals are enameled by covering them with vitrifiable compounds, that is, such as form a glass by exposure to heat. You cannot dissolve this enamel or apply it in any other way. 3. You can melt it, and scrape it off without injury to the other metals. 4. Wet them with dilute sulphuric acid, and at the same time rub mercury over them till a bright coating is produced.

C. says: I am running an engine, of which the governor does not work well. There is no place to oil the valve, and it sticks. I say that it would help it to put a lubricator in the pipe to oil the valve. Another man says that it will do no good. Which is right? A. We do not think the trouble is in the valve. It is probably caused by having the valve stem packed too tightly, or by some imperfection in the connections.

J. H. P., of Pa.—Minifie's "Mechanical Drawing," price $4.00, and Joynson's "Machine Gearing," price $2.00, are the two works you need. They may be had of Baird, Philadelphia, Pa., or of Van Nostrand, New York city.

D. E. B. says: Having read of the primeval copper tools found in the old and new world, I should like to ask: 1. Is it true that they will cut hardened steel? 2. What is the texture of the hardened part? 3. Is the tool hard all along or is it like our cold chisels only tempered at the point, or where needed? 4. Does heat destroy the temper? 5. What are the electric and magnetic powers? A. We are not able to give you much information on this subject. It is true that the ancients made tools and instruments of bronze, which seemed to possess all the hardness of those made of steel, but the process of manufacture is purely a matter of conjecture.

A. F. asks: Is there any process by which nitrogen can be separated from the oxygen in atmospheric air and if so what is it? Is the oxygen thus separated lighter than common air? A. Nitrogen can be separated from oxygen in the atmosphere by burning the oxygen out of the air. This is accomplished by setting fire to a small piece of phosphorus contained in a small vessel floating on the surface of water, and inverting a bell glass over it. The phosphorus will burn out or chemically combine with nearly all the oxygen contained in the jar leaving the nitrogen behind. This can be afterwards freed from impurity and dried by passing it first through water and afterwards through concentrated sulphuric acid. Nitrogen is lighter than the air, its specific gravity being 0·9713, while free oxygen is a little heavier, weighing about one tenth more than the atmosphere.

O. S. says: I am trying to heat my house with a hot air furnace; and in order to avoid the trouble and mutilation of plastered walls, incident to conveying heat by separate and distinct flues to every room, I purpose to have one large register directly over the furnace, which is in the cellar. Then three ventilating registers overhead are to warm three rooms which are right above. Can I do this successfully? A. Experiment shows that the most satisfactory results are obtained in the operation of a hot air furnace, by keeping the ascending current of air as independent of one another as possible. Heated air is sometimes conveyed from a furnace to a third story room through a pipe which also supplies a portion thereof to the first and second story rooms by means of a separate register in each of these stories; but this arrangement is seldom satisfactory. We understand the plan of our correspondent is to receive the whole volume of warm air into a first story room and then by three openings in the ceiling of this room admit the same air into three rooms in the second story. If the upper rooms are perfectly tight, very little air will pass through the openings in the ceiling; but if open and provided with open ventilators in the fire flues, a capricious supply may be obtained. The passage of sound, however, through these openings will make them very disagreeable. If ventilation is provided for the first story room, the warm air may pass out in this way and not ascend to the upper rooms; but without ventilation, all the foul air of the first story must ascend to contaminate the air in the second story. Probably the furnace illustrated on page 295 of our volume 29 is one that is planned more strictly in accordance with this view than any other. In this furnace, the cold air itself is divided into separate pipes before it enters the furnace; and the air, warmed in the pipe, is kept separate from the other currents until discharged at its destination. Our correspondent will find it best to have separate pipes to each room if possible, and these he may be able to insert in his chimney flues, and so avoid cutting away his partitions.

J. H. B. asks: How can rubber be reduced to a liquid state, so that it will always remain so? I have tried benzine and wood alcohol; the latter I find to work the best, but it will only dissolve a very little. I have tried linseed oil, setting it in the sun. I wish to dissolve the rubber without heat. A. The difficulty is that most of the solvents of caoutchouc are volatile, and those that are not, like linseed oil, require heat. We would suggest dissolving the rubber first in caoutchoucine, a liquid distilled from India rubber, and while liquid adding linseed oil, and stirring until a homogeneous fluid is obtained, as the oil is also dissolved by caoutchoucine. As the latter evaporates, add the oil, with frequent stirring until thick enough.

J. S. S. says: Please answer through your invaluable paper: 1. Where can I get a permanent magnet that will lift 8 lbs., and what will be its probable weight? 2. What force would it exert at a distance of one sixteenth of an inch from the poles? A. 1 From any good maker of physical apparatus. Horse shoe magnets of 1 lb. weight have been made to sustain more than 26 lbs. 2. You had better determine this by experiment.

J. P. C. says: I have a engine house some sixteen feet from a well. The well has a cucumber pump in it, and is 26 feet from platform to bottom. If I tap a pipe into the pump stick, either above or below the stuffing box in the stationary tube or box, and carry the pipe into the engine house, and there attach a lift and force pump will it work satisfactorily? A. We see no reason why the proposed plan will not work satisfactorily. We never recommend any particular make of machinery in these columns.

B. asks: How can I make alloys of metals that will melt at 315° and 325° Fah. respectively? A. The rule for making these alloys is as follows: Melting point of alloy = per cent by weight of first metal × its temperature of fusion + per cent of second metal × its temperature of fusion, + etc., if more metals are used. It is found, in practice, that this rule does not always give the melting point with accuracy, and it will probably be necessary for you to experiment a little, using the rule as a starting point.

S. A. says: A dispute has arisen between a friend and myself as regards the heat of water in a boiler when under a steam pressure. A says that water boils at 212° at the pressure of the atmosphere and the higher the pressure the higher is the boiling point of the water. B. says that the boiling point does not rise, that it is always 212° Fah. Which is right, and what is the ratio of the increase, if any? A. A is right. You will find the rate of increase given in a formula on page 81 of volume 29.

H. A. S. asks: How can I make a soft solder for cans, that can be easily cut with a knife? A. The usual plan, when it is desired to fasten on a cover that can be easily removed, is to use very thin plate for the cover, and fasten it with a small amount of common soft solder.

J. G. says: I am running a 8 x 12 inches engine at 100 revolutions per minute. Steam varies from 25 to 70 lbs. on the gage. The boiler is an upright, 42 inches diameter and 7 feet high, with 36 three inch flues. In the month of September I burned 190 bushels of soft Illinois coal in 26 days of 10 hours each (80 lbs. to the bushel). How many lbs. of coal per horse power per hour am I burning? Is the engine doing good duty? It is a plain slide valve engine with lap cutting off at about ⅝ of the stroke. Answer: From the data sent, we are unable to make the calculation you desire, as we have no way of determining the mean and back pressure. Send us a sketch of your valve and ports, with note of dimensions. If the point of cut-off is as stated, you must have a very large exhaust port, or a distorted action.

M. asks: Given a rotary air pump of ordinary construction, by what simple rule can I calculate how to increase or diminish the size, keeping the different proportions correct? A. We do not think there is any safe rule by which you can calculate the details of a pump of larger or smaller size, from another of given dimensions and different size.

E. A. says: Sheet iron pans are used for the evaporation of sap; a pan 8 feet long x 3 feet wide would give 24 feet heating surface. How much would it add to its evaporation to put in 14 three inch flues and let the fire pass through them and over the 24 feet heating surface? Would it make any difference how close together the flues were? Would smaller or larger flues be any better? A. The proposed plan would work well if it did not heat the sap too much. It will make little difference what size and number of flues you employ if you are careful to give them sufficient area to ensure a good draft.

E. S. A. says: 1. The atmosphere at the equator has a velocity of rotation less than the earth, equal to the velocity of the trade winds. Let us assume, however, that it is the same. The force of gravity at the surface of the earth is 289 times greater than the centrifugal force, and decreases as the square of the distance from the center of the earth. The centrifugal force increases as the distance from the center of rotation. Is there then any reason why the atmosphere may not attain a hight (from the surface of the earth) of 6½ times the semi diameter of the earth? 2. If the atmosphere were influenced solely by the two forces above mentioned, the highest part would be over the equator, that is, the plane of the greatest diameter of the atmosphere would coincide with the plane of the celestial equator. But when we consider the influence of the attraction of the sun and moon, and the extremely mobile character of the molecules of the atmosphere, would not the plane of the greatest diameter be inclined from the plane of the equator towards the plane of the ecliptic, so as to almost coincide with it? 3. What is the average velocity of the trade winds? I do not find it stated in any of my books. 4. In what work will I find these subjects most thoroughly discussed? A. The earth when fluid, assumed its present form of equilibrium, an oblate spheroid. Therefore the atmosphere would be of uniform depth, as regards centrifugal force at the earth

continued to turn uniformly. 2. The Signal Service will decide the question of aerial tides. 3. We do not know. 4. The "Physical Geography of the Sea" is a superficial work, though interesting.

S. S. asks: How can I calculate the torsional strain, or ultimate resistance to rupture, of a wrenching or twisting force applied to rectangular bars of cast and wrought iron, the length of the lever to which the force is applied being known? A. Let S = one side in inches, s = other side in inches, L = leverage in inches.

For cast iron: Torsional strength in lbs. $= \frac{12{,}000 \times S^2 \times s^2}{4\sqrt{S^2 + s^2} \times L}$

For wrought iron: Torsional strength in lbs. $= \frac{15{,}000 \times S^2 \times s^2}{4\sqrt{S^2 + s^2} \times L}$

The constants given are average values.

E. A. S. asks: How can I make ink that will write with a "greenish" color, at first, and afterwards change to a deep black? Answer: There are various formulæ for making ink. We can recommend this on good authority: Aleppo galls (well bruised) 4 ounces, clean soft water 1 quart; macerate in a clean corked bottle ten days or two weeks, with frequent agitation. Then add gum arabic (dissolved in a wineglass full of water) 1¼ ounces, lump sugar ½ ounce, mix well and afterwards furth. r add sul hate of iron (green copperas) crushed fine, 1½ ounces; agitate occasionally for two or three days; then decant for use, but it is better to let the whole digest together two or three weeks. Product one quart, pale at first but soon turning intensely black.

J. E. A. asks: Are tables ever moved in the presence of so-called mediums, without contact with any person or mechanical device whatever? A. Statements to that effect have frequently been made, but we should require stronger evidence than has yet been presented to induce us to credit them.

A. M. S. says: A. H. on page 363, inquires how he can remedy the lack of power in a 25 feet breast wheel. The only remedy is in running it faster, not slower, using as much (and a little more) water in proportion as it runs faster than before. Let him reduce the 8 feet drum so as to give the wheel a little advantage over the present arrangement. He will not get so good a result from the water as formerly, and will consequently need to make a little allowance for that. I should say that if the 8 feet drum was reduced to 7 feet, or if the pulley driven by the 8 feet drum was lagged in proportion, he would be enabled to get speed. There might be a question of supply of water in the latter case.

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

J. R. E.—From our recollection of the small specimen of blue clay sent, it contained no graphite. Although graphite is sometimes contaminated with clay, it generally occurs in quartz, granite, gneiss, or carbon, ate of lime. Many clays take a polish from the finger nail; and when dark, as blue clay, the luster is metallic like that of plumbago, although none of the latter be present. Graphite, again, when disseminated in primitive or transition rocks, occurs in minute scales or nodules of different sizes not difficult to distinguish. Should it occur in small masses with clay, it could be separated from the clay by washing and running off the suspended clay, the plumbago sinking to the bottom of the vessel.

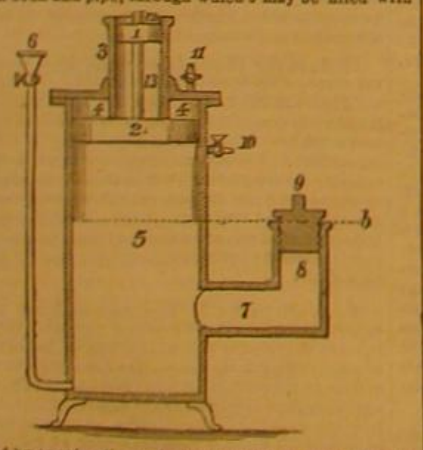
J. H. S.—The tar enclosed is a hydrocarbon of the nature of liquid bitumen, and the substance from which it has been obtained is probably (judging from the mineral enclosed) a limestone impregnated with bitumen. The mineral is limestone, containing a small quantity of iron pyrites. From the indications disclosed, and the fact that oil is found floating on the surface of ponds in the vicinity, we should judge that petroleum might be found at a sufficient depth.

J. H.—This ore is micaceous oxide of iron, so called from its being easily broken and reduced to small shining scales like mica. It is often found in connection with common specular iron, and is sometimes associated with the red oxide of iron, but is rarely in sufficient quantity to be explored by itself. It yields about 70 per cent of good iron.

W. M. L.—Selenite, a pure variety of crystalized sulphate of lime or gypsum.

A. M. B.—Carbonate of iron, or sparry iron, a compound of carbonic acid and iron.

A correspondent sends us the following problem: 1 is a piston, 6·25 square inches in area, moving airtight in cylinder 3. 2 is a piston, 12·56 square inches in area, moving airtight in cylinder 5. 3 3 is a cylinder 6·25 square inches in area and of at least 3 inches stroke. 4 4 is an annular space 1 inch deep between the head of the cylinder, 5, and the piston, 2. 5 is a cylinder 12·56 square inches in area and 12 inches long. 6 is a funnel with cock and pipe, through which 5 may be filled with



fluid by opening the cock 10 to let air out—filling first by removing plug, 9, and filling up to dotted line *b*, then replacing plug. 7 and 8 is a bent tube of 6·25 square inches area attached to cylinder 5. 9 is a plug to stop mouth of 8 airtight. 10 and 11 are ordinary cocks. 12 and 13 are ordinary piston rods. If 5, 4, 3, 6, 7 and 8, being full of water or mercury and all the cocks closed, pistons being in position shown in the figure, if the plug 9 is removed and weights are so placed as to overcome the friction of the piston, will they fall? If so, with what velocity, and how far? [We think our readers will have no difficulty in solving this question, as it is capable of rigid demonstration, if weights of the moving parts and the liquid are given. We shall be glad to have replies.—EDS.]

F. C. L. asks: How can I make an emery wheel?—S. H. N. asks: Is the superheating attachment placed in the Great Eastern steamer still in use?—C. A. B. asks: Is there published a book of instructions on newspaper and job printing?—S. A. T. asks: How did the old Romans calculate sums by numeral letters? For example, how did they divide MDCCCLXXII by XXIV, or multiply DCCLII by XXIV?—R. C. C. asks: How can I make colored transparent pictures for the magic lantern? I cannot make water colors transparent.

COMMUNICATIONS RECEIVED.

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

On Magic Squares. By G. B. M.
On Sewage. By G. H. T.
On the Diameter of the Earth. By A. F.
On the Percentage of Work. By E. W.
On the Nickel Mines in the United States. By N.
On Coal Tar Products. By J. T. P.
On the Labor Question. By N. A. W.
On Ramming the Mold. By B. W.
On Magnets. By C. H. M.
On Solar Heat. By J. G.

Also enquiries from the following:
Q. X. P.—J. M. C.—C. L.—A. L. B.—A. B.—H. & Co.—C. C.—J. H. W.

Correspondents in different parts of the country ask: Who makes the best foot power jig saw? What is the best work on short hand writing? Who sells the best post hole augers? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal" which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

December 9, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Bale tie, cotton, G. N. Beard	145,273
Bale ties, forming, J. McClean	145,357
Bands, making endless, L. Binns	145,386
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Umbrella, G. W. Pressey	145,510
Umbrella supporter, W. A. Drown, Jr	145,408
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Yoke bow fastener, etc., ox, E. N. Bacon	145,381
Zinc, apparatus for granulating, E. H. Richter	145,449

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:

27,438.—BLACKWASHING MOLD.—W. Ferguson *et al.* Feb. 25
27,447.—TIMBER BENDING CHAIN.—L. Heywood. Feb 25.
27,478.—TURNING LATHE.—W. Sellers. Feb. 25.
27,485.—LANTERN.—A. Tufts. Feb. 25.
27,545.—FITTING SINKS.—J. Ingram. March 4.
27,594.—SEWING MACHINE.—L. W. Langdon. March 4.
27,655.—HORSESHOE NAIL MACHINE.—W. Tallman. Mar. 11.

EXTENSIONS GRANTED.

26,408.—FIRE KINDLER.—E. Bellinger.
26,410.—SEED PLANTER.—W. Blessing.
26,454.—RAILROAD SWITCHES.—W. Wharton, Jr.

DISCLAIMER.

28,344.—RUFFLE.—G. B. Arnold.

DESIGNS PATENTED.

7,018.—BUTT HINGE.—W. Gorman, New Britain, Conn.
7,019.—DOOR KNOB ROSE.—W. Gorman, New Britain, Conn.
7,020.—DOOR KNOBS.—W. Gorman, New Britain, Conn.
7,021.—ESCUTCHEON.—W. Gorman, New Britain, Conn.
7,022.—GRINDING MILL FRAME.—J. G. Lane *et al.*, Millbrook, N. Y.
7,023.—LAMP SHADE.—W. L. Libbey, Boston, Mass
7,024.—FLY WHEEL.—J. G. Baker, Philadelphia, Pa.
7,025 to 7,033.—CARPETS.—H. Horan, East Orange, N. J.
7,034.—CARPET.—H. Knight, Philadelphia, Pa.
7,035 to 7,037.—FLOOR OIL CLOTHS AND CARPETS.—C. T. Meyer *et al.*, Bergen, N. J.
7,038 to 7,043.—CARPETS.—E. J. Ney, New York city.
7,044 & 7,045.—CARPETS.—H. Nordmann, New York city.
7,046.—BADGE.—J. Seymour, Syracuse, N. Y.
7,047.—SHOW CASE CORNER.—T. Vaughan, Boston, Mass.
7,048.—COOK STOVE.—N. S. Vedder, *et al.*, Troy, N. Y.

TRADE MARKS REGISTERED.

1,565.—SOAP.—R. M. Bishop & Co., Cincinnati, Ohio.
1,566.—CURED MEATS.—W. H. Davis & Co., Cincinnati, O.
1,567.—CORSET SPRINGS.—F. L. Egbert, Waterbury, Conn.
1,568.—WHISKY.—E. A. Fargo & Co., San Francisco, Cal.
1,569.—FERTILIZER.—J. M. Rhodes & Co., Baltimore, Md.
1,570.—COTTON GIN.—Brown Gin Co., N. London, Conn.
1,571.—CARPETS.—J. Dornan, Philadelphia, Pa.
1,572.—WHISKY.—E. Howe, New York city.
1,573.—OYSTERS.—O. W. Miller & Co., Baltimore, Md.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

[Specially reported for the Scientific American.]

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA DECEMBER 15 TO DECEMBER 17, 1873

2,933.—J. H. Smith, Arlington Square, Middlesex county, Eng. Improvement on shuttle sewing machines, called "Smith's Combination Sewing Machine." Dec. 15, 1873.

2,934.—Edward Gurney, Toronto, Ontario. Improvements on heating stoves, called "Gurney's Improved Base Burner." Dec. 15, 1873.

2,935.—J. L. Thurston, Douro township, Peterborough county, Ontario. Improvement on corsets, called "Thurston's Improved Elastic Corsets." Dec. 15, 1873.

2,936.—A. A. Herriman, Greensborough, Guilford county N. C., U. S. Improvements on turbine water wheels called "Herriman's Acme Turbine Water Wheel." Dec. 15, 1873.

2,937.—G. M. Stevens, Portland, Cumberland county, Me., U. S. Improvement in mitering machines, called "Stevens' Mitering Machine." Dec. 15, 1873.

2,938.—F. Jessop, York, York county, Pa., U. S. Improvement in rotary steam motors, called "Jessop's Rotary Steam Motor." Dec. 15, 1873.

2,939.—N. Phaneuf, Montreal, P. Q. *Machine a presser et a polir les talons des chaussures*, called "*Une Roue Brunisseur*." Machine for pressing and polishing heels of boots and shoes. Dec. 15, 1873.

2,940.—D. E. Rice and A. W. Mitchell, Detroit, Mich., U. S. Improvements on water gages for steam boilers, called "Rice's Boiler Gage." Dec. 15, 1873.

2,941.—M. T. Boult, Battle Creek city, Calhoun county, Mich., U. S. Improvements on wood working machines, called "Boult's Wood Working Machine." Dec. 15, 1873.

2,942.—C. W. Palmer, Cleveland, Cuyohoga county, O., U. S. Improvements on portfolios, called "Palmer's Novelty Music Rest and Portfolio." Dec. 15, 1873.

2,943.—M. Stephens, Brooklyn, Kings county, N. Y., U. S. Improvements in cement lined metal pipes, called "Stephens' Cement Lined Metal Pipes." Dec. 15, 1873

2,944.—J. H. Thorp, Chicago, U. S. Improvements on portable burglar alarms, called "Thorp's Portable Burglar Alarm." Dec. 15, 1873.

2,945.—I. Erb, Buffalo, Erie county, N. Y., U. S. Improvement on washing machines, called "Erb's Improved Washer." Dec. 15, 1873.

2,946.—Jas. Foley, Montreal, P. Q. Extension of a provincial patent, being No. 2,614, old law, for the manufacture of the extract from hemlock, oak and other barks, for tanning purposes and as a mordant for printers' and dyers' use, called "The Non-Atmospheric Process." Dec. 17, 1873.

2,947.—O. Meijh and H. Voelter, Paris, France. Process of preparing wood or other ligneous or vegetable matter for the manufacture of paper, card board and other analogous products, called "Meijh and Voelter's Process for Preparing Wood for the Manufacture of Paper, etc." Dec. 17, 1873.

2,948.—G. Lowden, Brooklyn, Kings county, N. Y., U. S. Improvement on portable gas apparatus, called "Lowden's Portable Gas Apparatus." Dec. 17, 1873.

2,949.—C. K. Knowlton, Rockland, Me., U. S. Improvements in car couplings, called "Knowlton's Car Coupling." Dec. 17, 1873.

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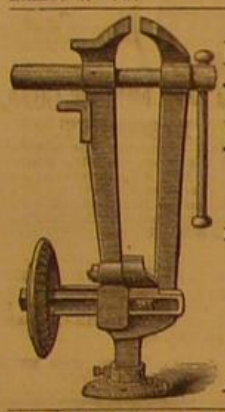

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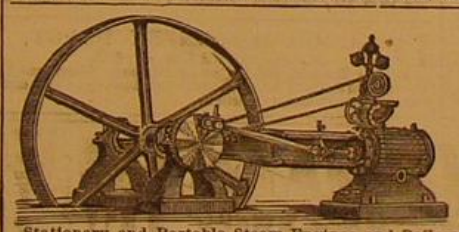

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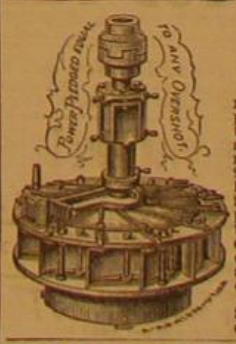

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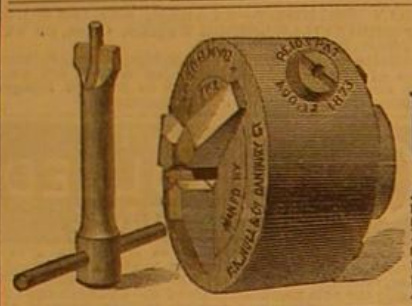

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Vol. XXX.—No. 3. [NEW SERIES.] NEW YORK, JANUARY 17, 1874. [$3 per Annum, IN ADVANCE.

THE NEW STATE CAPITOL AT HARTFORD, CONN.

It is curious to note how the course of architecture in this country has closely followed the changes in the art developed in Europe and more especially in England. The severe Roman classical style of the last century became supplanted in the Greek revival of 1762, and in both Great Britain and the United States appeared buildings in the main reproductive of ancient Hellenic temples. The British Museum in London, and our own public buildings in Washington, besides numerous custom houses, hotels, and banks, are types of more imposing edifices erected in the Greek style; while scores of wooden country dwellings in almost every village in the Eastern States attest, by their heavy pillars and broad porches, the predilection of architects for its use wherever possible. As the Roman has failed before the Greek, so has the latter in no small measure become less popular than the Gothic, the revival of which style may be fairly dated as of fifty years ago. Fostered by progress in archæological studies and by ecclesiastical patronage, the mediæval in art grew steadily in favor; and as a result, an almost new order of architecture, the modern secular Gothic, sprang into existence, which, emancipating itself from purely religious application, has reformed the very principles of the original designs. To Ruskin is ascribed this change, and Eastlake says that it was reserved for him "to strike a chord of human sympathy that vibrated through all hearts, and to advocate, independently of considerations which had hitherto only enlisted the sympathy of a few, those principles of mediæval art whose application should be universal."

With this brief review of the origin of the secular Gothic in architecture, we lay before our readers a fine engraving of an edifice which, when completed, will probably be the most prominent and striking example of the style as treated in the United States. It is the State Capitol of Connecticut, and is located in the City Park, a tract of some 40 acres, in the city of Hartford. The site is on elevated ground, is commanding and appropriate, and admirably suited to display the fine design of the structure. The central feature is the dome, which, springing to a hight of two hundred and fifty feet above the ground, is surmounted by a colossal female figure, representing Connecticut, holding in her hand the original charter of the State. In common with the entire edifice, the dome is of white marble and richly adorned with arcades, columns, galleries, and with thirteen figures placed one at each terminal at angles, each statue supporting a shield bearing the arms of one of the original States. The dome in plan is a dodecagon 56 feet in diameter, and is flanked by towers 160 feet in hight.

The extreme length of the main building is 300 feet and its greatest depth 200 feet. Its construction is of the most substantial description, iron beams and brick arches, and also ground arches in brick filled in, being used throughout. The main entrances are on the north and south fronts, having vestibules, and leading through arcaded openings. In the tympani of the arches over the grand entrance, are five bas reliefs representing Putnam leaving his plow, and his celebrated horseback ride down the steps, the charter oak, the landing of the pilgrims, and the surrender of Cornwallis. On the front of the building above the main door are twenty-six niches destined for large statues, and suitable places are provided over all the entrances for the reception of busts of distinguished men. These decorations and the handsome slate roof, together with the general ornate type of the building, will render it, if we may judge from the finished drawings of the elevation, one of the most artistically beautiful structures ever erected. The lower and third floors are devoted to offices and apartments for state and other officials. The second floor contains the Halls of the Senate and Representatives, the Supreme Court, and the Library. The Representatives' Hall is in the central building of the front, is lighted on three sides, and is supported on arcades of polished granite columns, with capitals elegantly carved in marble. The library has two stories of windows, and of alcoves for books.

The main hall, which is approached by all entrances, is tiled and has a stone colonnade, supporting the groined ceiling and floor above. It is well lighted from the doorways and the corridors at each end. There are two grand staircases, entirely of stone and of very massive and beautiful design.

Mr. R. M. Upjohn, of this city, the designer of St. Thomas' Church on Fifth avenue and many other prominent buildings throughout the country, is the architect. He informs us that the ground floor of the structure is now completed and that the entire edifice will require about three years to finish.

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NEW YORK, SATURDAY, JANUARY 17, 1874.

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THE VIENNA EXHIBITION AND ITS RESULTS.

The Vienna Exhibition closed November 1 last, and that wonderful display of industrial products, which had been gathered with so much toil, and at such expense of time and money, from every quarter of the globe, has been broken up, and its exhibits are now scattered as widely as before their collection. The greatest of international exhibitions has become a thing of the past. Its influence, however, remains and will long be felt in every part of the world. Even on our side of the Atlantic, thousands of miles from the strange, busy scene in which we, of all civilized nations, took least part, we feel that, in some respects, we have been benefitted by the most important and most creditable of all Austrian enterprises.

We felt it our duty to warn the public of the risks which were to be met by those who proposed to take into Austria valuable inventions. We considered the defective patent code of that country no safeguard to inventors, and showed that, despite the promises—still unfulfilled—of liberal changes, any really valuable improvement would be likely to be pirated, unless, as could seldom be the case, the exactions of the law were fully complied with. These facts were so well exhibited that but few of our great inventions were seen at Vienna, and the United States section became conspicuous for its small extent; and our own people, visiting the *Ausstellung*, were struck with the barrenness of the American department. We were, however, well represented in quality, if not in quantity; and if we may judge from the official record of awards, the jury was very favorably impressed. The proportion borne by the number of awards of Medals of Progress to the number of Medals of Merit granted, as well as the large proportion of awards made to our small number of exhibitors, are both high, in Group XIII (machinery). The medals are nominally of equal value, but the second class mentioned are given for abstract merit, while the first named were given only where merit was accompanied by evidence of a substantial and meritorious advance, effected since the date of the Paris Exposition, in devices deemed specially meritorious at that time. The United States brought away one third more medals of the first than of the second kind, and is, we believe, the only nation in which the comparison does not give a reverse proportion.

The real results of this enterprize are properly gaged, however, by a broader view than this. The distribution of medals is but an incident of the grand work. Comparatively few of the exhibits taken to Vienna by our people will be brought back to the United States. They have found purchasers from all parts of the world, and go among strangers, civilized and uncivilized, to spread abroad the fame of American mechanics and Yankee inventions. Our sewing machines are distributed from St. Petersburg to Calcutta, and our agricultural implements are found in every grain raising district from Great Britain to China, and our wood and metal working tools are almost as familiar to the Hungarian and the Bohemian as to our own mechanics. In the Chinese and Japanese sections, even, it was noticed very early in the season that nearly every article was marked *verkauft* (sold) and the unique productions of the Orientals thus also become distributed throughout the world. From the farthest east, from north and south and west, the most intelligent and the most enterprising of every nation have met to see what others have accomplished, and to learn whatever may most aid their own advancement.

It is this universal dissemination of the acquired knowledge of every department of industry that constitutes the most important work of an international exhibition. Bringing together, as it does, the products of the labor of every nation, and displaying the natural resources of every country to all who can purchase the one or who can develope or utilize the other, bringing the nations of every part of the globe into close communion, and presenting to all the best fruits of the labors of each, the most advanced and most thoroughly civilized are stimulated by competition to greater exertions, and to the accomplishment of still nobler results; while those countries which are farthest behind in the great march of human progress are taught what has been done by others, and are awakened and urged to make an earnest effort to overtake those who are now so far in advance of them. All are taught that nations, like individuals, may choose between poverty and competence, if not affluence, and that intelligence, honesty, industry, and frugality invariably bring their reward.

Now that the Austrian Exhibition of 1873 has become one of the great bygones, we look forward with renewed zeal to the successful inauguration of our own coming Centennial International Exhibition of 1876. The time for preparation is none too ample, and we anticipate with anxious as well as hopeful interest the opening of its

> "* * * * * * * long laborious miles
> Of palaces; lo! the giant aisles
> Rich in model and design,
> Harvest tools and husbandry,
> Loom and wheel and enginery,
> Secrets of the sullen mine,
> Steel and gold, and corn and wine,
> Fabric rough or fairy fine,
> Sunny tokens of the line,
> Polar marvels, and a feast
> Of wonder out of West and East,
> And shapes and hues of part divine
> All of beauty, all of use,
> That one fair planet can produce,
> Brought from under every star,
> Blown from over every main,
> And mixed, as life is mixed with pain,
> The works of peace with works of war.

PATENT OFFICE PRINTING.

A correspondent of the New York *World*, writing to that paper from Washington, gives some items of public printing done by the Congressional Printer, among which is the sum of $142,793 charged for Patent Office printing. On this the writer complains in the following style:

"I selected the Patent Office from the Interior Department for this reason: the work done for that institution is not paid for by taxes, but by the people that take out patents. It is the people's money, not the Administration's, and in justice the work should be let out to the lowest bidder after advertisement. In this item 25 per cent, if not more, could be saved. In this connection the Government is running a monthly periodical for $1 a year, called the *Official Gazette*, a most flagrant abuse of public confidence and rather a small business for a government spending its $300,000,000 a year to engage in."

We fail to perceive where the "flagrant abuse of public confidence" would come in, even if it were true that the *Official Gazette* were a monthly periodical run at $1 a year. Unfortunately it is not true. The price is $6 a year, and it is published weekly. The publication is, however, carried on at a heavy expense to the government; but as it has been expressly ordered by Congress, the Commissioner of Patents only discharges his simple duty in attending to its publication, and the manner in which the work is produced is highly creditable to him. The *Official Gazette* takes the place of the former annual volumes, known as the Patent Office Reports, on which Congress was accustomed to spend far more than the weekly *Gazette* costs.

The Patent Reports were printed for free distribution by members of Congress, and the same practice is substantially maintained in respect to the *Gazette*. The public demand for it is far from sufficient to pay its support.

Ten thousand copies of the *Gazette* are printed every week, of which three thousand copies go to subscribers, who pay $6 a year, and seven thousand copies are given away to members of Congress, other departments of the government, courts, libraries, etc. The total cost of the publication is not far from sixty-four thousand dollars a year. The annual loss to the government by the publication, is a little under fifty thousand dollars a year.

Prior to the establishment of the *Official Gazette*, the patent claims were published in the SCIENTIFIC AMERICAN, and our publication of them was a matter of great convenience and advantage to the Patent Office. On the basis of the amount now paid out by the government for similar work, our publication of the claims must have saved the Patent Office from twenty to forty thousand dollars a year, during a period of nearly twenty years. But we never received a single centaro from the Patent Office for the service; indeed we could never prevail upon the department to be so liberal as to furnish us with a free copy of the claims for our printers to set up the types. On the contrary, we were compelled to pay the Patent Office from five hundred to a thousand dollars a year to furnish us with the copy. After the issue of our paper, the Patent Office was then accustomed to expend a few cents weekly in purchasing extra copies of the SCIENTIFIC AMERICAN, out of which it scissored the printed claims for use in the various examiners rooms, and in connection with the drawings, and the preparation of the annual reports.

The weekly publication of the claims is desirable as a matter of convenience, to the Patent Office, and to a limited number of persons, consisting mostly of patent agents and attorneys. But the public in general have little use therefor. We believe it would be a much better plan to enlarge the *Gazette* so as to give the specifications and drawings in full of all patents issued. This would form an invaluable work of great importance to the public, and, if issued at, say, $25 a year, would doubtless be self-supporting, provided the free list were wholly suspended, and the best economy practiced in the printing.

SCIENCE RECORD FOR 1874.

The new volume of this work is now upon the press, and will be ready for delivery about the 20th of January. The forthcoming book is one of unusual interest and value. It embraces a condensed account of the leading discoveries and improvements in the various branches of science, including Chemistry, Metallurgy, Mechanics, Engineering, Electricity Light, Heat, Sound, Technology, Pisciculture, Botany, Horticulture, Agriculture, Rural and Household Economy, Materia Medica, Therapeutics, Hygiene, Natural History, Zöology, Meteorology, Terrestrial Physics, Geography, Geology, Mineralogy, Astronomy, Biography, etc.

The various departments are illustrated with suitable engravings. In Metallurgy, for example, we have illustrations of Siemens' furnace and a description of his new and successful method of making iron and steel direct from the ore. This is accomplished at a cost of from 20 to 50 per cent less than by the present blast furnaces. The subject is of importance to iron workers. In Mechanics and Engineering, we have accounts of new railway improvements, novel machines, and a great variety of new devices. Technology is full of new information, and there is hardly a worker in any branch of the applied arts, but will here find some new hint, recipe, or suggestion, of more worth to him than many times the cost of the book. In Agriculture, we have accounts of new methods for preparing manures with economy, improvements in treating soils, new and useful plants and vegetables. Among the latter is illustrated a new and early variety of the potato, from which six hundred pounds are raised for every pound of seed planted, a most valuable acquisition for all who maintain gardens. Natural History, Zöology, Pisciculture, all are full of interest. Portraits of prominent scientific men and discoverers are given, among which we notice those of Liebig, Draper, Proctor, Lockyer, Baker. The miscellaneous department will be found especially attractive and useful. Here we have a series of engravings illustrating the various devices employed to assist learners in drawing. Among these is a new reflecting drawing board, which, by means of a simple pane of glass, throws down upon the paper the outline of the picture that is to be copied. Then we have the pentagraph, the perspective rulers, sketching frames, reducing and copying glasses. All are so described as to enable any person of intelligence, to make and use the several instruments. This series of engravings, with the practical instructions given for drawing, will greatly facilitate and encourage all persons, old or young, who wish to acquire the art of drawing. Not only are the various instruments shown, but their manner of use in actual practice is illustrated. *Science Record* for 1874 forms a handsome octavo volume of 600 pages, nicely bound, uniform with previous issues. Price $2.50. Published by Munn & Co., 37 Park Row, N. Y., and by them sent everywhere on receipt of price. May be ordered through any book or news store.

THE VALUE OF A KERNEL OF CORN.

In considering the curious and interesting chemical nature of corn, we shall use the word as applied to wheat, as well as to maize. The two grains are chemically constituted very much alike, and what may be said of one applies with almost equal truth to the other. Both are made up of starch, dextrin, gum, sugar, gluten, albumen, and phosphates of lime, magnesia, and potassa, with silica and iron. Wheat contains about double the amount of lime and iron, and considerable more phosphoric acid, but less magnesia and soda. The maize seeds are rich in a peculiar oil, which is nourishing and highly conducive to the formation of adipose or fatty matter; hence, the high utility of corn in fattening animals. What a remarkable combination of chemical substances is stored up in a kernel of corn? It may almost be said to be an apothecary's shop in miniature; and the order and arrangement of the mineral elements and vegetable compounds, needed to render the comparison more apt, are not wanting. For some reason, Nature places the most valuable substances in a kernel nearest the air and sunlight, while the little cells of the interior are full of the material used to keep erect and tidy our collars and neck bands—starch. With a moistened cloth, we can rub off from the kernel about three and a half per cent of woody or strawy material, of not much nutritive value; and then we come to a coating which holds nearly all the iron, potash, soda, lime, phosphoric acid and the rich nitrogenous ingredients. This wrapper is the storehouse upon whose shelves are deposited the mineral and vegetable wealth of the berry. Whence come these chemical agents? By what superlative cunning are they grouped within the embrace of this covering? They come of course from the soil; and by the mysterious and silent power of vital force, they have been raised, atom by atom, from their low estate, and fitted to perform the high offices of nutrition in the animal organisms. And should we not appropriate them to our use as the most carefully adjusted of all materials designed for human aliment? Certainly we should; but do we? Unfortunately we cannot render an affirmative answer. The sharp teeth of our burr mills drive ruthlessly through the rich wrappers of the kernel, and then torn fragments pass to the bolt, and from that to the barn or stable; the animals obtain the nutritious gluten, and the starch, in the form of fine flour, is set aside for family use. But it is not designed to enlarge upon this point. Let us look at the chemical offices the substances found in the kernel of corn subserve in the animal economy.

Starch is the wood or coal which, under the influence of oxygen, is to be consumed or burned to maintain animal warmth. It passes in as pure fuel, it is oxydized, and the ashes rejected through the respiratory organs. The warmth imparted by this combustion is necessary to the proper ful.

filment of the functions of the body Of these functions, those of digestion and assimilation are the most important. The digestive apparatus receives the gluten and the starch of the grain; the latter is pushed forward to be burned, the former enters the circulation; and out of its contained iron, potash, soda, magnesia, lime, nitrogen, etc., are manufactured all the important tissues and organs of the body. All of the iron is retained in the blood, together with much of the soda and phosphoric acid; the lime goes to the bones, and the magnesia very abruptly leaves the body, as it seems to be very plainly told that it is not wanted. Such, in brief, are the uses which the organic and inorganic constituents of a kernel of corn subserve in the chemistry of animal life.

The changes which they are made to undergo in the laboratory are almost equally interesting and important. Fecula, or starch, is a body of great interest, and is not found alone in corn. There is scarcely a plant or part of a plant which does not yield more or less of this substance. What a curious vegetable is the potato! Swollen or puffed out by the enormous distention of the cellular tissue in which the starch is contained, it seems almost ugly in its deformity. It is little less than a mass of starch when the watery part has been evaporated.

If we separate the starch from the gluten in corn, and boil it a few minutes with weak sulphuric acid, it undergoes a remarkable change, and becomes as fluid and limpid as water; and if we withdraw the acid, and evaporate to dryness, we have a new body, a kind of gum called dextrin. But if we do not interrupt the boiling when it becomes thin and clear, but continue it for several hours, and then withdraw the acid by chemical means, we have remaining a liquid, very sweet to the taste, which will, if allowed to separate, solidify to a mass of grape sugar. This is the method of changing corn into sirup and sugar. What is most extraordinary in this process is the fact that the acid undergoes no diminution or change. The play of chemical affinities lies between the amidine and the elements of water, grape sugar containing more oxygen and hydrogen, compared with the quantity of carbon, than the starch. Nothing can be more striking than these changes. From the kernel of corn we obtain starch, this we change easily into gum, and, by the aid of one of the most powerful and destructive acids, transform it into sirup and sugar.

We are now to consider another most extraordinary change which corn is capable of undergoing, that of being transformed into whiskey or alcohol. If we take the sweet liquid obtained by the infusion of malted corn, and subject it to a temperature of 60° or 70° Fah., it soon becomes turbid and muddy; bubbles of gas are seen to rise from all parts of the liquid, the temperature rises, and there are signs of chemical action going on in it. After a while, it slackens and soon stops altogether. Examination shows that it has now completely lost its sweet taste, and acquired another quite distinct. An intoxicating liquid is found, and if we place it in a still, we obtain a colorless, inflammable liquid, easily recognized as alcohol. By a peculiar arrangement of the condensing apparatus of the still, a portion of the grain, oils, and a large amount of water are allowed to go over with the alcohol, and this constitutes whiskey.

This is an example of the change called vinous fermentation. The influence of a ferment or decomposing azotized body upon sugar is strange and quite incomprehensible. Through its agency, we may cause the highly organized kernel of corn to take another step downward towards a dead inorganic condition. We can transform the alcohol over into acetic acid or vinegar, or the sugar may be formed into one of the most curious organic acids, the lactic. As in these processes, we follow the kernel of corn through the various changes, first into gum, then into sugar, then alcohol, then vinegar, and ultimately into carbonic acid and water, we obtain an imperfect idea of the marvels of vital chemistry. The chemistry of a kernel of corn is a comprehensive topic, and to be considered even in its outlines would supply material sufficient for a volume. The aim has been to group together a few of the most interesting points, and thus awaken a desire for a more complete and satisfactory investigation.

THE PRIME MOVERS AND THEIR RECENT PROGRESS.

The prime movers remaining unconsidered in our last issue are the heat engines. It was first pointed out by Benjamin Thompson, of New Hampshire, whose fame was won abroad at about the time of the war of the Revolution, and who was made Count Rumford in Europe, that heat was not a substance, as had been previously supposed, but that it was a kind of motion. In his paper, published by the Royal Society in 1798, he described experiments which not only proved this now well known and universally admitted fact, but also furnished *data* for estimating very closely the value of the "mechanical equivalent" of a unit of heat.* Sir Humphrey Davy, whose attention may have been called to the subject by Rumford's paper, in the following year made his celebrated corroborative experiment, melting ice, in an atmosphere below the freezing temperature, by friction, and published his acquiescence in the dynamic theory, becoming one of the earliest disciples of Rumford. Subsequently, the beautiful method of Mayer and the excellent work of Joule determined with precision the fact that the heat energy of a British thermal unit has an equivalent in mechanical power whose measure is 772 pounds raised one foot high. In heat engines, it is impossible to obtain all of this power from the heat obtainable from any source. If coal is burned, the heat developed becomes wasted, to a certain extent, in transmission to the prime mover, and a very large quantity is lost in the machine itself in many ways which have been already explained in these columns. It thus happens that, while the heat obtained from a pound of coal should do work equivalent to raising a pound weight to a hight of two thousand miles, our engines are so imperfect that our best builders decline to guarantee a tenth of this duty with even very large engines of the most perfect known design. In an editorial article, published in the SCIENTIFIC AMERICAN, January 11, 1873, we exhibited the reasons for this serious waste of power, and showed how far improvement is possible in heat engines working on known principles, and that the range of increased efficiency left to be effected by this improvement amounts to about 15 per cent in the engine and 30 per cent in the boiler of the steam engine, when working between the present limits of temperature. It is impossible to fix a limit to the gain by elevation of temperature and pressure and increased expansion.

We can record no important advance in steam engineering since that date. The use of the compound engine is becoming more general, and progress in the direction of higher steam pressure, and greater expansion is causing gradual modification of old forms of boilers to meet safely the higher pressures and the so-called "safety" or "sectional" boilers are coming into use still more extensively in consequence of this change. No great improvement has been recently effected either at home or abroad. In Europe, as was stated in the letters of our Vienna correspondent, the practice in steam engines is passing through the same phase of experiment and revolution which was witnessed in this country fifteen years ago in the period of the great contests of Sickles and Corliss for supremacy in the then just opening field.

To-day a pound and a half of coal per horse power per hour represents the highest economy of the best classes of large engines; and for ordinary sizes, such as drive our mills and our workshop machinery, double that expenditure is not considered extravagant. We can only hope to see these figures greatly reduced by some now unimagined and complete revolution in engineering. Such a revolution is by no means impossible or perhaps even improbable,, and it would be unwise to neglect any suggestion which looks promisingly toward such an inestimably important advance.

The immediate and well known directions in which engineers are seeking to improve the steam engines look to the prevention of external losses of heat by radiation and conduction, and to the reduction of internal losses due to cooling of the steam cylinder and to condensation of the prime steam, or to liquefaction by expansion and re-evaporation during the exhaust.

The first is accomplished very thoroughly by means of the many sorts of excellent "felting" now in the market, and by "lagging." The second is secured by superheating and by mixture of steam with air to a slight extent in non-condensing engines, and by the adoption of the "compound" engine, invented by Wolff a half century or more ago, long before the use of high steam and great expansion gave it its proper field.

Attempts have been frequently made, and a very promising one has been chronicled in our columns during the past year, to save and utilize the exhaust heat of the non-condensing steam engine, by applying it to the evaporation of some very volatile liquid, which is then applied to a supplementary engine. The real competition here lies between these "binary vapor" engines and the common condensing engine. The former would seem the more economical, and we are awaiting with interest the report of the performance of the engine which, it has been stated by the inventor, Mr. Ellis, is to be designed and tested by one of our most distinguished engineers. As we have already had occasion to remark, the effort to improve this class of prime movers is required to be exerted rather in removing the objections of the expense of the secondary fluid, the danger of loss by leakage, and the infinite annoyance, and generally the danger also, which attends its escape. These difficulties removed, a simple, durable, and properly designed machine of this class will find a ready market and will mark a decided advance, if in first cost and expense of maintenance it can compete successfully with the steam engine. Remembering that the economical value of a fluid depends simply upon the effectiveness with which it acts as a storehouse—a reservoir—of heat, and the advantages which it presents as a receiver and a dispenser of that heat, and remembering also that the mechanical effect depends just as much upon the volume as well as the density, upon the distance through which its pressure is exerted as well as upon the amount of that pressure, we can see that the value of any fluid as a medium of power transmission is not measured simply by its pressure at any given temperature. Up to the present time the vapor of water has been found, all things considered, the best single fluid for use in heat engines.

Air has been used very frequently in the production of power in heat engines, but it has not yet become a really successful and satisfactory motor. The convenience of obtaining an ample supply of air, its freedom from liability to produce destructive explosions, and the completeness of its expansive action, are important advantages, but they seem to be more than compensated by the difficulty of managing the fluid at the very high temperature at which it must be worked, the bulk and cost of construction and maintenance of the engine, and by difficulties, inherent in all known designs, of obtaining prompt and complete conveyance of heat into and out of the mass of air employed. Sixty years ago Dr. Robert Stirling proposed to use air in a heat engine, and his crude design was improved by James Stirling, who worked at the problem twenty years later. Our distinguished fellow citizen, Ericsson, still later, and nearly a quarter of a century ago, designed a form of engine which was so successful that it still continues in use, as subsequently improved by its inventor. Shaw's engine and that of Roper have also met with some success; and the very promising engine of Wilcox, when just seeming most successful, disappeared, for reasons to us unknown. The superheated air engine of Leavitt is the latest example of this class which has come to our notice, but we now hear nothing more of that. At present, we see nothing specially noteworthy in this field of invention. We have indicated the difficulties of the problem, and leave the matter in the hands and minds of the ingenious and experienced mechanics who read our paper, and hope that we may yet be called upon to record the performance of an engine which shall produce the horse power for the expenditure of a pound of coal per hour, as is said already to have been done, and without burning itself out after a few weeks of good work. A "furnace gas engine," or one which uses in its cylinder the products of combustion, will probably prove the most economical form.

Gas engines are another class of prime movers from which much has been expected, but with which little success has been yet obtained. They offer nearly all the advantages of air engines, with the additional one of readily obtaining high pressure; but possess disadvantages peculiar to themselves which have, as yet, effectually prevented their introduction to any considerable extent. The first engine which came prominently before the public, the Lenoir engine, awakened much interest both among engineers and with the public. Using an explosive mixture, fired by electricity, the pressure was irregular, the engine noisy and wasteful of power, and the voltaic battery was a troublesome and costly appendage. The later use of a much smaller battery and the spark of the inductorium reduced but has not eliminated these objections. The Hugon engine next came into notice, and in this machine, by igniting the charge by means of an ingeniously arranged gas jet, this great objection to the use of exploding gases was done away with. In both these engines, the machine itself was quite similar in its details to the ordinary steam engine. The Otto and Langen engine, recently introduced abroad and noticed in our Vienna correspondence last summer, acts much like a Cornish pumping engine. The explosion of the gas drives the heavily loaded piston rapidly to the top of the cylinder, and, as it descends, its weight exerts a useful power. It is economical, using scarcely half the gas required by the earlier engines, but it is more rattling and irregular in its action than even they were. The most recent gas engine is, we believe, that of Brayton, in which explosion is avoided and of which, it is claimed, the economy equals that last mentioned. It seems a most promising invention, and we hope that time will prove its claims well founded. A good gas engine will find a large market. Its motion must be steady, its gases should be gradually burned instead of exploded, and it should not be injured by the high temperature of the products of combustion, nor should it be subject to rapid deterioration by wear or by any other cause.

We have but superficially glanced over this vast and important field, and have laid before our readers the present situation as respects the progress of the prime movers. Were not our limits so restricted, we should readily find much more to write on this subject, but we hope that we have at least set some active and fruitful brains and some experienced and skillful hands on the right track in a work of the highest importance to mankind.

We do not expect soon to see steam superseded, but we do anticipate that other motors will share the field with it to a far greater extent than has been yet the case, and we also are very greatly disinclined to believe that the steam engine itself has even approached the limit of its development.

*Professor Tait estimates this value, from Rumford's *data*, at within 20 per cent of the true value, and Professor Thurston, using a more correct measure of the horse power, estimates it at 784 foot pounds, or within about 1½ per cent of the value now accepted—774 foot pounds.

OBITUARY.

Jephtha A. Wilkinson.

The last day of the last year brought to a close the eventful life of this venerable and vigorous man. Born in Providence, R. I., at a very early age he exhibited a singular mental activity in the form of what is now popularly termed "go-ahead-itiveness." He was always engaged in driving forward some striking enterprise. He served in the war of 1812. Invented a machine for making weaver's reeds, was one of the first inventors of repeating fire arms and cannon also of the planing machine and of the rotary printing press He was a man of great intelligence and remarkable memory. He passed away in the 83d year of his age.

Lloyd A. Williams.

Lloyd A. Williams, late Chief Engineer in the navy, died recently at his residence on Rood street, Georgetown, D. C., in the forty-second year of his age. Chief Engineer Williams was a native of Washington, and entered the service of the United States on the 16th of February, 1852. His total sea service was eight years and five months. His last cruise was on the Colorado, which arrived at the Portsmouth, N. H., navy yard in June, 1872. During this cruise he contracted rheumatism, while in the Gulf of Mexico, from which disease he suffered greatly, and retired in consequence shortly after, in conformity with the act of August 3, 1861.

Draper Ruggles.

Draper Ruggles, of the firm of Ruggles, Nourse & Mason, predecessors of the Ames Plow Company (thirty years ago), in making agricultural implements at Worcester, died a few days ago, aged seventy-four.

IMPROVED TRAMWAY AND VEHICLE.

We illustrate herewith an improved system of tramway, with a vehicle of peculiar construction, adapted for travel thereon. The inventor considers that his plan is applicable wherever the land transportation of heavy freight off of regular railroads is necessary, and for the running of stage coaches, etc. He believes it absurd to attempt giving a road a hard smooth surface, twenty to thirty feet in width, when but a few inches is required for the tread of the wheels. Moreover, any track reasonably hard and smooth, for the passage of the wheels of laden carriages, is unfit for the travel of horses, since in such case a yielding surface is required.

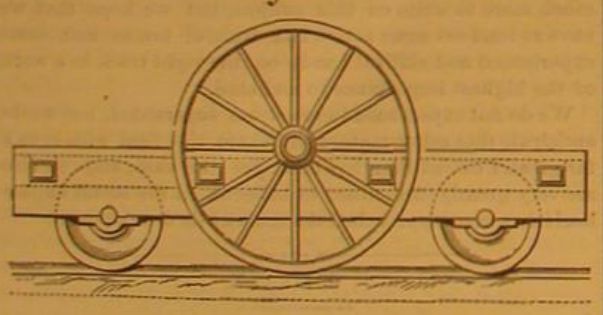
In the tramway herewith represented a longitudinal timber is simply bedded in the earth, even with the surface, and capped with a hard wood or metal rail. Each length is joined by iron sockets. It is stated that an oak or maple rail, sawn 2x4 inches, should last many years, but would require to be renewed several times before the bed timbers would be decayed. These, if of cedar, would be sound after 25 to 30 years' use.

The arrangement of cars proposed is as shown in Fig. 2. They are provided with two double flanged wheels, which may be constructed of wood sectors, having thin plate iron rims bolted or riveted to their sides. An iron arbor or axle passes through the center of the wheel, and is secured with flanges and nuts on each side, firmly screwed up. The outside courses of plank should be one inch in thickness, and project the same all around. Then the wheel is placed in a lathe and its periphery turned and trued up, making the edges of the outside courses form the flanges. A wheel thus constructed, of sound well seasoned oak or maple, will be good and durable, and will wear the track but little. Cast iron wheels should be used to run upon iron edged rails.

Each car needs a common carriage axle and wheels, bolted across for preserving its equilibrium. All should be proportioned so that these wheels should be within a few inches of the surface.

The inventor estimates the expense for these tramways, to be laid down on ordinary country roads, where no grading is required, as follows, per mile: 264 cedar logs, 20 feet, at 10 cents each, $26.40; 3,520 feet maple at $20 per M., $70.40; 1,700 lbs. cast sockets, at 3 cents, $52.80; 200 lbs. spikes, at 8 cents, $16; labor in laying and construction, $75. Total, $240.60. Such a road, it is stated, could be laid down for about $180 per mile by dispensing with iron sockets, etc. Trains of loaded wagons, whether propelled by horses or locomotive or traction engines, could be run over it at a cost for transportation much less, the inventor claims, than by any other style of rail, tram, or common roads.

Fig. 2



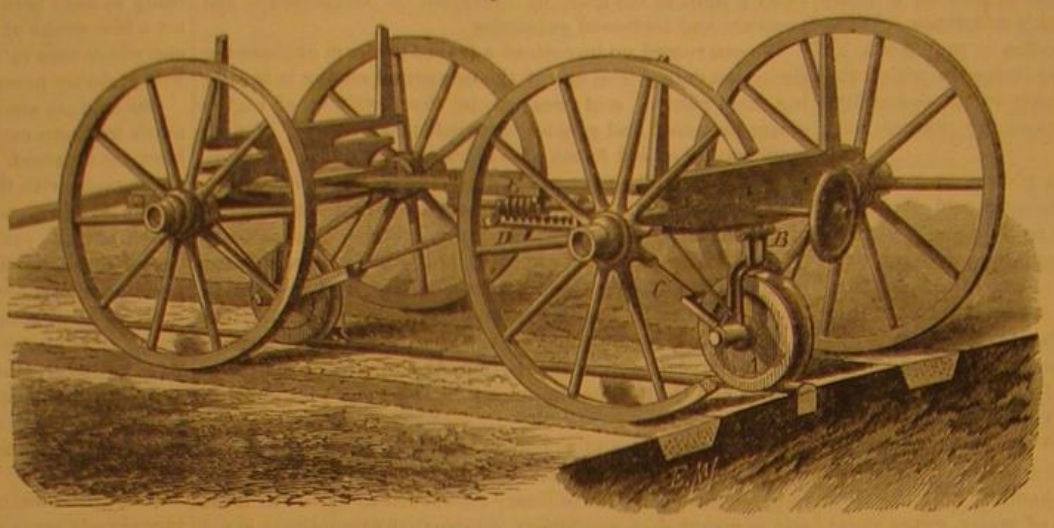
All ordinary vehicles, stage coaches, lumber wagons, etc., are easily adapted to run upon these tramways, by means of the device shown in Fig. 1. A are the double flanged wheels, which travel upon the central rail, and are supported in hinged frames, B. To the latter are connected shafts, C, which are suitably secured to the rack, D. In the teeth of the latter engages the worm, E, the shaft of which extends to the rear of the vehicle, and terminates in the hand wheel shown. By turning the latter the central wheels, A, may be swung up clear of the ground, or may be let down upon the rail to sustain the main weight, while the outer wheels serve to balance the apparatus. The track for the carriage wheels consists in gutters filled with broken stone, so as to form an even and level surface. For stage coaches and similar vehicles, the shaft and hand wheel for adjusting the central wheels should be carried to the driver's seat for convenience. Patented July 25, 1871, through the Scientific American Patent Agency, by Mr. James F. Cass, of L'Original, Ontario, Canada, to whom inquiries for further particulars may be addressed.

A Curious Law Suit.

The Philadelphia *Ledger* gives the following account of a suit at law recently terminated in that city:

Two mill owners on the Wissahickon creek, above Chesnut Hill, engaged in a curious law suit, which was decided last week at Norristown. The mills are three quarters of a mile apart, and the stream between them has not much fall. In 1823, the owner of the upper mill brought suit against the owner of the lower mill for having backed the water into the race course of the upper mill. Under a decree of the court, the sheriff put up four permanent marks to establish the lawful surface of the water. At two places holes were drilled in fixed rocks, a marble stone was set in the tail race of the upper dam and properly marked, and a pin was driven into a buttonwood tree just thirty-one inches above the surface at the breast of the dam. The mills have changed owners since that time, but recently the race of the upper mill has been overflowed by back water, and the owner brought suit for damages. Careful surveys were made, and the water was found to be four inches above the marks in the fixed rocks and on the marble slab, but exactly thirty-one inches from the plug that had been driven into the buttonwood tree forty-eight years ago. The question for the jury to decide was whether the upper mill and rocks had sunk four inches, or whether the base of the buttonwood tree had been lifted that much. Notwithstanding ingenious arguments to show that trees only expanded in size and sent out new growths from the extremities of branches, the jury, composed of farmers or those bred in the country, decided that the buttonwood tree had been elongated, by giving a verdict for the plaintiff for $150. Counsel for the defence will file reasons for a new trial.

Fig. 1



CASS' TRAMWAY AND VEHICLE.

Propagation of Tubercle by Milk.

At the last meeting of the French Association for the Advancement for Science, M. Chauveau gave to the section what he termed a demonstration of the transmission of tuberculosis by the digestive organs. He observed that his numerous observations enabled him to state that if the healthy young of animals susceptible of tuberculosis were fed with food with which the matter of tubercle was mixed, they would all exhibit tuberculosis in various organs. In anticipation of this meeting, he had purchased some healthy calves; and, having had them fed as described, on slaughtering them the sixtieth day after the first ingestion, the lymphatic system was found extensively tuberculized, while caseous deposits existed in the lungs. This thesis he demonstrates most conclusively, and he is supported in his inferences by an apparently wholly independent series of experiments carried on by Dr. Klebs, in Germany, which he has recorded in one of the *Archiv fur Erperim. Pathologie* (*Heft II*, 1873).

Dr. Klebs asserts that the milk of tubercular cows brings on tuberculosis in various animals. The affection generally commences with intestinal catarrh, followed by tuberculization of the mesenteric ganglia, the liver, and spleen, and ending in extensive miliary tuberculosis of the thoracic organs. Infection by means of the milk may be without result in vigorous organisms; and the author has even seen full formed tubercles resorb and disappear through cicatrization. It is likely, adds Dr. Klebs, that the tubercular virus is contained in varying proportions in the milk of cows which are more or less diseased, and the scrofulosis may occur, in children born without tubercle, through the milk of an unhealthy mother or wet nurse. In conclusion, the author expresses the view that the virus is contained in the serum of milk, in a dissolved state, and that it is not destroyed by boiling, which is ordinarily insufficient.

If these facts are not overstated, and they do not seem to be so, what a dangerous article must be that which is measured out in thousands of gallons daily, in all large cities, the product of phthisical cows, fed on distillery slops, and choked with foul odors! The milk of one tuberculous cow will contaminate that of the whole dairy when mixed in the cans.

The propagation of typhoid fever by milk has been only too clearly shown in London this year; and now have we not to lay to the charge of the same fluid the maintenance of a part of the terrible prevalence of phthisis among us?—*Medical and Surgical Reporter.*

LAUGH AND BE HEALTHY.—The physiological benefit of laughter is explained by Dr. E. Hecker in the *Archiv fur Psychiatrie:* The comic-like tickling causes a reflex action of the sympathetic nerve, by which the caliber of the vascular portions of the system is diminished, and their nervous power increased. The average pressure of the cerebral vessels on the brain substance is thus decreased, and this is compensated for by the forced expiration of laughter, and the larger amount of blood thus called to the lungs. We always feel good when we laugh, but until now we never knew the scientific reason why.

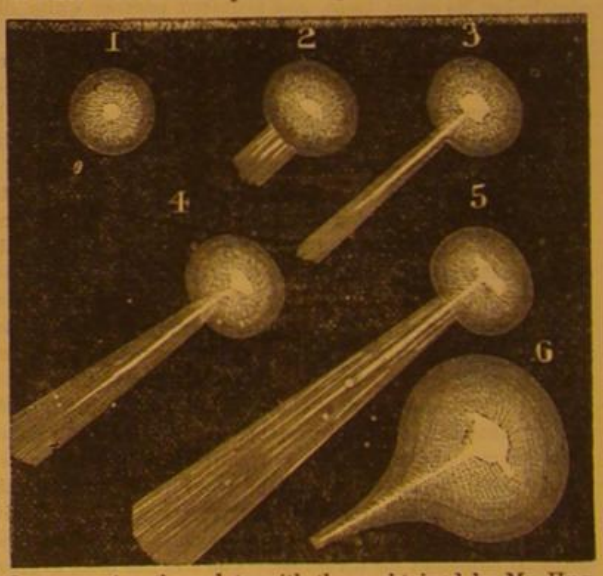
PROSPER HENRY'S COMET.

Comet IV of 1874, discovered on the 23d of August by M. Prosper Henry, at the Observatory of Paris, presents some remarkable peculiarities which distinguish it from all other and similar telescopic bodies. Its rapid changes of form, sudden elongation of tail, and its brilliancy, which became so great as to render it visible to the naked eye for some time previous to its passage to its perihelion, are considered to be phenomena which may throw light upon our hitherto indefinite knowledge regarding the constitution of comets.

On the day of its discovery, the body appeared as indicated in Fig. 1 in the accompanying illustration, the telescope showing a spherical nebulous mass, strongly condensed at the center, and exhibiting no traces of a tail. Its apparent diameter was about 4′, and it resembled a star of the 7th magnitude. There was little change in the aspect of the comet until August 26, when, as represented in Fig. 2, a tail began to appear, and the head assumed a slightly elliptical form, its diameter increasing to 6′. Three days later the tail, extending in a direction opposite to that of the sun, attained a length of 20′, and formed with the meridian, passing through the nucleus, an angle of 41°, Fig. 3. On September 2 (Fig. 4) the tail had grown to 2° in length and continued elongating. The nucleus remained nearly constant in size, although its brilliancy augmented until, on September 10 (Fig. 5), it became comparable to a star of the 4th magnitude.

The head of the comet, examined under a magnifying power of 200, times, appeared composed of three envelopes and a nucleus, the latter being situated near the summit. From the surrounding brilliancy emerged a luminous and very narrow thread, in which the tail appeared to originate.

From the observations of MM. André and Rayet, of the Observatory of Paris, and those of Mr. Plummer, at the Durham Observatory, the spectrum of the comet is found to be composed of three brilliant and very distinct bands. The first is in the yellow portion almost between D and E; the second, in the green, nearly coincides with line *b*; the third is in the blue beyond F. There was no trace of a continuous spectrum in the intervals between these lines. The green band was much the most luminous, while the yellow and blue lines were about equal in length and intensity.



On comparing these data with those obtained by Mr. Huggins from Comet I of 1868 (Wennecke's), it is concluded by Mr. Plummer that the spectra of both bodies are identical, and that the light of M. Henry's comet must be attributed to incandescent carbon, and hence the star must be self-luminous. M. Henry, in commenting upon this conclusion in *La Nature*, from which journal we extract our engraving, says that it does not accord with the fact of the variation of brilliancy of comets, which increases in luminosity as the latter approach the sun. It is also difficult to conceive that a body, of a mass so feeble as that generally attributed to comets, could retain for a long time a temperature so high as that required for the volatilization of carbon. It is, perhaps, more reasonable to suppose that the comet, illuminated by the sun, is a cold gaseous body, into the constitution of which carbon enters in the form, for example, of carbonic acid or oxide. This gaseous compound can evidently reflect only those rays which it is able to intercept, and such rays as are intercepted give only a few lines of the spectrum, among which are found those or carbon.

The polariscope, M. Henry believes, might furnish some valuable information on this point, and, used in connection with the spectroscope, he considers, must solve positively the question as to whether comets are or are not self-luminous.

A POISONOUS ANILIN COLOR.—The dye stuff called rosanilin which gives a beautiful carmine color, is, as we have stated an arseniferous production allied to arseniate of lime, and is soluble in lactic acid. It is used in lithography and for painting wooden vessels, etc. As it is very poisonous, it should never be employed in confectionery, and bright red sugar sticks should not be given to children.

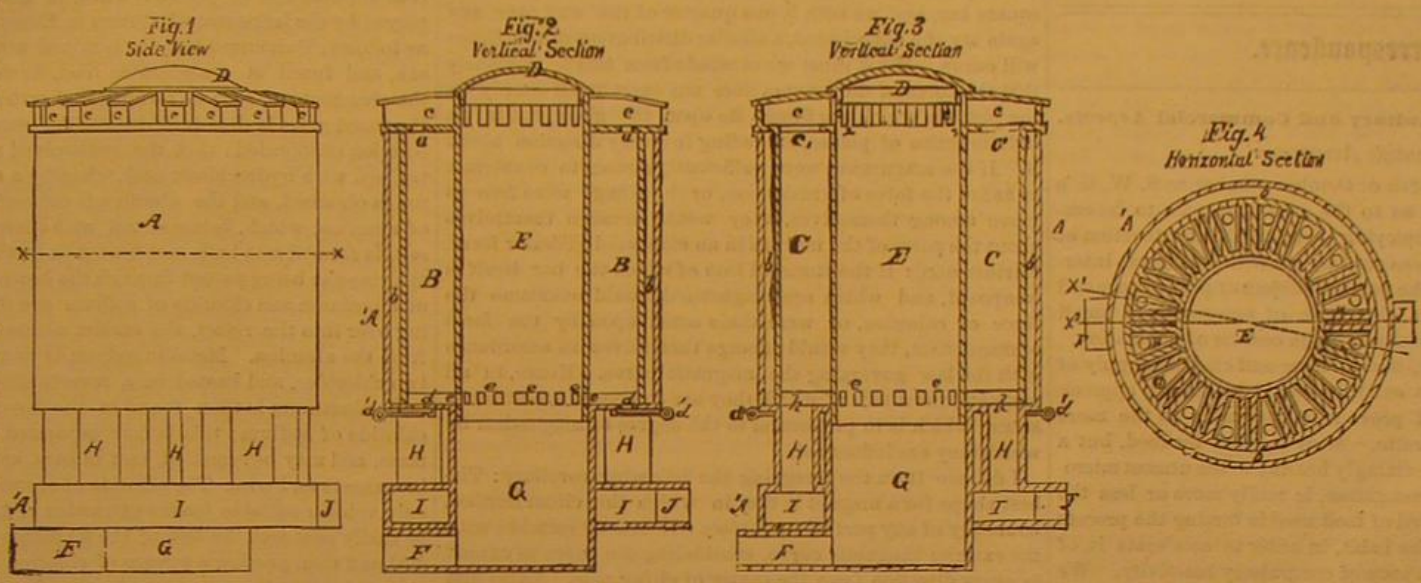
THE WILSON PROCESS FOR MAKING WROUGHT IRON DIRECT FROM THE ORE.

BY EDWARD M GRANT, C.E.

The repeated attempts to manufacture wrought iron direct from the ore are so well known that it is useless to recount the history of past inventions, and, therefore, I will proceed directly to a description of the process which I have investigated.

This furnace was invented and patented by Mr. Joel Wilson, of Dover, N. J., who has spent his whole life in the iron business, in England and America, and has been working on this process for nearly twenty years. His last patent was taken out in July, 1872; and his furnace has been in operation a portion of the time during the last twelve months. The stoppages have been caused by changes made at various times in the puddling furnaces, to adapt them to this process; several hundred tuns of iron have been made by this method during that time and sold in the New York market.

I first heard of his invention in August, 1872, and in December I came north for the purpose of making a thorough investigation of its merits. I brought several tuns of hematite ore from Alabama, for the purpose of testing the working of our native ores by this process. I became so much interested in the matter that I remained in the vicinity of the works until September, 1873, when they were closed in consequence of the panic. During this time I weighed nearly all the ore and coal used in the furnace, and kept complete records of the yield in muck bar from each retort, as well as the amount of coal used in puddling, time of heats, etc. I also preserved samples of muck bar from the various charges of ores, to test the uniformity in quality of the iron produced.



WROUGHT IRON DIRECT FROM THE ORE.—THE WILSON IRON FURNACE.

The accompanying diagrams will assist an explanation of the apparatus. The ore is crushed to the size of small shot, and mixed with the proper percentage of powdered coal, and then charged in the retorts, B, through the apertures, *a a*. These retorts are built of fire brick or tile, and dovetailed together in such a manner as to hold them firmly in position. They contain from 1,300 to 2,000 lbs. of ore, according to the comparative weight and bulk of the mineral. The heat employed is produced from the gases escaping from two or more puddling furnaces, which are conducted from said furnaces through the flues, F, into a collecting chamber, G, whence the gases ascend to the level of the base of the retorts at *d d*. Here part of the heat passes under the retorts through the small flues, *h h*, into the annular space, *b b*, thence up to the top of the furnace, where they are conducted through the conduits, *c c c*, into the intermediate flues, C' C' C', and thence downward. The major part of the gases rises up through the central chamber, E, to the cap, D, thence through the conduits, *c c c*, and down through the flues, C C, uniting therein with the portion of the gases that went up the annular space, *b b*, thence down through the stand flues, H H, into the circular collecting flue, I I, which conducts the escape heat to the stack.

In this way the gases pass entirely around the retorts, heating them from the outside, while the ore is completely protected from the action of the puddling furnace gases.

After the ore in the retorts has been reduced by the action of the carbon mixed with it, and thereby freed from its oxygen, the metallic iron, in the shape of red hot particles (which flow freely, like fine gravel), is taken out at the bottom of the retorts through the apertures, *d d* (covered by the slides, *d' d'*), and received into an airtight vessel, of my own design (thus protecting the ore from oxidation from the atmosphere), and is there transferred to a hopper, opening into the puddling furnace, whence it is charged upon the hearth beneath, without losing the heat absorbed in the reducing furnace.

This reducing furnace contains sixteen of these retorts, twelve feet high, arranged in a circle about the central chamber, E; the tiles forming the retorts are two inches thick and twelve inches in hight; all parts of the furnace exposed to the action of the products of combustion are constructed of fire brick or cast iron lined with fire clay. The central chamber, E, is seven feet in diameter, and this size of the passage prevents any cutting away of the brickwork by the flame, and also produces an even distribution of the gases through the intermediate flue system, C C C. The heat which escapes from the flue, J, looking to the stack, is sufficient to raise steam for blast and rolling machinery. One of these reducing furnaces will supply three puddling furnaces with reduced ore, so as to keep them in constant operation, and the escape gases from two of these furnaces will furnish all the heat required to deoxidize the ore.

The construction of the puddling furnaces is based upon the same general principle as that adopted in ordinary bar mills; they are lengthened out, however, so as to form three bottoms, about the ordinary size; the first, next to the flue, is inclined, and upon this hearth the ore is charged; it is thoroughly heated up here, and is then moved forward upon the second hearth, by a tool designed for the purpose, where it is heated sufficiently to melt the slag produced by the fusion of the impurities of the ore; from there it is moved to the third bottom and balled up. The operation is continuous, as a second charge is placed upon the first bottom as soon as the first one is moved to the second hearth. The puddling involves less muscular exertion than that required for working pig iron, and only requires one laborer in addition to the usual puddler and helper employed in the ordinary furnace; and the yield from the puddling furnace is fully equal to the production of similar furnaces in using pig metal.

The operations of hammering or squeezing, rolling, etc., are, of course, the same as in the ordinary working of pig iron blooms. A tun of finished iron can be made with two tuns of coal, including that used for reducing purposes. The cost of these reducing furnaces is a small item, and they can be erected in any rolling mill, and the puddling furnaces modified as described, and thus render the mill owners independent of the blast furnaces.

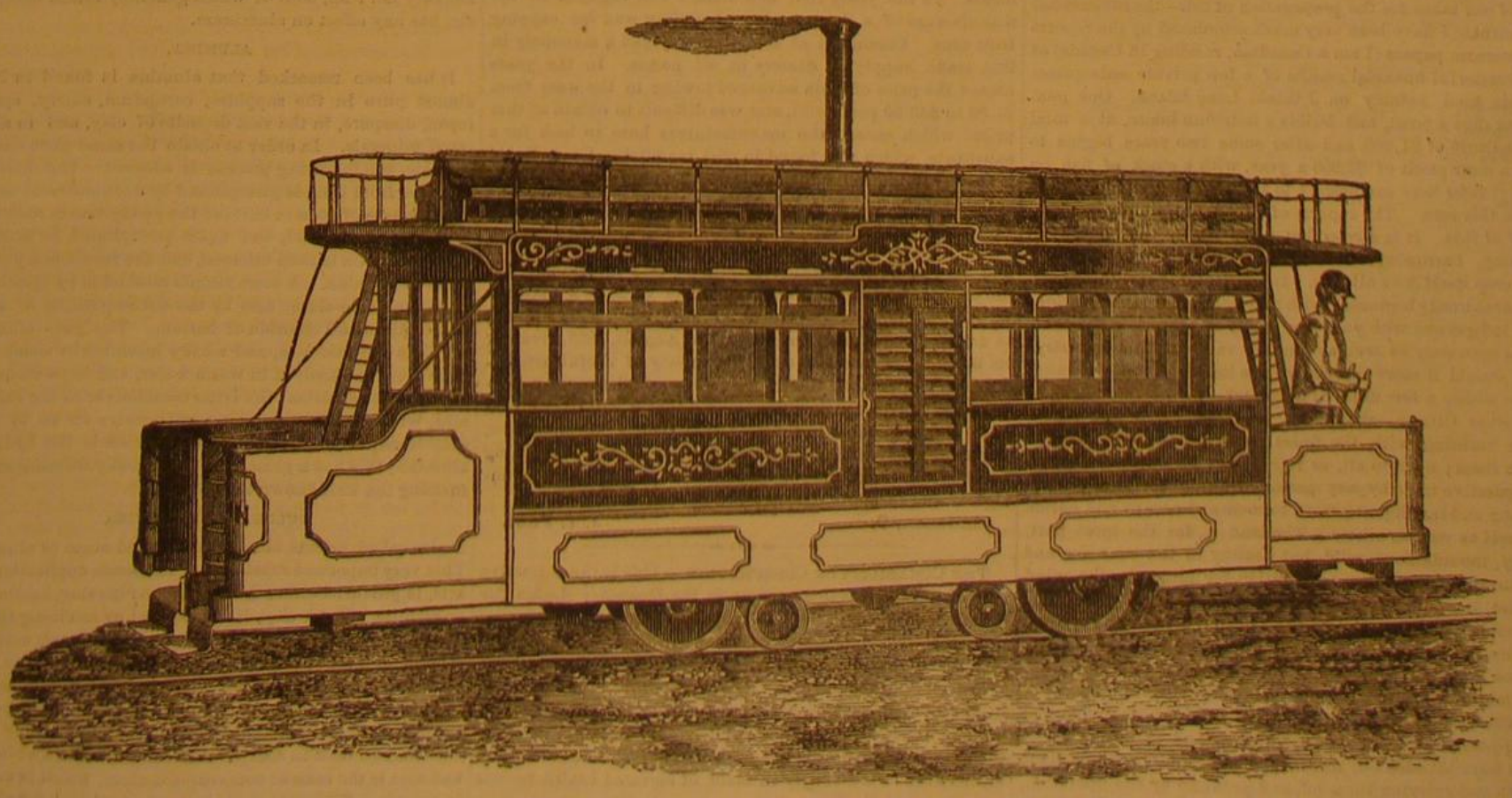
The yield in muck bar from the ore is about the same in amount as that obtained at the blast furnace in the shape of pig iron. The Alabama ore assayed 54 per cent, and I obtained 47 per cent muck bar. Seven tuns of ore sent me from Georgia assayed about 50 per cent (being surface ore) and yielded 45 per cent. Spanish ore from Bilboa, assaying 48¼ per cent, yielded 45 per cent, and many ores from New Jersey and adjacent States yielded to within two to five per cent of the assay. Magnetic and hematite ores were worked with equal facility, and they were mixed together in various proportions, fully demonstrating that mixtures of ores could be worked so as to produce any kind or quality of iron desired. The muck bar showed a uniform fracture both in color and texture, and there is no question about this process producing a quality of iron equal, if not superior, to any produced from the same ores by the old process. The degree of heat employed in the reducing furnace is not sufficient to produce any visible effect upon the bricks, and, therefore, they will endure a long period of service. The furnace is surrounded by a casing of tank iron, with a fire brick lining between the iron and the annular space, *b b*.

Ores containing an excess of impurities may be fluxed in the puddling furnace with perfect facility.

During my investigations, every facility was afforded me by the proprietors of the works; and for a good portion of the time, the operations were practically under my own direction, the inventor following my suggestions so that I might have every point tested in my own way, and to any extent deemed necessary. My conclusions were so favorable that we should have had our works in the South, upon this plan, well under way by this time, but for the unexpected stringency in the financial world, which has, of course, postponed all new enterprises.—*Engineering and Mining Journal.*

A NEW STEAM OMNIBUS AND STREET CAR.

Our engraving illustrates a new style of steam passenger cars, for street railways, the invention of Mr. Grantham, of London, where the improvement was lately tried. Two small boilers are used, one on each side, fired from the ex-



NEW STEAM OMNIBUS AND STREET CAR.

terior of the car. This novel vehicle has a double set of wheels, one set with flanges, intended for use when the machine runs on the street railway track, the other set being employed when running on common roads. Most railway cars and locomotives are useless when at the end of the track; but not so with this device. It can then steam off, independent of the track, through streets or roads, as far as may be desired. The axles of the flanged wheels are supplied with cranks and rods, and with a worm wheel and lever, under the control of the driver, who may, at any moment, raise up the flanged wheels, so that the vehicle will rest on the plain wheels, for running on common roads. The axles of the plain wheels have a screw steering device connected with them, so that the vehicle may be guided in any direction. The car is provided with seats on the top, and, as shown, has a capacity for some forty or fifty seats. But the end platforms, it appears to us, are too long. Taken as a whole, however, this device presents some good ideas, and is creditable to the inventor

Correspondence.

Pisciculture in its Sanitary and Commercial Aspects.

To the Editor of the Scientific American:

Your reply, in your 18th of October number, to S. W. G.'s inquiry for information as to the best materials to be employed and mode of employing them in the construction of a dam for a fish pond, was read by me with very great interest, in connection with the general subject of pisciculture and utilization, especially in this form of enterprise, of small sheets of water in proximity to large centers of population.

I believe, most firmly, that a larger and cheaper supply of fish than that at present existing would be readily appreciated by every class, and prove most conducive to the more general promotion of health. Meat is good for food, but a vast quantity of meat, seemingly healthy to the utmost microscopic and scientific investigation, is really more or less the reverse, owing to the kind of food used in forcing the process of fattening, and also the habit, in order to accelerate it, of keeping the animal in a state of compulsory inactivity. We are indebted for the comparative immunity we happily enjoy from the natural, morbid consequences of consuming this, as well as many other kinds of really deleterious articles of food, to the benevolence of the *vis medicatrix naturæ*, or *vis vitæ*, to use the language of medicine. But when a man turns the age of 45 or 50 years and his vital power begins to weaken in its resistance to what is injurious, then does he begin (and continue, by an inevitable law of physical life, in accelerated ratio as his years increase) to suffer in one way or many ways, in one organ or many organs, as may be determined by congenital idiosyncrasy or acquired habit. The evil becomes deeper, more irradicable, and therefore more dangerous, by the slowness with which it grows. The remoteness of the effect from the cause throws suspicion into fatal sleep until awakened by the magnitude and seriousness of disease; the physician is called on and in vain invoked to exorcise by a drug the seven spirits which, insinuating themselves into the very citadel of life, refuse to leave until accompanied by that life which they expressly came to take away. But I must not allow myself to be carried away into inordinate length by my subject. I shall not, therefore, anticipate the answer that possibly might be urged—for assumption grows in extravagance with the extent of ignorance—derived from the easily accessible quantity of salt fish. Neither shall I touch on the admitted, because admitted, healthfulness of change of food. My object is simply to avail myself of the most potent of all arguments why our attention ought to be more generally directed to the utilization of our lakes for the propagation of fish—the commercial argument. I have been very much astonished by the reports in American papers (I am a Canadian, residing in Canada) of the wonderful financial results of a few private enterprises of this kind, notably on, I think, Long Island. One gentleman digs a pond, and builds a hatching house, at a total expenditure of $1,500, and after some two years begins to reap a clear profit of $3,000 a year, with a stock of fish on hand (I refer here exclusively to trout) valued at more than treble this sum. The reports of others are simply confirmatory of this. It is a crop that sows itself, that needs no plowing, harrowing, drilling or cultivating of the soil. The crop itself does all this. It is therefore nearly all profit. You are already beginning, with that intelligence and foresight now indigenous with you, practically to appreciate the enormous pecuniary as well as sanitary value of this industry: why should it more especially urge itself on me? Because I live within a few miles of a country—the northern bank of the river Ottawa—abounding in lakes, large and small, some teeming with the finest trout, but nobody cares to catch them; open to all, or rights may be purchased for a comparative trifle by any person, waiting for some enterprising and intelligent person to come and occupy and enrich himself as well as others. The land is, for the most part, rocky, mountainous, wild, but healthy in the extreme and picturesque. In eager exploration for minerals, the mind cannot, it would seem, appreciate the value of the living minerals which in vain, by their glitter, attract the eye and fearlessly invite attention to their numbers and their beauty.

You have an equal share with ourselves already in our salt water fisheries. It must be because you are ignorant of the extent, perhaps the existence, of our fresh water fish that I suppose you are not already catching and exporting them. You have invaded our forests and are rapidly cutting them down and carrying them off, and profiting by the operation. I think I may safely promise your appearance with rod and bait a very warm welcome, and a very profitable result. But I must desist. I do not know if you will consider this a suitable subject for your paper; if so, I shall gladly hail its appearance in the interest of my aim, the extension of a valuable industry and the promotion of our physical well being.

These remarks embody the views of our very intelligent Deputy Minister of Fisheries, enunciated some time ago in a conversation with me. The subject is, with him, one of scientific as well as practical interest. CANADIAN.

Magnetism and the Nodular Form of Iron.

To the Editor of the Scientific American:

Those much acquainted with magnetism are familiar with the magnetic curves described by iron filings, when shaken about a bar magnet. If we lay on a bar magnet a pane of glass, and shake upon the glass some fine iron filings, and gently strike the glass, the filings will distribute themselves after a certain uniform manner in obedience to a force operating them from the magnet. If our magnet be a square bar, and we turn it one quarter of the way over, and again try the experiment, a similar distribution of the filings will ensue. What must we conclude from this? Obviously that the force of the magnet does not exert itself simply in the plane in which the filings lie upon the glass, but in an infinite series of planes, extending in every direction about it. If the magnetism were sufficiently strong to counteract or annul the force of gravitation, or the filings were free to move among themselves, they would arrange themselves about the poles of the magnet in an elongated globular form. Furthermore: If the atoms of iron of which the bar itself is composed, and which are magnetized, could overcome the force of cohesion, or were alone acted upon by the force of magnetism, they would arrange themselves in accordance with the law governing the magnetic curve. Hence, in all magnets, the atoms of which they are composed are under a strain, which is in proportion to the degree of magnetism by which they are influenced.

I deduce from the foregoing the following corollary: The best shape for a magnet is that in which the circumscribed boundary of any part of its surface will exactly coincide with the exterior magnetic curve, considering the curve to extend in every direction from the center of either pole. I also find in the above theory an explanation of the fact that iron which has been deposited from solution (as in the clay basins of Missouri) has assumed a globular shape, and is almost universally found in nodules. The atoms of iron have been deposited in obedience to the magnetic force; and being in solution and free to move, the atoms, in aggregating, have arranged themselves on the magnetic curves. While this was going forward, the nodules were probably in pairs. Subsequently, violent action has rended them asunder, causes have operated to demagnetize them, and oxidation and attrition have modified their primary form.

Louisville, Ill. C. H. MURRAY.

Coal Tar Products.

To the Editor of the Scientific American:

Allow me to add, to your list of the products of coal tar, rhigoline, which is now used in the artificial manufacture of ice. There is also a beautiful black varnish for iron, which dries quickly and produces a gloss almost equal to Japan; this is made by dissolving the pitchy residuum of coal tar in the heavy oil that distils from the same, being the only liquid which will dissolve it. This varnish is known to the trade as paraffin varnish, but this is a misnomer, as that article, although a product of coal tar, does not enter into its composition.

A few years ago I was connected with the coal tar pitch interest in such a manner as to lead to a series of experiments. In the years 1861 and 1862, I was engaged in the manufacture of a cheap quality of sealing wax for capping fruit cans. Cincinnati at that time enjoyed a monopoly in that trade, supplying dealers at all points. In the years named the price of rosin advanced (owing to the war) from $1.80 to $40.00 per barrel, and was difficult to obtain at that price, which caused the manufacturers here to look for a substitute, which was found in coal tar pitch. So well did it answer the purpose that at least fifty tuns were cast into suitable shape and sold for sealing wax, the only objection to it being the odor.

The beautiful gloss of this wax, together with its strength and the facility with which it could be cast into molds, led me to make some experiments as to its value as a material for decoration, picture frames, statuary, etc. This resulted in my securing a patent on the 5th of August, 1865, covering its use for the manufacture of a variety of useful articles. From that time until the present, I have endeavored to develope my invention, being convinced that it will be as useful as vulcanized rubber in time. I send you a blacking box, cast of the material, which please accept as a curiosity, being another link in the long chain of useful products of the unsightly and formerly despised article, coal tar.

Cincinnati, O. J. T. PEET.

THE CURABILITY OF CONSUMPTION.—This is the attractive title of a very excellent article in the *Deutsches Archiv fur Klinische Medicin*, June, 1873, by Dr. Massini. He shows, first, that true tubercular consumption is curable, as post mortems of persons dying with other diseases prove. That it is communicable he also attempts to prove, and hence he disapproves of consumptives marrying. The means of prevention are general and special. His enumeration of them includes nothing novel; but with most of the later German authorities, he is strongly in favor of elevated health resorts —pure mountain air.

ALUMINA, FROM THE CLAY TO THE SAPPHIRE.

READ BEFORE THE POLYTECHNIC CLUB OF THE AMERICAN INSTITUTE, ON DECEMBER 18, 1873, BY DR. L. FEUCHTWANGER.—CONCLUSION.

It has been stated that alumina is the oxide of the metal aluminum. We will now proceed to describe the process of obtaining this peculiar metal, and its qualities and applications.

It is an earthy metal, like cerium, zirconium, glucinum, erbium, and yttrium, and was first prepared by Wöhler in 1828; it is one of the most important metals on account of its usefulness in the arts. Its extraction from its mineral compounds, however, is not very easy, or it would ere this have been the great rival of the precious metals; in fact it possesses some qualities superior to them. Several methods have been proposed for its extraction, all of which depend upon the use of metallic sodium. Common clay, cryolite, and other aluminous minerals may be employed, but the mineral called bauxite, from France, containing about 60 per cent alumina and 40 per cent silica, is now principally employed by the large manufacturers in Europe. The process is as follows: Pulverized bauxite is mixed with powdered soda ash, and fused at considerable heat, during which process the aluminate of soda is formed, and carbonic acid escapes; the fused mass is dissolved in boiling water, and the clear solution evaporated; then the redissolved aluminate is neutralized with hydrochloric acid, whereby a chloride of sodium is obtained, and the alumina is converted into a hydrate of alumina, which, being mixed with charcoal and common salt, is formed into balls and heated in earthen cylinders, dry chlorine gas being passed through the heated mass. Chloride of aluminum and chloride of sodium are thus produced, going over into the retort, the carbon abstracting the oxygen from the alumina. Metallic sodium is now mixed with the two chlorides, and heated in a reverberatory furnace. Metallic aluminum is then found at the bottom of the melted chloride of sodium; this is now separated from the fused mass, and may be remelted, cast in bars, and then rolled out into sheets and wire. The chloride of aluminum is as yet the only vehicle suitable for the extraction of the metal; it may be easily produced by fusing the ammonio-alum with charcoal and then passing a stream of chlorine gas through the mass; the chloride goes over in the form of vapor which condenses in a receiver as a solid crystaline mass. The metallic aluminum is now largely manufactured in France and England; the business has been attempted in the United States (from cryolite, by Monier and Parmele), but has not been carried to any extent.

Aluminum possesses the following remarkable properties: It is of white color, resembling silver, and is very sonorous, more so than any other metal; it is the lightest metal, having a specific gravity of 2·5 (while silver has a specific gravity of 10·53); this property renders aluminum very valuable in the arts, such as for making small weights used in chemical analysis, for dentists in the manufacture of plates for artificial teeth, and many ornamental purposes, particularly as it resists so well the action of a moist atmosphere. It even resists boiling nitric acid; this property puts it on equality with gold and platinum; but hydrochloric acid attacks it. It is, however, not blackened by hydrosulphuric acid. It is infusible in cast iron heat by exclusion of air, but burns in the same with brilliancy, and in oxygen gas the combustion is so fierce that the eye can hardly bear to look on it; it is then formed into the earth alumina It dissolves readily in dilute caustic alkali, such as ammonia, and in dilute sulphuric acid; it is not attacked by cold sulphuric or nitric acid.

Aluminum bronze is an alloy of 1 part aluminum and 9 parts metallic copper. It has the color of gold, but becomes dull after a while, and it is as strong as iron; neither mercury nor lead, both of which generally attack other metals, has any effect on aluminum.

ALUMINA.

It has been remarked that alumina is found in Nature almost pure in the sapphire, corundum, emery, spinelle, topaz, diaspore, in the vast deposits of clay, and in all silicated minerals. In order to obtain the same pure and in a hydrate, the following process is adopted: Commercial alum, free from iron, is precipitated by a concentrated solution of carbonate of soda in excess; the precipitate is redissolved in hydrochloric acid, and again precipitated by ammonia; this precipitate is then calcined, and the result is a pure hydrate of alumina. A more simple method is by igniting the pure ammonio-alum, also by the decomposition of a solution of alum and chloride of barium. The pure alumina is colorless and tasteless, and wholly insoluble in water. If a little alum is dissolved in warm water, and some ammonia is added to the solution; the latter combines with the sulphuric acid, while the alumina unites with water so as to form a semi-transparent gelatinous mass, which is the hydrate of alumina; this has a great affinity for many coloring matters, forming the well known lake pigments.

SULPHATE OF ALUMINA

is also called porous alum, concentrated alum or alum cake. This very important substance, of extensive application in the arts, is produced either from common pipe clay, kaolin, shale, or cryolite. From clay, it is prepared by calcining the same and treating it with half its weight of sulphuric acid, until it becomes a stiff paste, which is then exposed to the air for several weeks; sulphate of alumina is produced, which is washed out with water so as to leave the undissolved silica behind; the clear solution is evaporated to a sirupy consistence and allowed to cool; it then solidifies into a white mass, and this is the cake or concentrated alum, which is extremely soluble. The alum shale is much employed for this pur-

ose in Europe by roasting it in heaps and setting fire in several places under them; the iron pyrites (a usual companion of all shales) produces a decomposition, and sulphurous acid is evolved. On exposure to the atmosphere, as above stated, the sulphate of alumina is obtained.

In Pennsylvania, the cryolite from Greenland is altogether used for the manufacture of the alum cake, by the following simple method: The cryolite is mixed with chalk and calcined, and a double fluoride of aluminum and sodium is produced; while the fluoride of calcium, first formed, gives off its oxygen to the sodium and aluminum, converting them into soda and alumina. The soda is now crystalized out of a solution with the assistance of carbonic acid gas which is passed into it; and after setting the same aside, the soda as the carbonate crystalizes out of it, leaving the pure alumina in the mother liquor to be treated with sulphuric acid.

Sulphate of alumina has a sour taste, but also a sweet and astringent aftertaste; it is soluble in twice its weight of water. It is a powerful antiseptic and arrests animal putrifaction, and can be used for preserving bodies. Porous alum or sulphate of alumina is very extensively used by calico printers and papermakers, and is, in many instances, preferred to alum.

ALUM.

This, the chief compound of aluminum, employed so extensively in the arts, is obtained from the last mentioned substance, the sulphate of alumina. The solution is mixed with sulphate of potash, when, on evaporation, beautiful octahedral crystals are obtained. Sulphate of ammonia, as obtained from gas liquor, is now generally substituted for the potash; and instead of a potash alum, ammonia alum is now altogether put in market, although many manufacturers believe they obtain the old fashioned potash alum; but the ammonia alum answers as well in dyeing, calico printing, papermaking, etc., and in the manufacture of colors. In England, the chloride of potassium was formerly used in the manufacture of alum, this being a waste product from the soapboiler and the saltpeter refiner.

Ammonia alum is found native in Bohemia as a mineral, called tschermigite, which occurs in fiberous crystals, but not in such sufficient quantities to be of practical use. There are, however, many minerals from which alum can be extracted, and the localities may be seen all over the world: in Germany, particularly in the neighborhood of Halle in Prussia, on the island of Riga in the Baltic, in Bohemia, in Hungary, in England (where the deposits are most extensive), and in the United States.

The following sources of alum are mentioned, as they yield the mineral used for the production of alum and alum cake, independently of the pure clays or kaolins brought into market and used most extensively for the manufacture of porcelain, pottery, and Rockingham ware:

Alum earth, a mineral deposit in the brown coal formation.

The alum slate is a dull earthy black slaty mineral, of specific gravity 2·4; it contains some bituminous matter and fossil remains, and is found in England, the Netherlands, and Prussia.

The alum stone, called alunite, of obtuse rhombic form and white color. It has a vitreous and pearly luster, yielding: alumina 14 per cent, sulphuric acid 25 per cent, silica 24 per cent, potash 4 per cent, water 2 per cent; total, 100. In 1866, I found it between the gneiss and granite, in an efflorescent state, at First avenue and 51st street, in this city. The mineral is found in lava and trachytic rocks at Talfa near Rome, in Hungary, and in Auvergne, France. This material was used 1,000 years ago for producing the alum, and is called the Roman alum.

The aluminite, found abundantly in Prussia at Halle, and at Epernay in France, is also called websterite, and contains alumina 30 per cent, sulphuric acid 24 per cent, water 46 per cent. It is white and opaque; it adheres to the tongue, and has a specific gravity of 2·0. It is rather abundant in the localities named.

The many applications of alum in the arts are due to the alumina having great affinity for many coloring and other vegetable matters, for gelatin, etc.; and in the preparation of lakes, it forms an insoluble precipitate of alumina with vegetable colors. It is also used in preparing white leather by its action on gelatin, for clarifying water, as an addition to paste used by bookbinders, for preventing the depredations of insects, in fireproof safes as a filling, etc. Alum has been described by authors as early as Pliny and Dioscorides. Boerhaave gives a very extensive description of it, and says: Alum is a real fossil, procured either from a hard flaky stone, found deep in the ground, and so pregnant with sulphur and bitumen as easily to take fire or form a bituminous and combustible earth, which yields a noxious flame and a sulphurous stench. If exposed for a month in the open air, it crumbles into powder, and thus becomes disposed for the generation of alum, which before it was not. If dissolved in water, it may be precipitated by adding a fixed or volatile alkali; and it then produces a new salt, which is the alkali and the fossil matter together. In England, Italy, and Flanders, alum is principally produced." He also says "that alum has a sharp, rough, styptic taste. Its crystals are octagonal, four of the sides being hexagonal, and the other four triangular, surfaces. In Italy (at Civita Vecchia and at Solfatara, near Patella), the alum is manufactured from the natural substance in summer time.

Let me add a few words more about alum and its physical and medicinal properties. Alum is a white, slightly efflorescent salt, it crystalizes easily in octahedrons, but may be made to crystalize in cubes, if an excess of ammonia is added to the solution, which must be carefully evaporated; it dissolves in warm water, say in three fourths of its weight of boiling water. It is insoluble in alcohol, and has a specific gravity of 1·71; it reddens litmus, and changes the tints of the blue petals of plants to green; it assumes an aqueous fusion when heated to 212° Fah. Exposed to red heat, it gives off oxygen with sulphurous acid. It forms pyrophorus when calcined with fine charcoal, and then spontaneously forms an inflammable substance. There are several varieties known in commerce, among others, the Roche alum, which originally came from Rocca in Syria, of a pale rose color; and the Roman alum, which has always been considered as the purest. Five thousand tuns are still annually manufactured.

Alum is incompatible with the alkalies and their carbonates, lime and lime water, magnesia and its carbonate, tartrate of potash, and acetate of lead. It is an astringent and antispasmodic; in large doses, it is purgative and emetic. In cases of hœmorrhage, sweats, diabetes, chronic dysentery and diarrhœa, it is used as an astringent. It is used as a purgative in the painter's and nervous colics. Alum is also sometimes used for the adulteration of bread, with a view to increase the whiteness, but in very small doses.

It may be stated, in conclusion, that a great many minerals, known by mineralogists as oxygen compounds, the unisilicates, hydro-silicates, and some bisilicates, contain the oxide of aluminum or alumina as one of the component parts. The family known as zeolites, such as laumonite, natrolite, analcite, mesolite, scolecite, thompsonite, gmelinite, phillipsite, harmotome, stilbite and many more of this class each contain from 20 to 30 per cent of alumina, pachnolite 25 per cent, and staurolite 50 per cent. Kyanite contains 64 per cent. Several mineral springs in the United States, in Virginia, contain the alum in solution from 20 to 70 per cent, and are used in medicine.

I may say that alumina exists in the most common as well as the most precious minerals. White clay or kaolin is found in many localities in the United States to a very large extent. I have visited many deposits in Vermont, near Brandon, in Massachusetts, in Pennsylvania, at Jacksonville, Ala., and in South Carolina. At Bath I saw large deposits of a fine quality, and 10,000 tuns are annually brought to this city for papermakers' use. At Aiken, S. C., large deposits are yet undeveloped. At Perth Amboy, various qualities have been dug out for the last 50 years from strata 20 feet thick. It is found in the coal, tertiary, metamorphic and older formations. Stourbridge clay, so indispensable for glass pots, is principally brought from England. Alum is a very important branch of commerce. England produces annually 10,000 tuns, and Germany 10,000: and in the United States about 5,000 tuns are manufactured.

Death of the Big Rhinoceros in the London Zoological Gardens.

The "Zoo" is in mourning for one of its hugest and oldest inhabitants. The great rhinoceros, which had been from its earliest days a conspicuous object in the elephant house, has at last succumbed to the scythe bearer, or whoever the rhinoceral typical representative of death may be. For twenty-four years the creature had lived in comfortable quarters, and withstood the rigors of an English climate; for twenty-four years it had, day after day, partaken of its plain meals of hay and similar food, and day after day for twenty-four years it had thrust its snout as far as possible between the massive bars of its den, and opened its capacious jaws to receive the gratuities of its admiring visitors, in the shape of buns and biscuits, oranges and apples, and other titbits. The rhinoceros is liable to sudden outbursts of violent temper, and the late lamented individual was no exception to this general failing of its race.

Several years ago, in a furious attack on the rails of its den, it broke its jaw, and was for some time in rather a dangerous condition. It, however, survived the accident and has safely passed through the vicissitudes of English weather, and it may be considered that twenty-four years is about the average length of life among this species of pachydermata. The hippopotamus has bred in the gardens, but no success has attended the attempts to breed the rhinoceros in captivity, their violent tempers rendering it dangerous for them to be temporarily housed together. The skeleton and skin of the deceased creature are to be preserved, and valuable preparations will no doubt be made.—*London News.*

Railway Receipts and Expenses.

The proportion of working expenses to receipts is often put forward as evidence of the cheapness or dearness with which a line is worked; while in fact it proves nothing at all, either one way or the other. Recently a statement of the proportion of expenses on the Denver & Rio Grande Railway has been widely published at home and abroad as evidence of the cheapness of working a narrow gage line, the percentage given in the case before us being 48·5 per cent in August, and 45·4 per cent in September last. The proportion of expenses depends equally on two things: 1. The cost of transportation, and, 2, the rates received. Evidently, if it costs me two cents per mile to carry passengers and I get three cents for it, my working expenses will be 66⅔ per cent; while if I receive 4 cents per mile these same working expenses will be but 50 per cent. On the Denver & Rio Grande, we understand, ten dollars is charged for carrying a passenger 76 miles, and at this rate working expenses of 45 per cent give nearly six cents per mile as the cost of doing the work. This is no argument against the road and its management, for the traffic is light, and heavy charges would be necessary to support a road of any gage. The Central Pacific, whose charges are not half so high, is worked for 40 per cent of its earnings, its rates being still higher than those of most American roads with equal traffic. The Panama Railroad is worked for about 44 per cent, we believe, and one might think it wonderfully economical; but its charge for carrying a passenger 47 miles is twenty-five dollars, so the cost would appear to be something like 23 cents per mile.—*Railway Gazette.*

The Hours of Labor.

E. W. says: "I regret that A. B. Mullett falls into the very common error of accepting eight hours' labor as costing but twenty per cent more than ten hours, instead of twenty-five per cent more. Let me quote the following letter, written by me in June, 1872: 'If a piece worker asks 20 per cent advance to equalize wages, when the time worker has his hours reduced from 8 to 10, it does not make them equal in pay, as the former will find on experiment. The manufacturer, too, will find that, so far as the day hands are concerned, his wages account will be increased 25 per cent. If I have two hands at work, making shirts: to one I pay $4 per day, for 10 hours, and he makes 4 shirts per hour, or 40 shirts per day, costing me, of course, 10 cents each for labor; the other hand works by the piece, at 10 cents each shirt, makes 40 per day, and gets, of course, $4 per day. So far, so good; but the day worker now wants to work but 8 hours for $4; and he will produce for me, at 4 shirts per hour, 32 shirts, costing me 12½ cents each; certainly 25 per cent more. The piece worker then asks for 20 per cent advance over original price of 10 cents, and gets thereby 12 cents each for his 32, and, consequently, earns but $3.84, so that he does not equalize wages.' If, under the 8 hour programme, I have to employ five people to work 40 hours, when four now accomplish that much, am I not paying 25 per cent more wages?

"It has been asserted that a mechanic can produce as much work in 8 hours as in 10. If he can do that for his employer, why cannot the piece worker do that for himself, and not ask 20 per cent more to equalize?"

A New Floral Ornament.

A writer in *Les Mondes* suggests a new idea for floral decoration, which, it seems, may be readily put in practice. An ordinary earthenware flower pot is filled with water, the hole in the bottom of course being closed, and allowed to stand until its porous sides are completely soaked. The water is then thrown out, and the pot is repeatedly dipped until it will absorb no more, and its outside becomes thoroughly wet. On the outer surface fine seed is thickly sprinkled and allowed to remain sticking thereto. The pot is then refilled with water, and set in the shade under a bell glass. In a short time the seeds will germinate and throw out shoots, so that, to prevent their falling from the sides of the pot, some thread or wires must be repeatedly wound around the exterior of the latter. Eventually the entire vessel will become a mass of living vegetation, which is nourished by the percolation of the water contained within through the porous sides.

A non-porous receptacle may also be used, but some thick cloth must be wound about its exterior and the seed sprinkled thereon. This cloth is kept continually moist by repeated applications of fresh water.

The Wear of Gold Coin.

It appears from experiments made in St. Petersburgh that, contrary to the opinion generally entertained, gold coin wears away faster than that of silver. Twenty pounds of gold half imperials, and as much of silver copecks—coins of about the same size—were put into new barrels, mounted like churns, which were kept turning for four hours continuously. It was then found, on weighing the coins, that the gold ones had lost sixty-four grammes—the silver ones only thirty-four; but as the number of gold pieces was twenty-eight per cent less than those of silver, the proportion is of course greater to that amount in favor of the latter. The silver also contained more alloy than the gold.

Nickel in Missouri.

A correspondent, "Nick," writes to point out a slip of the pen in our issue of December 13, 1872, wherein we stated that the nickel mines of Pennsylvania are the only ones in the United States.

"In your paper of November 30, 1872, you have an article on American nickel, wherein you mention the mine La Motte tract, Mo.;" you also mention elsewhere that the ore is found in Pennsylvania and Missouri. The nickel mines of Mine La Motte are now being very extensively worked at the present time, and the owners, the La Motte Lead company have turned almost their entire attention to raising and reducing the nickel ore to regulus, which is being shipped in large quantities. Recently 7,000 lbs. of nickel ore were raised in one day; it assayed 35 per cent metal, and was worth $1 per pound at the mine. The work was done by six miners, $7,000 being dug out for a cost of less than $25.

An Excellent Pen.

Messrs. C. M. Fisher & Co., of No. 102 Fulton street, in this city, have devised a new form of gold pen, known as the Paragon, in which not only the form but also the characteristics of the quill are closely imitated. To those who have been accustomed to write with the latter, and have experienced the trouble of mending it, the gold pen, as made by the above firm, will, we think, prove to be a welcome addition to the writing table. We have used one almost constantly for the past month or two, and at the present time it is perfectly flexible, shows no sign of wear, and is one of the best pens we ever used. The makers adapt each pen to suit the hand; and hence, any peculiarity of holding can be allowed for, and the habits of the individual writer consulted.

TESTING THE QUALITY OF IRON, STEEL, AND OTHER METALS, WITHOUT SPECIAL APPARATUS.

BY PROFESSOR THURSTON.

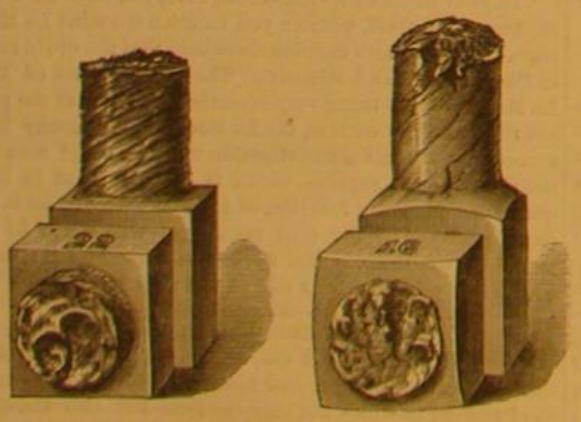
1. During the research which has occupied a considerable portion of the time of the writer recently, and to which reference has been made in the earlier numbers of the SCIENTIFIC AMERICAN, some very interesting facts have been observed; and much has been learned respecting the strength, stiffness, elasticity, ductility, and resilience of the metals used in engineering, which could only have been accurately obtained by means of apparatus capable of recording both the amount of distortion of the test piece and the coincident distorting force, at every instant during the experiment, up to the point of rupture.

2. Among these developments, and not the least important, has been the fact that the quality of any given material can be determined with some approach to accuracy, by adopting the *method* here in use, but without necessarily going to the expense of purchasing the powerful machines in general use for determining tensile strength, or even paying the two or three hundred dollars which is charged at the shops of the Stevens Institute of Technology for the recording machine with which these tests were made. A strong long handled wrench, a good spring balance, and a firm but delicate hand, afford all necessary means of procuring quite satisfactory results, as to mere strength of material; while a careful inspection of the fractured pieces, after a little experience, will assist greatly in the determination of the general characteristics of the metal.

MACHINE FOR TESTING THE STRENGTH OF IRON.

3. The method of procedure is neatly illustrated in the large engraving, and would, in general, be as follows. Cut, from the bar or mass to be tested, pieces about three and a half or four inches long, and turn them off in the middle to a diameter of half an inch for iron or brass and three eighths if of steel; make this neck one inch long. A square head is left at each end. Secure the piece vertically and firmly, by one end, in a strong vise; fit a solid ended wrench to the other end of the test piece; and to the extremity of the handle, which should be, for convenience, about five feet long, attach a spring balance capable of recording with accuracy up to fifty or sixty pounds.

Paint the scale of the balance with white lead or tallow, and spring the pointer so as to just touch the painted surface. The mark traced by the pointer then indicates the maximum force applied.



4. Commence pulling steadily on the balance, keeping the direction of pull at right angles to the wrench handle.

An apparently unyielding resistance will be felt up to a certain point, when the test piece will commence observably to give way. Note the indication of the spring balance at this point, which is the *limit of elasticity*, and record both that reading and, if possible, the distance through which the piece has twisted, the latter measure being an indication of its stiffness.

Continue twisting the piece until it has gone some distance beyond the limit of its elasticity, then stop and notice how far the arm springs back while gradually taking off the twisting force.

This distance is a measure of the *elasticity* of the metal, and is usually, if not invariably, the same, however great the set, even up to the point of rupture.

Renew the twisting force and break off the piece, noting the maximum angle which the piece has been twisted through and the maximum resistance, as indicated by the spring balance.

5. The *stiffness* of the metal is measured by the force required to twist it through the first small angle, say five degrees, should it yield so far without set. For half inch iron, this should be about fifty pounds on the end of a lever five feet long. For tool steel, it should be about thirty pounds, where the neck has a diameter of three eighths inch.

The *limit of elasticity* is determined by the force required to give it its earliest set.

The *degree of elasticity* is measured by the distance through which the wrench springs back when the force is removed after producing set.

The *ultimate tensile strength* is approximately proportioned to the force producing *rupture* by torsion.

The *limit of elasticity for tensile strength* is proportional to the force producing *set* by torsion.

The *ductility* of the metal is measured by the *angle* through which the piece twists before breaking.

The power of resisting shock, or *resilience*, as it is called by engineers, is nearly proportional to the product obtained by multiplying the breaking force by the maximum angle of torsion.

The *homogeneity* of the metal is determined by the regularity with which the resistance of the piece increases when passing its limit of elasticity.

6. By taking samples of well known brands of metals and pursuing this course, a standard is easily obtained, by reference to which a little practice will enable the experimenter to learn readily, and pretty accurately, the relative value of such other metals as he wishes to test.

7. Next, taking the fractured pieces, a careful inspection will assist wonderfully in pronouncing a correct judgment.

Thus, in our illustrations, No. 16 shows the side and the end of a fractured specimen of *wrought iron* of excellent quality, but seamy and not well worked.

The cracks extending around, in a spiral, through three fourths the circumference, and the appearance of irregularly distributed flaws on the end, prove the seamy character of the material, while the record of its test proves it tough, strong, and ductile.

Compare this with No. 22, which is the best piece of iron which could be found among a hundred tested specimens, and which is of almost wonderful toughness and ductility.

The surface of the neck, which, before being tested, was beautifully finished, has become greatly altered, and has assumed a curiously roughened and striated appearance. The spirals extend completely around the cylindrical portion, and the fractured end has the appearance peculiarly characteristic of very homogeneous and ductile metal. The record pencilled by the machine in this test shows it to have been fairly stiff, to have passed its limit of elasticity under a stress equivalent to about 30,000 pounds per square inch of tension, to have been more homogeneous than many specimens of shear or even than some cast steels, to have had a ductility exceeding that of any other specimen yet found of either iron or low steel, to have had a greater resilience, that is to say, power of resisting shock, than any other metal examined, and to have had an ultimate tensile strength of about 62,000 pounds per sq uare inch.

This metal was made of selected scrap from refined charcoal iron, rolled into half inch bars, cut and *polished*, and rolled down to one inch square. Such care must evidently produce a splendid iron. Unfortunately, however, it costs sixteen cents per pound.

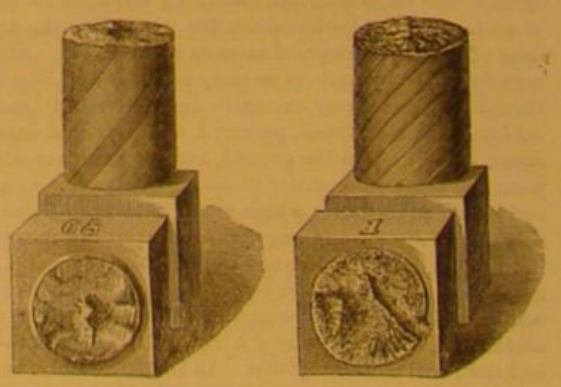
No. 1 is an iron of vastly different character. The record of the test shows it to be only a fairly good metal, and the end view exhibits a rough granular character of fracture, especially near the middle, and this proves its unreliability.

No. 23 is *cast iron* of a dark foundery grade, with a perceptible but slight ductility, and about half the strength of fair wrought iron.

The peculiar and almost mathematically regular form of the surface of rupture is noticeable in all irons of this class. No spiral markings are perceptible. The metal only yielded about ten degrees before fracture took place. Here the color and grain of the iron aid the judgment in forming correct conclusions after inspecting the record of test.

No. 30 is a hard white charcoal cast iron, such as is used for making "malleableized cast iron." It is a half stronger than the preceding, but is brittle, and has no ductility, snapping sharply at the limit of its elasticity.

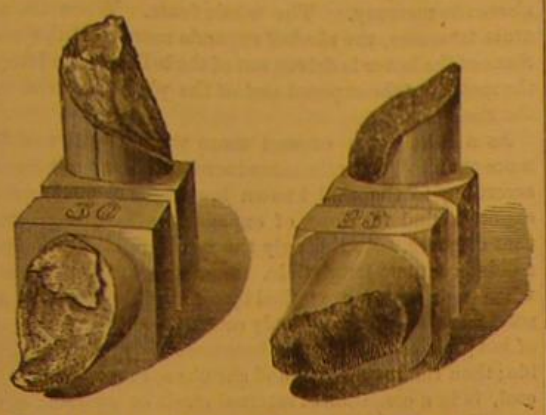
8. No. 35 is the same white cast iron *malleableized*. Its test indicates undiminished strength, combined with ductility exceeding, by several times, that of the toughest grades of cast iron, and even equaling some kinds of untempered steel. It is far less ductile, however, than wrought iron. The fracture exhibits its incomplete transformation, and the irregular distribution of the remaining carbon.



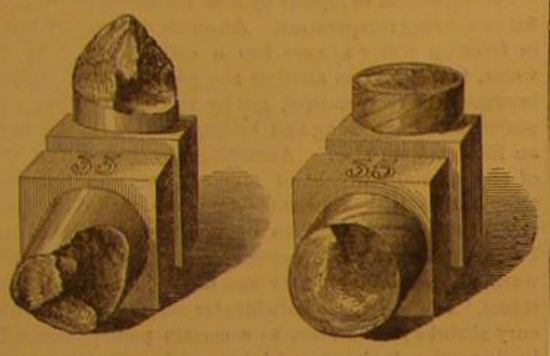
No. 35 is also a sample of similar character but much more thoroughly malleableized.

The test exhibits a strength equal to that of quite good wrought iron, and a toughness which is not very much less than that of some hard forged iron. The fracture indicates a very regular character, and freedom from defects, while the spiral markings prove its ductility. Such a metal as this is better for many purposes than much of the wrought iron in the market, and the cheapness with which awkward shapes can be made of it, as compared with forgings, give it special advantages in many cases where the pieces are small.

9. No. 68 is a specimen of low *steel*, and its peculiarities are those of "homogeneous" metal, or of steel made by either the Bessemer or the Siemens process. The test and an inspection of the fractured piece indicate its strength to be nearly double that of ordinary wrought iron, and prove its great ductility and resilience and its homogeneous character.

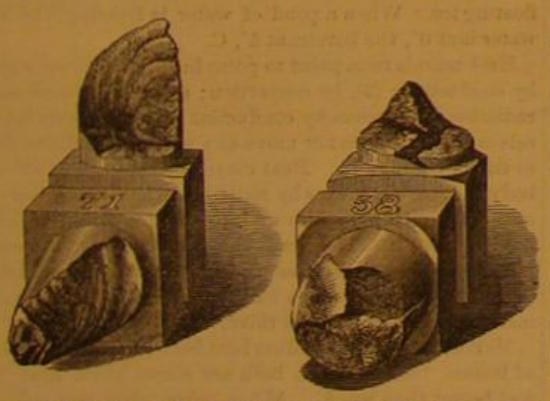


No. 71 is a piece of tool steel, having a strength twice as great as the best of iron, great elasticity, but a ductility only a fraction of that of good iron, excellent, in consequence of its strength and hardness, for tools and for resisting steady strain, but not so well adapted as steel of lower grade, or even as the better grades of iron, to meet shocks. Its jagged fracture and its fine even grain are evidence of the splendid quality of the metal and the perfect homogeneity of struc-



ture, which distinguish it from the fiberous wrought irons. The shear steels and the softer grades of tool steel usually exhibit an appearance very similar to 68, but are apt to crack along the side and through the neck, as is illustrated in No. 58.

10. Thus a little practice and careful observation will enable any good mechanic to test his materials even when he cannot afford to purchase a testing machine, and with a fair degree of confidence in the derived results, and at almost no expense.



A careful study of the accompanying illustrations, which the artist and engraver of the SCIENTIFIC AMERICAN have succeeded in making such perfect representations of the specimens placed before them, will assist greatly in the acquirement of this very valuable accomplishment.

Stevens Institute of Technology, Hoboken, N. J.
December, 1873.

The Vacuum Car Brake.

The vacuum car brake consists of a brass globe or bulb about fourteen inches long and five inches in sectional diameter in the largest part, and in shape very much like a lamp globe. The neck of the globe is about eight inches long. The enlargement is made to allow steam to surround a smaller pipe, which conducts the exhausted air. This part of the air pipe is about six inches long and two in diameter, reaching nearly to the neck of the bulb, leaving a space all around about one eighth of an inch wide; this tube is fitted tightly into the bottom of the globe so that none of the steam may escape below. To the lower part of this globe the air pipe is nicely fitted. In an enlargement of the end of this pipe, there is an air valve arranged to prevent the refilling the vacuum, and just below this is a relief valve to allow the air to enter. These valves are conical, so that the greater the pressure the more tightly they fit. Beneath each car, and connected with this apparatus by tubes, made so as not to collapse, is a cylinder with solid ends and flexible sides, which are kept from entirely collapsing by iron rings. The ends of this cylinder are connected with the brakes, so that, when the atmospheric pressure forces the ends together, the brakes are put on. The steam, being introduced from the boiler, passes out around the end of the air tube and removes the atmospheric pressures, producing a vacuum. By enlarging the cylinders beneath the cars, the power may be increased at pleasure.—*Polytechnic Bulletin.*

Ramming the Mold.

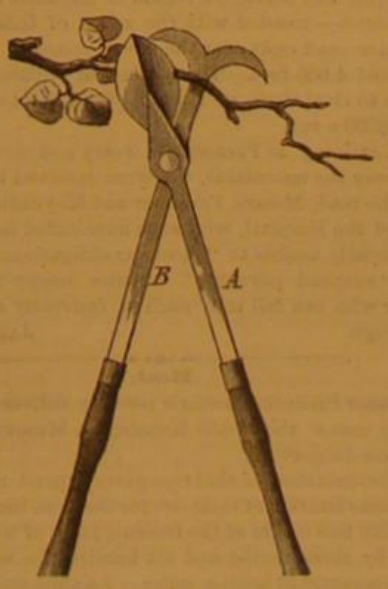
S. W. says: "In your number of November 22, 1873, you say that "ramming the mold is not a complicated performance, nor does it require the ability of a very skilled artisan." I have for many years been a close observer of losses in foundries, and I have found that about six tenths of the wastrels are on account of imperfect ramming, the latter being either too hard, causing the mold to blow and scale: or too soft, allowing it to strain as long as the metal retains its liquidity, and, when turned out, is too large to fit where it was intended. Hence the casting is condemned, in either case, on account of bad ramming. Any person posted in figures can calculate the pressure of fluids; but it requires the experience of years to know how much ramming is required to resist that pressure. He can only become skillful in the science of ramming by observing closely the result of every day's work, not only of his own, but of other molders also, so that he can ascertain the cause of any defect he may see on a casting, and thereby prevent the re-occurrence of the same. Ramming is a most complicated and important process; it amounts to but a very small portion of the cost of other work required to complete the job; but too hard, too soft, or irregular ramming, will cause all the work done on the job to be lost. The causes of the loss of the other four tenths are numerous, such as: Sand too wet, or too dry, inability of the molder to secure his mold before casting, lack of judgment in venting, lack of judgment in locating his gate to prevent warping and cracking in cooling, lack of judgment in stripping the casting so as to allow all parts of the casting to contract together, as that part of the casting that is allowed to contract last puts a great strain on a certain other part of the casting, and is likely to break it as soon as it is put to use. I hope the science of ramming will be further and more ably discussed in your valuable paper, and that you will be the means of getting molders to become more skillful with the ram, in which most valuable ability too many are lacking."

IMPROVED PRUNING SHEARS.

It is asserted that, to properly prune a tree, the limbs should be cut from the under side, and the blade should pass through them upon the outer side of the hook, resting upon the stump. In this way, horticulturists say, the end of the stump will not be splintered, and hence will be left in a better condition for rapid healing over.

Mr. Myron de Groodt, of Eaton, N. Y., has recently devised a pruning shears, acting on the above principle, by which the operator may cut off limbs upon opposite sides of the tree without shifting his position, on simply reversing the instrument.

The handle, A, connected with the blade, is grasped by the right hand, the handle, B, communicating with the anchor like hook with the left. In applying the shears, one of the arms of the hook is brought over the limb, and the handle, B, is held in a vertical position, while the other handle is elevated to open the jaws to a required distance. The blade then cuts through the limb from the under side and in an upward direction, with the hook bearing against the stump. To operate from the opposite side of the tree, it is only necessary to reverse the shears by simply moving the

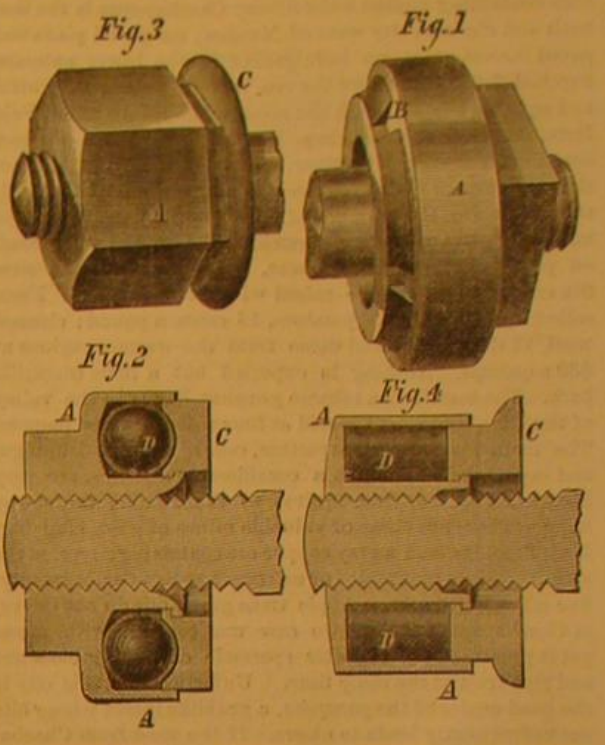


handles past each other without changing the hand, when the other edge of the blade acts with the hook precisely as before. In this way, the inventor says, a person may remain in one position and prune a tree nearly all around.

IMPROVED NUT LOCK.

The invention herewith illustrated is a new patent nut lock which, by the suitable combination with it of an elastic substance, is enabled to compensate for the longitudinal expansion and contraction of the bolt, thus preventing the nut from working loose under jars or shaking motions.

Our engravings represent two forms of the device as applied to railroad fish plates. In Figs. 1 and 2, which are perspective and sectional views between the two flanges, A A, is provided a chamber containing inside radial projections, B, which fit into corresponding notches in a washer, C. These notches and projections serve to lock together the nut so far as rotary motion is concerned, compelling the different portions to turn together. Into the chamber, between the flanges, A, are inserted a number of rubber balls, D, which are also received in suitable concavities in washer, C, Fig. 2. When the nut and washer are screwed together, it is evident that the balls are compressed and caused to spread until they fill nearly, if not entirely, the whole hollow space between the flanges, A. If the bolt becomes elongated by expansion, the balls take up the increase, through their own enlargement by elasticity, thus preventing the nut from working loose.

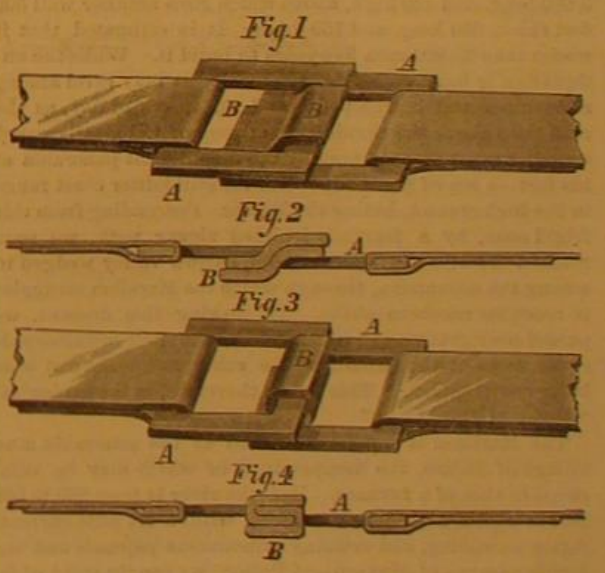


In Figs. 3 and 4, small cylinders of rubber are substituted for the balls, D, and the washer enters directly between the flanges. The tubular end of the nut is upset on the hole of the washer, in order to prevent separation of parts. The device appears simple and practical, and doubtless will meet with extended application upon railroads.

Patented November 25, 1873, by Casper Dittman. For further particulars address Dittman & Landis, Leacock P.O., Lancaster county, Pa.

STARR'S COTTON BALE FASTENER.

We illustrate herewith a very simple and ingenious device designed as a clasp or fastener for the bands which surround cotton bales. The invention is simply a square buckle of iron, A, having at its outer end a rigid tongue, B. Both sides



of the attachment are alike, so that, when the ends of the strap are brought together, the tongue of one buckle slips under that of the other, and interlocking takes place, as shown in Figs. 1 and 2. Figs. 3 and 4 are the same contrivance somewhat differently constructed, the tongue, B, being bent to form more of a hook. The device can be stamped or cut out of heavy sheet iron; and, if desired, a projection or stop may be combined with it to prevent the buckles slipping back after being once locked or hooked. The inventor states, however, that this latter precaution is entirely unnecessary, as a perfect double lock is afforded.

The mode of operating is as follows: After the bale is in the box, duly pressed, etc., the band is put on the top, hanging over in front with one of the buckles attached, hook out. The band is then brought under the bale, through the channel made for the purpose, and thence up to meet the attached buckle, when it is bent back on the inside. Over this bent end the second buckle is slipped, hook in. The two buckles are then brought together and locked as before described. The strap, it is stated, will not detach itself until the bale is put in the compress, when it can be easily manipulated.

For further particulars address the inventor, Mr. Henry D. Starr, Texana, Jackson county, Texas.

WOMEN DENTISTS IN EGYPT.—Dr. Edward Warren writes from Cairo, in Egypt, to a friend in Baltimore, that there is "a good opportunity for women dentists in Egypt, as the women are forbidden to consult with men." There are three or four English women practicing dentistry in Cairo already, according to Dr. Warren's letter. In all these eastern countries, there seems to be a wide field of usefulness and profit for woman doctors and dentists.

THE NEW EXPLORATION OF THE AMAZON RIVER, BY PROFESSOR ORTON.---OVER THE ANDES.

No. 6.

CHACHAPOYAS.

While most other towns in Northern Peru are but vast pig sties containing human habitations, Chachapoyas is the best built and cleanest city west of Manáos; its grand plaza and paved streets grant no indulgences to the lower animals. Perched 7,600 feet above the sea, it possesses a delightful and equable climate, with the mean temperature of 62° Fah. Here, for the first time since leaving New York, we saw bread made from native flour. Yet there is very little of that agriculture which requires a preparation of the soil: the people (to the number of 5,000) depend mainly on the voluntary gifts of Nature, scratching the ground with wooden plows to raise a little wheat, corn, potatoes, and rice. Six crops of rice can be raised without re-sowing. Flour sells for $10 a quintal; potatoes, 15 cents a pound; cleaned wool, 18 lbs. for $2; and cacao from the warmer regions at $30 a quintal. Nothing is exported but a little cascarilla bark. The best Indian tobacco grows at Bagua in the valley of the Utaubamba, and is sold at four reals for three pounds. The main woods for construction, cedar, walnut, ishpingu, and capuri, being brought a considerable distance, are very high. All boards, from Iquitos to the Pacific, are cut by hand. There are signs of valuable mines of gold, cinnabar, lead, limonite, and a gray copper ore containing silver, in the vicinity; while mountains of salt occur at San Carlos, twenty-five miles northwest. Apple trees grow, but do not thrive, at Chachapoyas; the one we saw was covered with moss, yet it presented the singular spectacle of bearing blossoms and ripe fruit at the same time. Unfortunately, this city is the head center of the *garapáta*, a grublike insect whose bite not unfrequently leads to ulcers. If the road from Chachapoyas to the Marañon by the way of Olleros and the Aichiyacu recently surveyed by Mr. Wetterman, is ever opened, it will bring the city into easy communication with the outside world.

From Chachapoyas to the next great city, Cajamarca, is about seventy miles. On the maps, this intervening country between the coast range and the central cordillera is represented as a broad valley; in the reality, it is a jumble of precipitous mountains. The road, for the first two days, is excellent, following the romantic Utcubamba and passing within sight of the lofty Cuelap mountain which is crowned with ruins too old to be Incarial.

A PRE-INCARIAL FORTRESS.

These are the ruins of a fortress, containing chambers and tombs, and consist of a wall of cut stone 560 feet thick, 3,600 long, and 150 high, above which rises another wall 500 feet thick, 600 long, and 150 high. It is estimated that it would take 20,000 men five years to build it. While the antiquarian is busy with this, the geologist may revel among ammonites and brachiopods; and on the third day, as the road rises above the clouds to the tiptop of Calla-calla, every traveller must be entranced by the magnificent panorama at his feet—a sea of mountains with the still loftier coast range in the background, hiding the Pacific. Descending from this frigid zone, by a fearfully inclined zigzag path, we soon reached the other extreme—a deep, narrow valley wedged in among the mountains, through which the Marañon struggles to reach its northern outlet. In making this descent, we passed over granite and mica schist, the first metamorphic rocks west of the Huallága, the other rocks east and west being sedimentary. This point, therefore, is the geological "Heart of the Andes."

The Marañon is crossed on a raft at the miserable mud village of Balzas, the temperature of which may be compared to that of a furnace. Here the river is from 250 to 500 feet in width, according to season, with a six mile current. Again ascending, and crossing monotonous pajonals and the fertile pampas of Huanco and Polloc, we caught sight of famous Cajamarca, seated on the eastern slope of the western cordillera and fronting the most beautiful plain in all the Andes.

THE HEART OF THE ANDES.

This highland plain or campagnia, sixteen leagues in circumference, is almost as level as a billiard table, rich as the Connecticut flats, and well watered by the mint-bordered Chonta and Masscon. The roads crossing it are hedged in with century plants, and here and there rises the "sauci" (*salix humboldtiana*) the most conspicuous tree in the region. The surrounding mountains are barren and brown but nevertheless are exceedingly picturesque.

CAJAMARCA AND ITS RELICS OF ATAHUALPA.

Cajamarca, the Caxamalca of Pizarro's day, claims to have 14,000 citizens; certainly it is the largest and finest city on our route from Pará to the Pacific. Its altitude is about 9,400 feet, and the temperature ranges from 40° to 72°. The houses are generally built of adobe, and tiled; but the churches are of the coarse conglomerate from the sierra, and have elaborately sculptured fronts. The grand plaza is adorned with a fine stone fountain, around which congregates a motley crowd of Indian women every morning to vend their little piles of vegetables, fruits, grains, meats, salt, pepper, etc. for the plaza is the "market place" in Spanish towns. The following are some of the prices current. Flour, $16 for 320 lbs.; corn, $1 for 26 lbs.; rice, $24 for 260 lbs.; coffee, $4.80 an arroba; cacao, $24 a quintal; tobacco, 50 cents per mazo of three or four pounds; sugar, $4 an arroba; cotton cloth 10 to 20 cents per vara; wool, $1 20 to $2 an arroba; hides, $2 to $3 each horses, $70 to $100 each cows $25 each; oxen, $40 each; sheep, $2 each; tiles, $16 a thousand; a cedar board, 2½ varas long by ½ vara wide (say 7 by 2 feet), $5; land on the plains, $50 per "fanigada" of eight acres. Wheat, barley, corn, and potatoes are about the only vegetable productions within sight of the city. The province yields annually over 7,000,000 lbs. of wheat, 160,000 head of sheep, 30,000 head of cattle, and 16,000 horses. The manufactures amount to nothing; and the imports greatly exceed the exports in value. A few textile fabrics of wool and cotton are made, and some straw hats, from the "tamsi" instead of the "bombonaje." The celebrated silver mines of Gualgayoc, 18 leagues northwest, are not yet exhausted, but are not so productive as formerly.

Cajamarca occupies an important place in the history of Peru. It was the favorite residence of the Inca when his empire stretched from the Rio Andasmayo north of Quito to Rio Maula in Chili. The stone walls of his palace still stand for about 15 feet; and along the eastern edge of the plain a line of vapor indicates the "Baños del Inca." These hot springs, even now used for baths, are copious, but not medicinal; we found the temperature as they issue from the ground 162° Fah. The story goes that, when conquered by the Spaniards, the Peruvians threw the throne of gold of their Inca into a crater, from the sides of which came these thermal waters. The paved "via real" or military road, designed to connect Quito and Cuzco, stopped unfinished a little beyond Cajamarca. Its construction was interrupted by the landing of Pizarro or Tumbez, who garotted Atahualpa after receiving the ransom of "$16,000,000 gold and $175,000 in silver"—one of the many fictions of history.

Again we mounted our mules to scale the last cordillera which separated us from the Pacific. The range, as we crossed it westward, presented three main aspects: the eastern half was of quartzite, and the mountains comparatively smooth and rounded; then succeeded rugged rocks of trachytic porphyry. Here the landscape was purgatorial, presenting the confusion of the "grab box" of a geologist; volcanic piles, marine and river deposits, fiercely contorted granite dykes, etc., are huddled together as if Nature had been in a hurry. Finally, as we neared the ocean, there was a fine exhibition of the ceaseless conflict between sea and land; the barren, rocky mountains, upon which even the lichen refused to grow, stubbornly yielded to the supremacy of the older ocean; and as the great Andes died away along the shore, the southerly wind covered them with a winding sheet of sand.

AN AMERICAN ENTERPRISE.

Two days from Cajamarca, we shouted for joy at the sight and sound of a locomotive. It was the sign of civilization: the signal that our hardships were at an end. The Pacasmayo railway, now completed 54 miles from the coast, is a model of American enterprise and American skill. It is the creation of Mr. Meiggs, the Vanderbilt of Peru, and will cost $7,000,000. The money comes from the sale of guano; the laborers from China: the ties from Oregon and Chili; the rails from England; and the rolling stock from the United States. The buildings are of corrugated galvanized iron. The track is broad gage, and will have, when finished, a total length of 78 miles. Starting from an iron pier, which is to reach half a mile into the sea, the road winds over the pampa, and among the sand drives, and beside the Rio Jequetipeque, and through a region of intensest interest to the archæologist—crowded with the relics of Incarial cities and cemeteries—and ends near the silver mines of Chilate, at an altitude of 4,000 feet. These mines of Chilate, just opened, promise to rival those of Potosi. They yield an assay from $60 to $200 a tun.

Upon arriving at Pacasmayo, weary and worn by our long tramp over the mountains, we were received by the managers of the road, Messrs. Faulkner and Maynadier, and by Dr. Heath of the Hospital, with such unbounded hospitality that we are totally unable to "meet our obligations" and accordingly "suspend payment." Thrice happy the American traveler who can fall into such a fraternity at the close of his voyage.

JAMES ORTON.

Heat.

Professor Frederick Guthrie recently delivered a lecture to working men at the South Kensington Museum, London, on the above subject.

The lecturer showed that true gases expand nearly precisely the same fraction of their size for the same increase of heat, each cubic foot of gas at the freezing point of water becoming larger by three tenths and six hundredths when heated to the temperature of boiling water. An appreciable divergence from this rule occurs when we are dealing with a gas near its point of liquefaction.

Returning to the relative expansions of solids, a few practical applications were briefly considered, subh as the fusing of glass about platinum on making apparatus for the analysis of gas, or for passing electric sparks through confined gases. Inequality of expansion is also made use of in the gridiron or compensating pendulum. In this a copper bar is placed side by side with a shorter zinc bar, the lower ends being fastened together; the upper end of the zinc bar carries the bob, and the whole is hung from the upper end of the copper bar. The greater expansion of the shorter zinc bar upwards exactly counterbalances the lesser expansion of the longer copper bar downwards, and the center of oscillation remains a constant distance below the point of support, so that the rate of oscillation does not vary with the temperature. So a little rod of zinc, pointing inwards and fastened at one end to the circumference of the balance wheel of a watch, expands inwards as the wheel increases in size in warm weather, and makes the time of vibration constant. The watch become a chronometer. A certain quantity of mercury placed in a cylinder is also used, instead of the ordinary bob of a pendulum. The mercury expands more than the metal of which the rod is formed for equal columns, and therefore, by taking unequal columns, equality of expansion may be obtained. A most sensitive thermometer can be formed by availing oneself of the inequality of expansions of mercury and alcohol. A little platinum diving bell is partly filled with alcohol and placed in mercury, and provided with a slender platinum wire arising above the mercury. The whole floats. When the temperature increases, the alcohol expands more than the mercury. Some of the latter is driven out of the bell, and the latter rises; the motion of the exposed end of the platinum wire exhibits the rise.

As a rule, gases expand more than liquids and liquids, more than solids for the same increase of temperature; and so, according to the well known law of mechanics, we should expect to find the force of expansion of solids greater than that of gases. Accordingly the force exercised by expanding solids is almost irresistible. Iron rods are bent or snapped when their centers are pulled by contracting metals. A semi-solid mass, as glass, suddenly cooled becomes brittle. A drop of hot glass cooled in water becomes solid and rigid on its outside; then the inside cools and shrinks so that the whole, when cool, is in a condition of internal strain or unstable equilibrium. Disturbed in one place, the whole crumbles to pieces in its endeavour to assume the proper size due to itst emperature. The process of annealing depends upon the so gradual cooling of a soft body that the parts get to their proper distance. The bursting of pipes in winter time proves two things: first that the ice is lighter than water; and second, that the ice is almost incompressible. Water frozen in a bomb shell two inches thick will burst it.

The expansion of liquids by heat furnishes us with means for measuring temperature. An ounce of mercury immersed in freezing water always has a certain size. In boiling water, it always has another and greater size. And at any intermediate temperature, got by mixing together different proportions of freezing and boiling water, the mercury has an intermediate size. According, by measuring the size of any constant weight of mercury, we can tell what its temperature is. Thermometers are made by enclosing any convenient quantities of mercury or alcohol in glass bulbs, with very narrow stems, so that, when the liquid gets warm and expands, it may rise a considerable hight in the stems. Plunge such a bulb into freezing water, and the mercury shrinks in the stem to a certain point; plunge it into boiling water, it rises to a higher mark. The lower mark is is sometimes called 0° and the other 100° (C.), or 80°(R.), or the lower is called 32° and the higher 212°(Fah.) Water is at its greatest density at 4° C. If we take a flask full of pure water bearing a narrow stem and cool it from, say, 10° C., we find it shrink pretty regularly as it cool still it gets to 4° C. It then expands as it cools so that at 3° it is of about the same volume (and density) as at 5°, at 2° as at 6°, at 1° as at 7°, and at 0° as at 8°. It then freezes and swells in that act to a very great amount, measured by the proportion between the whole volume and submerged volume of a piece of floating ice. When a pond of water is freezing, the surface water is at 0°, the bottom at 4°, C.

Heat travels from point to point in space in three ways: (1), by conduction; (2), by convection; and (3), by emanation or radiation. It moves by conduction when the body which receives the heat does not move as a whole, but allows the heat to travel through it. Heat moves by convection when a hot body moves. It moves by radiation when a hot body gives off heat into empty space or into some medium which does not intercept it. The gradual heating from end to end of a poker in a fire illustrates the first of these methods, the flight of a red hot cannon ball the second, and the roasting of meat or the solar heat the third.

Metals, as a class, conduct heat better than any other class of bodies. Hence, when both are above blood heat, metals feel hotter than wood. When below, they feel colder. So that paper is scorched when heated in contact with wood, but not so easily when in contact with copper. Hence, also, lead may be melted in paper. Among the metals, silver and copper are pre-eminent. That copper conducts heat better than iron is shown by heating rods of the two at the plane of contact, and noting the melting of fragments of wax arranged along the two. The great conducting power of metals is shown by the cooling effect they have upon the mixed gases of a burning body. The metal withdraws so much heat from the gas in its neighborhood that combustion is impossible. The miner's lamp is based upon this principle.

Liquids conduct heat as a class worse than solids. The conducting power of liquids is measured by heating the upper surface of a film of liquid, and noting the expansion of the air in a chamber upon whose upper side the liquid film rests. The more complex the composition of a liquid is, the more opposition does it present to the passage of heat by conduction. Chlorine, iodine, and bromine are especially strong in resisting heat conduction. Water is by far the best conductor amongst non-metallic liquids.

Gases are far worse conductors than liquids, and the imperfect conduction of many solids is due to the gases, generally air, which they inclose in their pores or between their fibers. Clothing thus protects the body from loss of heat in cold weather and from the scorching heat of the sun in hot weather. A red hot ball may be carried in the hand if a mass of asbestos, which incloses the air, is interposed. Hydrogen conducts heat far better than other gases, and accordingly cools bodies in contact with it with great rapidity.

Gold may be readily cast; but it contracts so much in cooling that the process of casting is seldom employed in the arts

SCIENTIFIC AND PRACTICAL INFORMATION.

THE COMPANION OF PROCYON.

We noticed some time ago that Struve had discovered, by the aid of the magnificent refractor of the Pulkowa Observatory, a small star near Procyon, which he regarded as being the probable cause of the irregularities of the movements of the latter body. Dr. Andrews has since repeated his calculations regarding the proper motion of Procyon, which appears to be circular, in a period of a little less than forty years, around some invisible center. He does not now definitely conclude that to Struve's star should be ascribed this peculiar movement, but considers that the question will be decided next spring, if the new star is then visible. In such case, Struve's star should be at a considerable distance from the common center of gravity of both bodies, and a mass must be attributed to Procyon equal to eighty times that of our sun, and to his companion, a mass equal to six and two-thirds of the same body.

THE PURIFICATION OF TALLOW AND LARD.

Dr. Dotch states that tallow and lard can be kept from getting rancid by the following process: The tallow or lard is first treated with carbonate of soda in the proportion of 2 pounds of soda to every 1,000 pounds of lard, and is then subjected to a digestion with alum in the following manner: 10 pounds of alum are dissolved in 500 pounds of water, and 1 pound slaked lime added to the solution and boiled. This solution is stirred well with 1,000 pounds of lard at a temperature of 150° or 200° Fah. for about half an hour. The liquor is then separated from the lard, and the lard is treated with the same amount of pure water again. This lard will keep for an exceedingly long time. The fact is that the alumina in the alum applied acts very readily in a disinfecting manner upon those compounds which are liable to give rise to rancidity. The lime is added to the alum in order to render the alumina more active by its giving up some of the acid to the lime. This treatment has also the advantages of restoring the original flavor and of producing a lard of a greater whiteness.

ANILINE COLORS.

Professor Kopp, who has recently made a careful study of the aniline colors at the Vienna Exposition, says that the manufacture of these pigments from coal tar products is making most remarkable progress. Fuchsin, constituted by a salt of rosanilin, is obtained exclusively by the reaction of arsenic acid on commercial aniline. In order to afford an idea of the enormous consumption of this violent poison in the manufacture of fuchsin, it is stated that in Germany alone the same is estimated at 3,300,000 pounds a year. It is only lately that the residues have been treated to regain the arsenic in commercial form. M. Kopp mentions as a novelty a beautiful rose red coloring matter called saffronin, which upon silk is a very brilliant dye.

A NEW TEXTILE PLANT.

The ordinary wood nettle, as is well known to many of our readers, is found in profusion on the Alleghany mountains, often at a level of over 5,000 feet above the sea. A short time since, M. Rozel succeeded in transporting to Europe a number of living specimens of the plant, some of which he dispatched to the Prussian Minister of Agriculture, in order that the value of the weed, if any it had, might be determined. It appears that quite favorable results have been obtained in using the plant for textile purposes, and for such employment it is now attracting considerable attention in Germany. It is known botanically as the *laportea pustulata*, and is perennial. As it is, therefore, unnecessary to sow the seed each year, the plant has in this respect an advantage over hemp or flax, while it is stated to necessitate less labor and expense in preparing the fiber. In a wild state, the nettle attains a hight of two or three feet, but we learn that such as has been cultivated in Berlin has already exceeded this limit, and it appears possible that, by care and proper soil, even a still greater altitude may be gained. Experiments thus far made point to the fact that the plant will prove a not unimportant addition to our textile materials.

DECISIONS OF THE COURTS.

United States Circuit Court---District of California.

WATER CLOSET PATENT.—WM. SMITH *vs.* J. O'CONNOR *et al.*

[*In equity.—Before Sawyer, Judge.—Decision September* 1, 1873.]

A claim for "a receiver for pan water closets formed and constructed so that the side into which the pan swings for emptying will conform to the shape of the pan, etc., held, on comparing it with the specification, to be a claim not merely for a conformity, but for a conformity attained by specified means, and to be valid.

Held, also, on a like comparison with the specification, that the claim was not too broad.

A patent held not to be void for want of utility in the invention upon its appearing that it possessed certain advantages over others.

Although a third party had conceived of the invention before the plaintiff, and had made some progress toward completing a model, yet, if he then suspended his labors, and before he resumed them, the plaintiff had perfected the invention and had embodied it in a practical working machine, his patent will be sustained.

An invention will not be held forfeited in consequence of its having been on sale more than two years before the application was filed on which the patent issued, if within the two years the inventor had filed a previous application which described the invention, and was intended to cover it, although it was not specified in the claim in express terms. The second application will be considered a continuation of the first.

Supreme Court---District of Columbia.

PAPER FILE PATENT.—SMITH *et al. vs.* WOODRUFF.

[*In Equity.—Before Humphreys Justice.—Opinion delivered Sept.* 13, 1873.]

Where two patents have been granted for articles which resemble each other, a presumption arises from the action of the Office that there is such a difference between them that the use of one constitutes no infringement of the patent for the other.

If one paper file holds the paper better than another which is patented, and has driven it out of market, that is *prima facie* evidence that the mechanism is different, and is a new invention and that the use of it does not violate the patentee's monopoly.

A patented combination may be used without infringing the patent if one of the elements of the combination is omitted, although another is substituted in its place which is new, or performs a substantially different function, or if it was not known as a proper substitute when the patent issued.

Although a bill for restraining the infringement of a patent is dismissed, the defendant will be allowed no costs if the rights of the parties are thereby settled, and a benefit consequently results to him as well as the public.

W. F. Stevenson, attorney for plaintiff.
S. T. Mussey, attorney for defendant.

United States Circuit Court---Eastern District of Missouri.

TRUSS BRIDGE PATENT.—JAMES V. WESTLAKE *vs.* M. S. & H. B. CARTTER.

[*Before Treat, Judge.—Decided October* 11, 1873.]

It is not sufficient to give notice of special matter of defense in an action upon a patent thirty days before the trial; it must be given thirty days before the first day of the term.

Such notice need not specify the particular portion of the plaintiff's patent to which the evidence applies.

Patents may be given in evidence to show the state of the art without such notice; but printed publications cannot be.

The proceedings in the Patent Office upon the plaintiff's application for the patent are not admissible for the purpose of giving it a different construction.

If the defendant claims that the patent is void for uncertainty, it rests with him to establish the charge.

The patent is not void for want of utility, if the invention possesses it in any measure, however slight.

A combination may be patentable on account of the novelty of the arrangement, although all the elements are old.

A patent for a combination is not infringed unless all the elements enumerated are used, or the equivalents of those which are omitted are substituted for them.

To show that the parts omitted by the defendant from a patented combination are unessential, will not render him liable as an infringer for the use of the rest.

A device is the equivalent of one that is patented if it performs substantially the same function in the same way and produces the same result, though it may be of a different form and bear a different name; and the use of it will be an infringement.

If the defendant has a patent, it is evidence of the opinion of official experts that it does not conflict with the plaintiff's patent, and that in working under it he is guilty of no infringement.

Such evidence will be submitted to the jury; the court will not compare the patents.

If the patentee is engaged in manufacturing the patented article for sale, his damages will be manufacturer's profits.

Verdict for defendants.

M. Kinealy for plaintiff.
Samuel S. Boyd, for defendants.

NEW BOOKS AND PUBLICATIONS.

THE OVERLAND MONTHLY for January has, among other interesting papers, an article by Professor George Davidson on the "Abrasion of Our North Western Coast," in which the remarkable table lands or *mesas*, in that portion of the country, are described. As an explanation of the origin of these peculiar formations, the writer thinks we can appeal to the "action of ice moving slowly but surely as a great planing or molding machine. If we accept an ice sheet over the continent, or a part thereof, and an ice belt contiguous to the continental shores, we can readily understand that it moved as a great stream, or, more likely, in currents, from the north." The second of these papers, on "New Zealand," contains some fresh information regarding that little known country. The "Japanese Merchant at Home" and "Summering in the Sierras" are pleasing descriptions, entertaining and readable. The usual selections of poetry, editorial miscellany etc., complete a table of quite varied and interesting contents. Published by John H. Carmany & Co., 409 Washington street, San Francisco, Cal. $4 a year.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*.

This 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, Drawing, 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.

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.

Caveats.

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

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.

To Make an Application for a Patent.

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

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.

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Recent American and Foreign Patents.

Improved Track Clearer.

Frederick Buse, Fergus Falls, Minn.—This invention consists in two wheels arranged in front of the cowcatcher of a locomotive and in a plane perpendicular to the direction of the track. By suitable gearing, these are connected with the forward axle so that the wheels are swiftly rotated, causing radial wings or shovels attached thereto to throw and blow the snow from the track, and thus work their way rapidly through the snow even should it be greatly drifted.

Improved Hoop Lock.

Thomas E. Lucas, Chesterfield, S. C.—The object of this invention is to provide a way for fastening or tying the ends of wooden hoops together for barrels, tubs, and other cooper work, and for other purposes, and it consists in a metallic tie having two sockets connected together, in which sockets the ends of the hoops are wedged.

Improved Cherry Stoner.

Eli Buck and Edgar W. Kirk, Cincinnati, Iowa.—By suitable construction, as punches descend upon the cherries in tapering holes, the stones are punched out of the fruit and through the holes, and fall into a dish placed beneath the said holes. As the punches ascend they carry the fruit with them up to a plate having holes in it, through which the punches pass but not the fruit, so that the latter is pushed or stripped from the said punches. As the punches ascend, the pan moves back so as to pass beneath the punches and receive the fruit as it falls from the plate. The fruit slides down the pan into a dish placed beneath the lower end of said pan. The descent of the cherries in the pan is regulated with one hand, while the crank is turned with the other.

Improved Cotton Gin.

Nicholas W. Gaddy, Nichols, S. C.—This invention is an improvement in the class of gins having auxiliary bars or fingers applied to the ordinary bars or fingers between which the saws revolve; and the invention consists in the arrangement of short secondary fingers so as to be readily attached and detached, and to be shifted or moved toward the saws from time to time, as they wear smooth at the corners, thus exposing new and sharp edges.

Improved Ticket and Delivery Holder.

Leonard J. Blades, Barrington, Del.—This invention relates to fare boxes, and consists in providing a lock case with sliding drawers which are partitioned off, inclined, and caused to allow the exit of the tickets one by one.

Improved Door Spring.

Henry Cody, New York city.—There is a casing of cast iron which contains the springs and jaws. The ends of the jaws clasp a central stud and a transverse plate on top of the stud which holds the jaws in place. The lower end of a shaft turns on a pivot on the bottom of the case, and has a roller on the end of an arm. The end of the shaft extends up above the top plate, and is rigidly attached to a lever. The jaws are forced toward each other by a circular spring which exerts a constant pressure. The lower end of the door is rigidly connected with the lever. When the door is swung open, it carries the lever and arm with its friction roll, which spreads the jaws one from the other. The jaw becomes a lever of constantly increasing power, the fulcrum being the stud and the spring the resisting point. When the door has made a quarter circle or is wide open, the roller will be carried to near the outer end of the jaw, and the arm will be parallel with the door. In this position the spring will bear directly against the axis, and the door will remain stationary. Should the door be left at any intermediate point, it would be closed by the spring. By means of this apparatus the ordinary butt hinges are dispensed with. The door is held open when desired, and is self-closing at all times when not wide open.

Improved Hand Corn Planter.

Eli Rogers, Rochester, N. Y.—A cap is placed upon the lower part of the seed box, where it is secured in place by two spring catches which pass up on the opposite sides of the lower part of the hopper and catch in notches formed in the sides. The lower part of the cap is formed by two parallel plates, one of which is stationary and the other pivoted. To the upper part of the pivoted plate is attached a hook which hooks upon a crank. Upon the crank shaft is formed an arm, to the outer end of which is pivoted the lower end of a connecting rod. With this arrangement the plates, which are pressed close together by the action of the spring, are forced into the soil, and the rear end of a lever is drawn upward or toward the handle. This movement operates the slide and drops the seed and plaster by spreading the plates apart. As the lever is released the spring moves the various parts of the machine back to their former position.

Improved Fertilizer Distributer.

James Lytch, Laurinburg, N. C.—This invention is a machine for opening a furrow and distributing guano in it preparatory to planting cotton or other seed, simple in construction, convenient in use, and reliable in operation. The invention consists in the shoe provided with a spout held in pivoted suspension bars, so as to allow the shoe to have a backward and forward movement. In the shoe is formed a hole, through which the guano escapes to the ground through the spout, which is designed to guide the guano into the furrow, and prevent it from being blown about by the wind. The rear part of the shoe is supported by a cord, so that the inclination of the shoe, and consequently the rapidity of discharge, may be increased and diminished by unwinding the cord from and winding it upon a knob. A wheel is placed directly in the rear of the conduction spout and is made with a deep V-shaped groove in its face, and with a number of rods crossing said grooves near the periphery of the wheel. As the wheel revolves, each rod pushes the lower end of a spring forward, which end, as it escapes from said rod, springs back against the next rod, thus jarring the shoe, and insuring the constant and regular discharge of the guano. The amount of guano escaping from the hopper is also regulated by a slide. By suitable construction, by operating a lever, the lower part of the spring is thrown forward away from the rods of the wheel, to allow the shoe to stand still, and thus enable the distribution of guano to be stopped when desired.

Improved Door Check.

Jacob Bader, Olathe, Kansas.—This invention consists of a pair of legs jointed together and to a slide on the door or gate, so as to be shoved down on the floor or ground, and at the same time extended from each other in both directions in which the gate or door swings, so that by bearing on the floor or entering the ground they will hold the door or gate from swinging. In the case of a door, the legs and slide will be arranged in a recess in the edge extending upward a suitable distance from the lower corner, so as to be worked up and down by hand, and will have a set screw to fasten it; but in a gate the legs, being similarly arranged in a recess on the end post of the gate frame, may be worked by a lever, with which buttons are arranged to hold it in the position for keeping the legs in the ground or out of it.

Propelling Canal Boats and Other Vessels.

Louis Bastet, New York city.—This invention consists in propeller wheels combined with close channels inclined downwardly from bow to stern, and receiving the water from the surface in front of the boat and discharging it at the rear, whereby the surface waves from the front of the boat, that tend to cause the washing of the banks, are prevented.

Improved Hand Corn Planter.

Michael P. Nemmers, St. Donatus, Iowa.—The outer case of the corn planter is of oblong shape, and the remainder half prism, base upward. A vertically sliding plunger extends through the full length of case along the rear side of the same. The plunger has at its upper end a handle, and at its lower end a metallic piece with sharp edge to enter the soil and carry the seed before it. On it there is a spring plate, placed diagonally to act with a cam movement on the teeth of a horizontal revolving seed cup disk. Above the latter another cam spring, diagonally placed in the contrary direction, completes the distributer. The corn chamber is arranged in the upper part of case. A vertical slide piece has an inclined end for the purpose of admitting a smaller quantity of corn to the revolving disk, and taking off the weight of the corn from the same, making thereby its motion easier and quicker. The revolving distributing disk is perforated by a certain number of holes of such size as to admit freely the seed or corn. A double row of vertical brushes is arranged to allow the seed to fill the holes to the rim, and to brush off the other seed to drop into the other holes when the same are approaching toward them by the revolving of the disk. By suitable adjustment the amount of seed passing to the distributer disk may be regulated. The seeds pass down as each hole discharges its contents into the lower part of the planter, dropping on an inclined band spring. The seed is then carried into the ground by the descending plunger end. The spring action of the band presses its end firmly against the plunger, so that no seed can escape. It serves, also, on the upward motion of plunger, as a scraper to clean the same from the adhering dirt. The depth to which the plunger is intended to penetrate the ground and deposit the seed can be adjusted as the different soils require it.

Improved Knife Cleaner and Polisher.

Cevedra B. Sheldon, New York city.—This invention consists in the improvement of knife cleaners by the introduction of a spring-pressed holder provided with a horizontally slotted top piece, and combined with a lever having a side pivot working in slot. By this improvement, a knife drawn back and forth a few times not only comes out perfectly clean but beautifully polished.

Improved Car Axle Lubricator.

James E. Bering, Newburgh, N. Y.—This invention relates to means for lubricating the parts of a car axle journal, whereby the surface of the flange and the body of journal are automatically provided with a graduated supply of oil or lubricating substance.

Improved Adjustable Bench Vise.

Jeremy B. Wardwell, Lawrence, Mass.—This invention is a bench jack for carpenters' and cabinet makers' use, for holding boards while being jointed. A bar is slotted to receive the jaw, and has notches to receive the pawl, by which the jaw is supported when adjusted. The jaw has ratchet teeth formed upon its upper side. The shank also passes through the frame, the forward end of which is so formed as to fit and slide upon ways formed upon the rear side of the ratchet bar. By suitable construction the shank of the jaw holds a piece in place in the frame, which forms a rest and also holds the frame in place upon the rear side of the ratchet bar. To the forward end of the piece is pivoted a pawl, which is so formed that its own weight may hold its lower or engaging end against the notched forward side of the bar. The pawl thus supports the rest, the frame, and the jaw, in any position into which they may be adjusted, the said parts all moving together. There is also other mechanism which allows the jaw to be more accurately adjusted to the thickness of the board to be held. In using the device, the ratchet bar is secured to the bench at a proper distance from the vise, and the jaw is adjusted at the proper hight to receive the board. The board is then arranged in place and the jaw pushed in against the side of the said board.

Improved Grain Hulling Machine.

Oren F. Cook, Grand Island, Cal.—This invention relates to a process for removing from grain its outer husk or bran, and it consists, first, in subjecting the grain after the ordinary cleaning to the action of water or steam, to soften the husk, then passing it between two roughened metallic surfaces, one revolving within the other.

Improved Boat Gripe and Crane Keeper.

Francis M. Howes, Somerville, Mass.—This invention relates to the gripes and cranes used on board of a vessel for the purpose of handling the boats, and consists in combining a lever having clamp and hook chain with a single chuck to hold the boat in position on deck, and allow it to be easily detached, swung out, and let down into the water.

Improved Match Box.

Morris L. Orum, Philadelphia, Pa.—The object of this invention is to provide safe and convenient receptacles for matches, connected with the gas burner bracket; and it consists in the match safe combined with the bracket, which was described and illustrated on page 342 of our last volume.

Improved Corn Planter.

Andrew Springsteen, Oquawka, Ill.—By suitable arrangement a plate not only serves as a guide for the corn, but at the same time the alternating movement of a roller gives to the said plate an up and down movement, so that it may push out any dirt that may enter the interior of the standard. A stirrer passes through a hole in the side of the hopper, so that the stirrer may move back and forth in the hopper above the discharge opening, and thus keep the corn stirred up, so that it cannot clog and will pass out freely. The stirrer moves back and forth close to the upper side of the dropping roller, so as to operate as a cut off to prevent any more seed than enough to fill the dropping recesses from being carried out by said roller. Covering plows or wings, which are attached to the sides of the lower end of the standard, are formed to guide the soil into the furrow at the rear of said standard and cover the seed.

Improved Middlings Purifier.

George Parker, Poughkeepsie, N. Y.—On the top of a rectangular case, near one end, is a funnel-shaped receiver, which is to be placed directly under the floor on which the pile of middlings lies, the floor having a hole as large as the top of the funnel, or thereabout. In the opening of the funnel is a revolving cone feeder nearly filling the opening. This cone, which is adjustable vertically to open the passage more or less, is provided with grooves in the sides, which facilitate the feeding by scraping off the mass lying upon the cone regularly, and producing an even stream. It is revolved by gearing at the lower end, connected with the main driving shaft. Immediately under the cone is a flat shaking sieve hung by hooks at the upper end to the wall of the case, and at the lower end resting on the cams, which lift it and let it fall at each revolution. At the lower end the coarse matters escape, to be blown out of the case by the blast from the fan, but the finer portions fall through the sieve on the returning chute attached to the under side of the sieve, and descending toward the upper end of the next sieve below, on which it discharges. This sieve is like the one above, except it is a little finer. The coarse light matters from the lower sieve also escape off the end, and are blown out of the case. These are again separated into two grades by the plates and a passage which turn the heavier portions downward, while the lighter portions pass over and beyond.

Improved Rotary Engine.

Peter Worrall, Sugartown, Pa.—The steam enters successively into two cylinders both fast to the main shaft and in each of which is a piston wheel. Each wheel has three pistons, so that two are always under steam pressure when the third one is taking steam. The pistons are of peculiar construction, being longitudinal sections of a cylinder, with a circular head at each end, upon which are journals, to the latter of which a crank is attached. When the pistons reach the abutments, they are turned so as to fit into the cavities. As they leave the cavity, they are directly turned so that the broad and more flattened sides take steam, thus making the steam surface or area of the piston greater than the area of the cylinder. The steam is introduced into the first cylinder from below, the valve being operated by means of a lever, which is held in position by means of a spring lever and circle. The exhaust aperture opens from the second cylinder. The intermediate valves between cylinders are placed back of the abutments, and are operated by means of the ribs on the plates of the piston wheels. The ends of the valves project inward, and are triangular in cross section. As the wheels revolve, the end of the ribs strikes one of the angles, and turns the valve so that the ports admit and exhaust steam. It will be seen that the steam, after doing work, and, consequently, losing a portion of heat and pressure in the first cylinder, is exhausted into the second cylinder, where it acts upon the pistons in the same manner, doing more work, and parting with a large portion of its remaining heat and pressure.

Improved Fire Place.

William Hoyland, Newcastle, Pa.—A couple of side plates are set upright in a groove in a cast metal bed plate, said plates being curved to correspond with the said groove. They are arranged on opposite sides of the bed piece, to rest at the back against the partition wall, being about as wide as the thickness of the wall, and as high as the fire place is to be. They are fastened in the groove, at the lower end, by a flange. The fire grate is a round basket fitting the side plates, and mounted on a pivot so as to turn freely. It has a partition of fire brick dividing it as high as the back plates, of which there is one for each room. The grate, together with its partition can be turned so that one fire in one part of the grate will warm both rooms or it can be turned half way around, and thus change the fire from one room to the other, which may be desirable when only a little heat is required for ventilating the rooms, or when the temperature is not very low.

Improved Nut Lock.

Charles A. Howard, Pontiac, Mich.—Four nuts are locked by this invention. This is the number of bolts usually employed for securing fish plates to rail joints. The end of the plate locks the first nut. The second nut is inclosed by a square hole in the plate. The third nut is locked by a lock plate, and the fourth nut by the end of the lock plate, or by both. The end of the spring plate extends sufficiently far to form a spring, and is reduced in width, so that it passes through a slot or hole in the locking plate. By raising the end of the lock plate to a right angle, the third nut is unlocked and the spring plate can be removed without difficulty. The tension of the spring of the spring plate holds the locking plate in place.

Button Hole Stitching Attachment for Sewing Machines.

Carl A. Hansen and George Harley, Guelph, Canada.—This invention consists of apparatus mounted on a frame arranged to be attached to the head of a sewing machine, and connected to the needle bar to be operated. The device is arranged to cause a hook to pass down through the throat plate, and engage the thread immediately after the shuttle has passed through the loop, draw it up through the button hole, and present it to a pusher, which, by a portion of said apparatus, is caused to carry the loop beyond the needle, and hold it until the needle goes down through it and completes the stitch.

Improved Clothes Wringer.

John Seaman, Groton, N. Y.—The journals of the rolls work in slots in the standards, and upon the journals of the upper roll are placed half bearings, upon which rest the ends of the curved spring, the middle part of which is attached to the top bar. To one journal of each roll is attached a gear wheel, the teeth of which mesh upon a circle of pins or cogs attached to the side of a disk or wheel attached to the other journals of the rolls. The gearing, thus constructed, gives greater capacity to the machine, or allows the rolls to work closer together or farther apart without binding or getting out of gear. Upon the edge of the gear wheel of the lower roll is formed an outwardly projecting flange upon the inner surface of which are formed gear teeth, into which mesh the teeth of the small pinion wheel, attached to the crank shaft, which works in a long bearing in a bracket attached to the standard. This construction is claimed to give a greatly increased power to the wringer.

Improved Bird Cage.

Edward Hutchinson, New York city.—This invention consists of a perch for bird cages, constructed in two parts, which are tongued and grooved together so as to form a very narrow crack along each side, such as insects and vermin, which infest birds, like to hide in, and so that the two parts of the perch can be readily taken apart to destroy the insects, when the perch is removed from the cage.

Improved Garden Cultivating Implement.

David Mack, Barnesville, Kan.—This invention is an improved implement for use of gardeners, nursery men, etc., for cultivating various plants by hand. It includes a shovel or plow, rake, weed cutter, clod-breaking roller, and an adjustable transporting wheel. The plow is made double, one end being made small and the other large, so that one or the other end may be used, according as the work to be done may require. The forked shank of the rake is bolted to the standard. The blade of the weed cutter is made V shaped, and is secured to the ends of the arms of the shank, which is, in turn, secured to the standard by the same bolt that secures the plow. The same means secure the roller by its shank. The function of the rake is to clear the surface of vines, weeds, etc., whose roots or stems may have been severed by the cutter. The roller is used by the weed cutter and rake, principally for the purpose of preventing the former entering the earth too far or sustaining too much of the weight of the frame of the implement. The shovel is detached when the weed cutter is used, or else turned so as to be crosswise of the standard. Similarly the weed cutter is detached when the shovel is used.

Improved Machine for Drawing Wire

Joseph Woods and Edwin Woods, Warrington, Great Britain.—The apertures in the plates or dies are of successively decreasing diameters, the last being of the proper size for bringing the wire to the intended gage, and the numbers of teeth in the pinions are so proportioned as to cause the pulleys and block to rotate at an increased surface speed in proportion to the attenuation of the wire. Motion being now communicated to the main shaft, the wire is drawn by the pulley successively through the different dies, the numbers of teeth in the pinions being, as explained, in such proportions as to enable the pulleys to take up the increasing length of wire. Instead of the pulleys being of the same diameter, arranged to be driven at different speeds as regards their revolutions, they might be of diameters increasing toward the block, in which case the series of bevel pinions might be furnished with equal numbers of teeth; further, instead of one pulley being used for each draw plate or die and the wire wound around such pulley, a series of small pulleys (say, three) might be employed, the wire passing alternately under and over them, so as to provide sufficient surface for holding contact with the wire. The surface speeds of the pulleys and block will be required to be varied in practice for obvious reasons such as when drawing wire of iron, steel, or brass; but the adjustment of the said pulleys and block, so as to provide a correct surface velocity, will be simple to practical wire drawers.

Improved Door Spring

Francis H. Richards, New Britain, Conn.—A tube is pivoted to a bracket attached to the casing, and supported by a second bracket passing through a slot in its bottom and secured to the door. In the rear part of the tube is placed a coiled spring of sufficient strength to shut the door quickly and with a slam, if allowed to act freely. The forward end of the spring rests against a piston, which is attached to the end of the door bracket, so as to move back and forth through the tube. The piston is made of such a size as to slide freely through the tube, and to its forward end is attached a cupped packing, made of leather or other suitable material, and which moves freely through the tube as the piston moves toward the rear end of the said tube, and which, when the piston moves forward, serves as a valve to push the air forward, and thus cushion the piston upon compressed air, so as to check the door just before it closes, and thus prevent it from slamming. The air escapes through the forward end of the tube, where its escape is regulated by a grooved screw.

Improved Steam Engine.

Abram Beekman, of New York city.—Part of the boiler constitutes a wheel case, in which there is a wheel to which the steam is delivered to the boiler through a passage on one side of the vertical center of the wheel, to give the steam that direction at starting by the lesser weight of the water on that side, due to the lesser hight of the water column. There is another passage from the boiler to the other side of the wheel, into which the steam is directed by a valve. When it is desired to stop the wheel, said valve closes the passage. The steam rises against the wheel, and impels it with a force governed by the hight of the water column and the amount of steam generated. In the upper part of water chamber, the steam condenses and flows back into the boiler.

Improved Road Scraper.

James W. Weston, Windsor, Ill., assignor to Turner M. Johnson, of same place.—This invention is a machine for grading roads. The forward ends of a mold board and land side are securely attached to a cast point which is made somewhat like a plow. The lower part of the mold board is faced with a steel plate, which projects beneath the lower edge of the said mold board. By suitable construction, by bearing down upon the rear end of a lever, the forward end of the machine will be raised from the ground for convenience in turning. By lowering the free end of another lever, the rear end of the machine will be raised and supported upon a rear caster wheel. By means of a sharp rimmed guide wheel, the machine may be guided as desired.

Improved Rotary Engine.

Leonard H. Woods, Syracuse, N. Y.—The object of this invention is to produce a rotary engine, which overcomes some of the defects of that class of engines by being built very compactly, having no dead centers, and reversing with perfect ease. The invention consists of the arrangement in an outer steam cylinder with abutments, of a rotating drum on a stationary hollow shaft with steam ports, by which the steam is alternately applied to vibrating gates placed at right angles in the two sections of the drum, and exhausted by suitable ports.

Improved Coffee Pot.

John E. Weber and Peter Knutson, La Crosse, Wis.—The pot is composed of three different sections—the upper or water receptacle, the middle one, into which the gas, alcohol, or coal oil lamp is placed, and the lower receptacle, for the coffee or other articles which are intended to be boiled. The lower part is detachable, and the coffee, tea, etc., placed therein. The upper receptacles is filled with water, closed tightly, and the lamp then lighted. The generation of the steam forces the boiling water up through a tube to a glass bulb, and then, through a smaller tube and strainer, to the lower part, extracting the strength of the coffee. The lamp is then extinguished, and the liquid slowly drawn up again into the water receptacle. The process is repeated, if the coffee is desired to be very strong. The glass bulb or tube indicates, by the passage of the liquid through it, the different stages of the cooking process. The coffee is then drawn off for use.

Improved Heater and Feeder for Boilers.

Garner C. Williams, Catskill, N. Y.—To the feed water pipe, and a certain distance apart, are connected tubes leading from the lower rear portion and from the middle of the under side of the boiler. The water forced along the feed pipe past the junctions with the tubes naturally induces currents from the boiler by the friction of its particles with the particles of the water coming in at the other pipes, which, uniting with the feed water, re-enters the boiler again along with it. To increase this action, a contrivance similar to the head of a steam siphon or injector is arranged in the feed pipe at the point of entry therein of each tube. By this plan, it is claimed that the feed water will be heated nearly to the degree of the water in the boiler, which is much greater than it can be heated by the ordinary feed water heaters.

Improved Steam and Vapor Generator.

Richard Brereton, Easton, Pa., assignor to Benjamin Douglass, Montrose, N. J.—This invention relates to the instantaneous development of steam or vapor from fluid substances by application of the substances to highly heated surfaces in expanders. The essential feature of the invention is a series of hollow spherical balls or expanders, with a feed pipe and jet bulb to each, so arranged that each receives its due measure of feed in such small quantity that the force of the instantaneous expansion is controlled by the balls, and the vapor produced is sent therefrom, along with that from the other balls, to the pipe which conducts it to the engine, in such manner that there is no accumulation anywhere larger than the conducting passage. By this means, it is claimed, the great pressure attainable by the direct contact of the fluid with the red hot metal can be controlled as it could not be in large chambers affording any considerable accumulation. Another feature of the invention is an arrangement of the expansion balls in the furnace so as to be directly surrounded by the fire, to bring the fluid into the most direct contact with the highest heat of the fire,

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Price only three dollars—The Tom Thumb Electric Telegraph. A compact working Telegraph apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 260 Broadway, cor. Warren St., New York.

By touching different buttons on the desk of the manager, he can communicate with any person in the establishment without leaving his seat. The Miniature Electric Telegraph—Splendid for offices, factories, shops, dwellings, etc. Price only $5, with battery, etc., complete for working. Made by F. C. Beach & Co., 260 Broadway, corner Warren St., New York. The Scientific American establishment, New York, is fitted with these instruments.

Wanted—Situation by machinist familiar at lathe, planer and vise. Address Machinist, Penn Yan, N.Y., Box 289.

Steam Boiler and Pipe Covering—Economy, Safety, and Durability. Saves from ten to twenty per cent. Chalmers Spence Company, foot East 9th St., N.Y.

Diamond Carbon, of all sizes and shapes, for drilling rock, sawing stone, and turning emery wheels; also Glaziers' Diamonds. J. Dickinson, 64 Nassau St. N.Y.

The New Elastic Truss presses uniformly all around the body, and holds the Rupture easy, night and day, till cured. Sold cheap by the Elastic Truss Co., 683 Broadway, New York.

You can get Improved Machinery from Gear, Boston, Mass.

Just Published—"Workshop Receipts" for Manufacturers, Mechanics, and Scientific Amateurs. $2, mail free. E. & F. N. Spon, 446 Broome Street, N. Y.

Reliable 2d hand Engines, Boilers, etc., Cheap. Illustrated circulars free. E. E. Roberts, 52 Broadway, N.Y.

The Universal Hand Planer is recommended in most favorable terms by all using them. Saves its cost in Files and time of workman in a short time. Attached to any vise. Jacob E. Suitterlin, Manufacturer, 60 Duane Street, New York

For Leather Manufacturers—Rights for Sale of a new patent process of Coloring Leather: most delicate colors; from 1c. per skin up. For particulars address John Koppitz, 1 Studley Pl., Boston, Mass.

Wanted—Applications for Specimen Copies of The Manufacturer and Builder. The cheapest Mechanical and Scientific Journal in the world. $2 a year; $1 6 mos. Address Austin Black, Sec'y, 37 Park Row, N. Y.

Engines for Sale Cheap—Three 8x12 horizontal stationary; one 12x18; one 5x8. Also, one second hand 7 and 8 ft. Planers; 2—8 ft. 20 in. swing Engine Lathes; 1—6 ft. 15 in. hand. Enquire at D. Frisbie & Co., New Haven, Conn.

For the best Small Portable Engine in market, address Peter Walrath, Chittenango, N. Y.

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

Rue's "Little Giant" Injectors, Cheapest and Best Boiler Feeder in the market. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

Flour, Feed, Paint, Ink, and all other kinds of Mills. Ross Bro's. Williamsburgh, N. Y.

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

Parties needing estimates for Machinery of any kind, call on, or address, W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

Iron Steam Boxes for Stave Bolts & Veneer Cutting Machines. T. R. Bailey & Vail, Lockport, N.Y.

Boult's Unrivaled Paneling, Variety Molding and Dovetailing Machine. Manufactured by Battle Creek Machinery Company, Battle Creek, Mich.

Buy Gear's Improved Balanced Jig Saw, Boston, Mass.

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

For Bolt Forging Machines, Bolt Holding Vises to upset by hand. J. R. Abbe, Manchester, N.H.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Ms.

Brass Gear Wheels, for models, &c., made to order, by D. Gilbert & Son, 213 Chester St., Phila., Pa.

All Fruit-can Tools, Ferracute, Bridgeton, N.J.

Dean's Steam Pumps, for all purposes; Engines, Boilers, Iron and Wood Working Machinery of all descriptions. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

For best Presses, Dies and Fruit Can Tools, Bliss & Williams, cor. of Plymouth & Jay, Brooklyn, N.Y.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

Damper Regulators and Gage Cocks—For the best, address Murrill & Keizer, Baltimore, Md.

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

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

ANSWERS TO CORRESPONDENTS

We are obliged to J. H. W. for his explanation of the degrees of proof of alcoholic spirit, but the subject is exhausted.—U. U. should consult a maker of hay presses.—F. R. & S. can harden iron mold boards by the processes of case hardening described on p. 362, vol. 25.—T. O. M. will find a good recipe for paste on p. 280, vol. 28. Shaving with pumicestone is described on pp. 149, 180, 281, vol. 26.

T. H. G. asks: When is it winter in Patagonia (Cape Horn) and when is it midwinter there? A. Winter commences on the 21st of June, and it is midwinter in the month of August.

G. M. asks: 1. If a vessel containing 5 cubic feet of compressed air be placed inside of another vessel of 20 cubic feet capacity, and the compressed air be very gradually let into this vessel, with a proper means of escape to prevent an increase of pressure, could a person breathe inside the large vessel? If so, how long would the compressed air supply the necessary amount of air for respiration, the air being compressed to 300 lbs. per square inch? 2. How is gas of ammonia made? A. 1. A person making 15 respirations in a minute would require, under ordinary circumstances, $43 \times 15 = 645$ cubic inches of air. The inner vessel would contain $200 \div 15 \times 5 \times 1728 = 115{,}200$ cubic inches of air at ordinary pressure. Hence the air would support respiration for $115{,}200 \div 645 = 178\frac{14}{43}$ minutes. 2. Put equal weights of quicklime and sal ammoniac, powdered and intimately mixed, in a retort; gently heat it, and an abundance of pure ammonia gas will be given off. An ounce of sal ammoniac will yield about 380 cubic inches of the gas.

C. E. G. asks: How are we to reconcile the conclusions of scientific men in regard to the strength of iron at extremes of temperature? Common observation shows iron to be stronger at a temperature of from 75° to 90° Fah. than at from 25° to 35° below zero. I went to work on a very cold day; the thermometer showed 38° below zero; in attempting to drive a mill dog with a mallet, I broke the dog in two places. The iron showed clean breaks. The rod was one inch square at one break, and ¾ inch round at the other, parting in both places at the same blow. I tried another dog and struck it into the log with my hand covered by a buckskin mitten. This dog also broke where it was ¾ inch in diameter. Thinking it dangerous to try to run the saw, we thought we would try to get some stones and ice from the tail race that obstructed the water. I took a common crowbar; and getting a short bite under a stone frozen in, I sprung the bar with my heft, and the bar broke about 6 inches from the fulcrum, showing a perfectly clean break of 1¼ inches square iron. Thinking the laws of cohesion had suspended for a time, we suspended operations until a warmer day. This and the facts shown by R. H. Thurston are a paradox. A. The following conclusions, as stated by Professor Thurston in his paper on the "Molecular Changes Produced in Iron by Variations of Temperature," will probably make this matter plain. "10. That the general effect of increase or decrease of temperature is, in solid bodies, to increase their power of resistance to rupture, or to change of form, and their capability of sustaining 'dead' loads. 11. That the general effect of change of temperature is to produce change of ductility, and consequently, change of resilience and power of resisting shocks and of carrying live loads. This change is opposite in direction, and usually greater in degree than the variation simultaneously occurring in tenacity. The practical result of the whole investigation is that iron and copper, and probably other metals, do not lose their power of sustaining 'dead' loads at low temperatures, but they do lose, to a very serious extent, their power of sustaining shocks or resisting sharp blows."

J. M. McG. asks: Will you give me a good plan for steaming and bending plow handles, etc.? What pressure of steam should be used, and how long should they remain in? Is there anything that, if put in the water, will facilitate the softening of the wood? 2. Why were all the American quarter and halves of dollars made in the year 1853 stamped with an imitation of the sun's rays on the eagle side, and none before or since? A. 1. The steam chest for bending timber is commonly made of wood, and connected with the boiler. It is the exposure to the heat of the steam that softens the wood, and probably nothing put into the water will hasten the process. It does not make much difference what pressure of steam is maintained. After the pieces are softened, they are bent to shape, and then, being secured in that position, are placed again in the steam chest, to take a set. 2. Probably because this suited the designer at that period.

C. C. S. asks: 1. What is the length of the Mississippi river from Cairo to New Orleans? 2. What is the speed of the current per hour between these two places? 3. We wish to start from Cairo and go to New Orleans in a small boat. Do you think this is feasible? If not, why? 4. Would the wind aid us in sailing? 5. What size and kind of a boat would you advise us to build? 6. Do you know of any good book describing the Mississippi? A. 1. 1,040 miles. 2. At high water, the velocity is about 2·6 miles per hour; at low water, between 1·5 and 2·1 miles per hour; mean velocity for mean water, 2·26 miles per hour. 3, 4. Yes. 5. Probably it will be best to build a cat-rigged center board boat, from 18 to 20 feet long. 6. There are numerous guide books of the Mississippi, which doubtless contain much that would be interesting and useful to you on your voyage.

C. M. B. asks: 1. What is decalcomania, and how do you "decalc" any thing? 2. Is there any remedy for that every day annoyance, a bad cold in the throat? A. 1. There are various methods of decalcomania or transferring of pictures. The finest is to transfer the pictures on wood. Paper pictures for this purpose are now sold by the stationers. A varnish is applied to the picture only, and it is then pressed on the wood. When dry the paper is dampened and rubbed off with the fingers, leaving the picture on the wood. 2. The way to prevent taking cold is to keep the feet always warm and dry, the chest well protected and to eat plenty of nourishing food. The remedies that have been prescribed for sore throat would fill too much space to be inserted here. Gargling with strong salt water is a good remedy, if used the moment a sensation of soreness is perceived. Singers should wrap the throat up after exercise when going out into the cold air, but at other times the throat should not be too much covered, so as to harden it to the weather. Growing beards is said to be a good preventive against colds in the throat for those who have them to grow.

S. W. asks: How can I run a small bellows without using my hand? A. You might arrange a motion to be worked by your foot.

R. B. S. asks: 1. How can I make a battery that I can silver plate with? Would an ordinary local battery, such as is used in telegraph offices, do? 2. Can you inform me how to clean and polish shells of various kinds? 3. I have tried to make a Hero's fountain, but have not succeeded very well. Suppose I have two tanks, each one holding five gallons, what size should the inside of the tubes connecting them together be? Are all the tubes to be the same size? What hight should the top tank be above the top of the other? A. 1. We think such a battery would answer very well. 2. See p. 122, vol. 27, and use friction for giving a fine polish. 3. Inside diameter of tubes, about one quarter of an inch. All the tubes can be the same size except that you should contract the opening for the jet. Hight of upper vessel below bottom one is regulated by the hight of jet required. From 4 to 5 feet would do very well.

W. P. asks: What is an average analysis of coal? A. Carbon 78·65, hydrogen 4·65, oxygen 14·21, sulphur 0·55, ash (consisting of silica or quartz, oxide of iron, clay, potash, soda) 2·49.

W. S. B. says: 1. I have been told by several mechanics that a block cannot be squared on all sides, that is, that all the sides of a cube, at right angles to each other, cannot be obtained by a common try square. 2. Can a screw be set up tighter with a long screw driver than a short one? What is the theory of this? A. 1. We think a block can be squared on all sides by the use of a carpenter's square, first dressing one face out of wind, and marking a square on it, to serve as a guide in laying off the other faces. 2. The increased inefficiency of a long screw driver is due to the greater leverage afforded by inclining the tool, as already explained on page 393, vol. 18.

R. J. T. asks: Can a locomotive start with more cars, one crank being on the center or dead point, with the other crank below the axle, or above the same? A. There would be no difference in the two cases, except the power required to lift the crank and connecting rod from the lower half center.

E. H. B. asks: What is a remedy for biting the finger nails? A. Keep the fingers out of the mouth. If that fails, wear mittens.

R. H. D. asks: Will the same amount of power exerted on a long screw driver produce a greater effect than on a short one? A. As a matter of fact, it is well known that more effect can be produced with a long screw driver than a short one. See p. 393, vol. 18.

A. D. says: I have a hollow iron cylinder, in which I have made a deep dent. I have tried to fill the dent up by pouring in melted lead, but I could not make the lead to adhere to the iron. How can I make the lead stick? A. You can make the lead adhere by boring holes in the cylinder.

C. D. asks: Why is it that, during rainy weather, when the air is filled with vapor of water, the barometer falls? A. The barometer falls just before stormy weather, because the vapor in the air is condensed, thus lightening the column of air that supports the mercury.

G. J. V. D. says: You say that for casting small articles of iron, plaster of Paris would be better than clay. Will it also do for brass, for articles 6 or 8 ozs. in weight? Would vent holes be needed for the escape of gas? A. We think that plaster of Paris would answer in the cases mentioned, if proper vent holes were provided.

P. G. K. asks: Is it precisely 12 o'clock, noon, at any given point when the sun is due south of that point? Does it vary? If so, what is the variation? When is the sun due south of San Francisco at noon? A. It is precisely noon under these circumstances at four times in the year, about December 25, April 16, June 16, and September 1. At all other times the noon time, as shown by the sun, must be corrected by the equation of time, which is given in the Nautical Almanac for every day of each year. In answer to your other query, consult a lawyer.

J. R. asks: Where should the draw bar of a locomotive be attached? If above the center, she will tip up in front, vertically. A. As low down as possible.

R. M. S. asks: 1. What is gasoline composed of? 2. Is it more dangerous to burn than common coal oil? If so, why? 3. What are naphtha and benzine composed of? A. 1. The term gasoline is a barbarism applied to highly rectified naphtha, one of the liquid hydrocarbons distilled from petroleum. 2. It is extremely dangerous to attempt to burn it in the ordinary manner, on account of its volatility, the combustibility of its vapor, and its explosiveness when mingled with the air. 3. Naphtha and benzine are two names for the same thing. They are compounds of hydrogen and carbon. We do not know the other fluids you mention.

J. F. A. asks: What proportions of carbonate of soda and sulphuric acid, each in solution of equal quantities of water, will generate the best quality of carbonic acid gas for extinguishing fires? A. The quality of the carbonic acid gas will not be affected by varying the proportions or the strength of the solutions employed.

L. H. D. asks: 1. How can I make a gold wash? 2. How can I mold hard rubber, so that it shall retain its elasticity? A. 1. You can make a gold wash as follows: Dissolve 1 part of gold in 3 parts of nitro-muriatic acid (a mixture of nitric and muriatic acids) evaporate until vapors of chlorine cease to be evolved, and then set the solution aside to crystalize. Dissolve the crystals, which are the terchloride of gold, in water. To the solution add ether and shake the two together for some time. Finally pour off the upper portion, which is an ethereal solution of gold. When this is applied with a camel's hair brush to polished iron or steel, the ether soon evaporates and leaves the surface covered with a film of pure gold. In this way any fancy device or writing may be executed with facility. 2. When rubber is melted it does not readily again become solid. Your best plan is to immerse the rubber in a mixture of bisulphuret of carbon 95 parts, and rectified alcohol 5 parts, until it swells into a pasty mass, which may then be molded into any desired form.

J. A. E. asks: Can you give me any information respecting the merits of the Vera Cruz cement, used by the Mexicans for building purposes? 2. How can I construct a cheap home made telescope? A. 1. It is very highly spoken of by engineers who have made experiments to determine its qualities. 2. See p. 7, vol. 30.

F. T. H. says: In trying to make gun cotton, I took a handful of cotton and poured upon it one ounce of nitric and one half ounce of sulphuric acids, mixed well, and allowed to cool before pouring. After allowing my cotton to remain in this solution 10 or 15 minutes, I removed it and washed it until the cotton did not have any chemical effect on blue litmus paper. I then dried and ignited it, but it burnt only as common cotton would do. A. Your acids were not in the proper proportions and probably not strong enough. Treat as follows: Mix together equal measures of concentrated nitric acid (S. G. 1·5) and concentrated sulphuric acid (S. G. 1·845). When cool, pour into a glass vessel and immerse in it clean dry carded cotton, in as loose a state as possible, for 4 or 5 minutes, promoting the action of the liquid by stirring with a glass rod. Then pour the acids off and squeeze the cotton as dry as possible, by means of the glass rod, or between plates. Then throw the cotton into clean soft water, as large a quantity as practicable, squeeze dry again, and then wash in a stream of water until the article is perfectly free from acid. Lastly dry by a steam bath at about 180° Fah. Only small quantities of cotton should be prepared at a time, and the greatest caution observed in handling after manufacture. Good gun cotton explodes at 300° Fah., without either smoke or residue.

S. A. B. says: I am told that nitrogen may be formed by fabricating coke. Will you explain this? Does it mean that coking the coal accomplishes it, and can it be done in open air? 2. How much nitrate of potassa will be sufficient to put in a ton of fertilizer? A. 1. There is no free nitrogen formed in the destructive distillation of coal. A ready means on the small scale of obtaining nitrogen is to burn up the oxygen in a bell glass filled with air, over water, by means of phosphorus. 2. Dr. Jeannel's fertilizer (see p. 401, vol. 28) contains 25 per cent nitrate of potash.

J. M. says: I have a plain cylinder boiler 16 feet long. The fire goes under it and up the smoke stack. Would a check wall built at the far end of boiler save fuel? A. We do not think the proposed arrangement will prove efficient.

A. K. asks: 1. What fish swims the fastest, and where could I see a good drawing of the same? What is the name of the fluid which removes all dirt from the works of a watch by immersion? A. 1. Either the sword fish or tunny. You will find them illustrated in almost any good encyclopedia. 2. See p. 98 of our vol. 26.

R. T. asks: How can I make a filling for walnut wood, that will take varnish well? A. Mix with good whiting such colors as will produce the desired hue. Give the wood a good coat of oil, and sprinkle the mixture over the work until it is pretty well covered, then rub in well with a soft rag. Wipe off the superfluous filling, let dry, and varnish.

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

S. S. S.—This is a fine specimen of micaceous oxide of iron. It is often found in connection with common specular iron, but rarely in sufficient quantities to be explored by itself.

N. R. T. Jr.—1. Copper pyrites, a compound of copper, iron, and sulphur. 2. Quartz conglomerate. 3. Iron pyrites and quartz. 4. Red oxide of zinc and magnetic iron.

W. H. H.—This mineral is a compact brown oxide of iron.

E. E. B.—1. Clay with oxide of iron. 2. Clay containing brown oxide of iron. 3. Brown quartz.

D. McD.—Your mineral is shale, and its presence is considered a strong indication of coal in the vicinity. The bituminous variety, however, is more closely connected with coal. The presence of bitumen may be easily determined by the smell, after heating for a moment in the flame of a lamp.

W. S.—Your mineral is bog iron ore, a variety of brown oxide of iron. Bog iron ore generally yields about 30 of 35 per cent of cast iron; but on account of its containing a small proportion of phosphoric acid, the bar iron made from it is often more or less "cold short." It is advantageously smelted with the brown oxide and other ores of iron.

Josiah M. Hess, 292 East Washington street, Indianapolis, Ind., wishes to know who makes the best horse radish grater. Will some correspondent inform him?

COMMUNICATIONS RECEIVED.

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

On Photographs of the Invisible. By J. H.

On an Aerial Ship. By W. O.

On What to Do in Hard Times. By G. E. and by J. P. A.

On the Ventilation of the Senate Chamber. By R. T. C.

On Small Steamers. By G. S. C.

On a New Means of Producing Fire. By C. C. A.

On Purifying the Air. By S. B.

On Administrative Reform in the Patent Office. By G. R.

On Some New Inventions. By C. W. P.

On an Instance of Atmospheric Refraction. By T. H.

On the Alignment of the Hoosac Tunnel. By C. F.

On a Total Eclipse of the Moon. By J. M. B.

Also enquiries from the following:

F. S. L.—D. C. T.—K. A. H.—H. M. P.—G. W. K.

Correspondents in different parts of the country ask: Who makes steam fire engines? Who makes a pie lifter, of copper wire? Who sells knitting machines? Where can machinery for light cooper's work be obtained? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal" which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

December 16, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Inhaler, medical, J. C. Parkinson 145,679
Inkstands, tool for molding, A. W. Brinkerhoff 145,619
Iron and steel, refining, I. M. Phelps 145,680
Iron, etc., preventing corrosion of, R. A. Fisher 145,496
Knitting machine register, D. A. Lehman 145,509
Knife, drawing, M. Brooks 145,485
Ladder, step, A. W. O'Bleness 145,522
Lamp shade and drip cup, J. S. & T. P. Atterbury 145,543
Lampshade supports, W. N. Weeden 145,702
Lamp wick, P. Martin 145,667
Lamp slide pendants, J. A. Evarts 145,637
Lantern, magic, L. J. Marcy (r) 5,686
Latch and door check, R. L. Omensetter 145,523
Lath machine, T. Bruno 145,486
Lathes, tool holder for, L. Reder 145,684
Leather perforating machine, L. D. Woodmansee 145,543
Leather metal fastening, C. Keniston 145,658
Lightning rod coupling, J. W. Fritch 145,641
Lithographic transfer, O. P. Wolff 145,606
Lock tumbler, E. W. Brettel 145,618
Mallet for driving tubes, etc., C. Stewart 145,537
Mast for vessels, hinged, J. E. Hammond 145,648
Mattress frame, wire, G. V. & W. I. Bunker 145,553
Mattress spring, D. N. Sellig 145,597
Medical compound, S. Field 145,560
Medical compound, S. Gilbert 145,498
Meter, dry gas, A. Harris 145,650
Meter for wheel vehicles, way, J. A. Robinson 145,527
Motion, converting, J. P. Taylor 145,599
Motion, converting, H. Wheeler 145,540
Motor, L. H. Dean 145,490
Music blackboard, Brown & Carey 145,622
Musical pneumatic action, W. F. Schmoele *et al* 145,532
Nail cutting machine, M. Thibault 145,696
Nail machine, cut, E. A. Kimball 145,504
Nail plate feeder, J. Poulson 145,681
Numbering machine, J. D. Smith 145,598
Ores, etc., flux for, P. N. Macksy 145,580
Ox shoes, forming, S. Deeble 145,631
Ox shoes, making, R. French 145,561
Pad, shoulder, L. Kyser 145,661
Pans, machine for forming, E. Kuessner 145,660
Paper feeding machine, C. M. Wielings 145,542
Paper pulp, Brown & Denison 145,620
Petroleum, distilling, A. W. Wilkinson 145,707
Photographic background, J. Buchtel 145,487
Photographic background, A. B. Costello 145,457
Photographs, guide for cutting, L. T. Young 145,711
Piles, sinking broken, E. C. Boobar 145,483
Placards, etc., exhibiting, Morrell & Moore 145,709
Planing sheet metal edges, G. B. Rundlett 145,593
Planter, cotton seed, Z. Carter 145,554
Planter, hand corn, Tracy & Platt 145,698
Planters, dropper for seed, H. H. Koeller 145,575
Plow, C. M. Clark 145,627
Portfolio, L. F. Raimond 145,683
Potass, bitartrate of, L. Adler 145,607
Press, cotton and hay, E. S. Collins 145,629
Printer's rules, preparing, J. B. Bancroft 145,549
Printer's side stick and quoin, F. Keehn 145,574
Printing press, copper plate, T. S. Bates 145,610
Propellers, operating screw, F. H. Tobias 145,697
Pump or blower, rotary, A. Brear 145,617
Pumps, condenser for steam, D. Stoddart 145,538
Punch for metal, hand, S. F. Leach 145,578
Punching and shearing machine, C. Swanson 145,694
Railway rail joint stiffener, H. Harding 145,649
Railway switch, E. Mercier 145,518
Railway switch, T. Newman 145,678
Railways, removing snow from, J. A. Bryant 145,623
Range, L. Meyer 145,674
Rein holder, L. Fawcett 145,559
Rice, machine for hulling, H. B. Stevens 145,693
Roadways, removing snow from, G. Hart 145,566
Roofs, attaching slate to, D. Ryan 145,529
Roofing, cement for slate, H. Wheeler 145,705
Ruler, F. A. Combes 145,555
Sad and fluting iron, L. Mooney 145,676
Saddle tree, O. V. Flora 145,639
Saw gummer, L. Gibbs 145,043
Saw handle, W. Clemson 145,628
Saw mills, head block for, G. Zschech 145,712
Screw driver, S. R. Kneeland 145,506
Screw plate, T. L. Van Dorn 145,701
Scythe holder for rag cutters, E. D. Aldrich 145,475
Secretary, wardrobe, and bedstead, A. Weeks 145,703
Separator, seed, F. W. Mase 145,668
Sewing machine, J. A. House 145,570
Sewing machine, I. Manning 145,515
Sewing machine, E. F. Richardson 145,687
Sewing machine gage, C. C. Roberts, (r) 5,689
Sewing machine table, J. Bennor 145,612
Sewing machine tucker, J. H. Bean 145,482
Shafting, bearing for, P. J. Hardy 145,565
Shutter worker, T. and C. T. Rowe 145,688
Skate fastening, G. W. Barlow 145,551
Soda fountains, charging, J. C. Kennedy 145,503
Sower, seed, B. Morse 145,520
Spark arrester, J. W. Seigh 145,596
Spark arrester, Thornton & Buckland, (r) 5,687
Spinning mule, T. Houlding 145,569
Spring, F. K. John, (r) 5,685
Steam trap, R. J. Barr 145,480
Still for alcoholic spirits, C. E. Werner 145,704
Stock and die, J. W. Hardie 145,500
Stove, lamp, E. Savoral 145,531
Stove pipe thimble, N. Linden 145,579
Stove, portable, S. J. Dibble 145,491
Table, ironing, C. Blom, Jr 145,614
Telegraph transmitter, D. Hermann 145,567
Thill coupling, G. M. Dunlap 145,635
Thill coupling, H. Manwaring 145,516
Tobacco stripping machine, Tunnicliff *et al* 145,699
Tongs, culinary, A. Greenleaf 145,564
Trap, fly, T. Lane 145,507
Tree protector, J. Neff 145,585
Urn, coffee, C. Hitchcock 145,653
Vault cover, W. Dale, (r) 5,684
Wagon standard, C. W. Saladee 145,594
Washing machine, Tull & Weston 145,602
Watch chain, Frontier & Bellemere 145,642
Water closet, J. F. Nellson 145,586
Way, elevated, H. W. Farley 145,638
Weather strip, O. W. Booth 145,616
Whalebone or rattan, splitting, J. Taggart 145,539
Wheel, buffing, E. & W. Dixon 145,492
Windmill, J. A. Wheeler 145,541
Window blind slat adjuster, Beach & Berry 145,481
Window screen, W. G. Anderson 145,547
Wrench, S. J. Wright 145,710

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:

27,637.—CULTIVATOR.—C. M. Hall, D. E. Hall. March 11.
27,641.—HARVESTER.—F. T. Lomont *et al*. March 11.
27,743.—BOILER FEED.—T. Snowden. March 18.
28,004.—CAR AXLE.—J. Montgomery. March 8.
28,269.—BAYONET SCABBARD.—E. Gaylord. April 29.

EXTENSIONS GRANTED.

26,475.—BREECH LOADING FIRE ARM.—B. Burton.
26,484.—PLATFORM SCALE.—T. Fairbanks.
26,496.—PIPE MOLDING.—J. Firth, J. Ingham.
26,497.—SCREW TAPS.—W. and Robert Foster.
26,506.—WATER TRAP.—J. A. Lowe.

DISCLAIMER.

27,475.—BREECH LOADING FIRE ARM.—B. Burton.

DESIGNS PATENTED.

7,049.—LAMP PEDESTAL.—N. L. Bradley, W. Meriden, Ct.
7,050.—CARPETS.—J. Fisher, Enfield, Conn.
7,051 to 7,059.—CARPETS.—O. Heinigke, New York city.
7,060 & 7,061.—CARPETS.—H. Horan, East Orange, N. J.
7,062.—SHOW CASES.—J. Irons, Philadelphia, Pa.
7,063.—SODA WATER APPARATUS.—G. F. Meacham, Newton, Mass.
7,064.—FUR TRIMMING.—A. Molnar, New York city.
7,065 & 7,066.—CARPETS.—J. H. Smith, Enfield, Conn.
7,067.—TABLE CASTER HANDLES.—H. C. Wilcox, West Meriden, Conn.

TRADE MARKS REGISTERED.

1,574.—COMPOSITION GOODS.—Greanelle Manu. Co., New York city.
1,575.—BURNING FLUIDS, ETC.—Netterfield *et al*., Burr Oak, Mich.
1,576.—WHISKY.—D. Porter, San Francisco, Cal.
1,577.—PERFUMES, ETC.—G. J. Wenck, New York city.

SCHEDULE OF PATENT FEES.

On each Caveat $10
On each Trade Mark $25
On filing each application for a Patent (17 years) $15
On issuing each original Patent $20
On appeal to Examiners-in-Chief $10
On appeal to Commissioner of Patents $20
On application for Reissue $30
On application for Extension of Patent $50
On granting the Extension $50
On filing a Disclaimer $10
On an application for Design (3½ years) $10
On application for Design (7 years) $15
On application for Design (14 years) $30

[Specially reported for the Scientific American.]

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA DECEMBER 23 TO DECEMBER 29, 1873.

2,950.—W. A. Weldon and J. S. Dennis, Chicago, Ill., U. S. Improvements on curtain fixtures, called "The Weldon Curtain Fixture." Dec. 23, 1873.

2,951.—W. A. Lyttle, Grove, Hammersmith, Middlesex county, Eng. Improved process for preserving timber, called "Lyttle's Process for Preserving Timber." Dec. 23, 1873.

2,952.—I. S. Russell, New Market, Md., U. S., and H. R. Russell, Woodbury, N. J., U. S. Improvements in earth closets, called "Russell's Earth Closet." Dec. 29, 1873.

2,953.—J. G. Tourangeau, Quebec, P. Q. *Machine pour faire la pate*, called "*Le Petrin Tourangeau*." "A Dough Making Machine." Dec. 29, 1873.

2,954.—I. Kinney, London, Middlesex county, Ontario. Machine for designing and cutting scrolls and curved lines more accurately and expeditiously than has heretofore been done, called "Kinney's Instrument for Designing and Cutting Scrolls and Curved Lines." Dec. 29, 1873.

2,955.—P. English, Hamilton, Ontario. Improvements in rotary steam engines, called "English's Improved Rotary Steam Engine." Dec. 29, 1873.

2,956.—C. W. Jenks, Somerville, Mass., U. S. Improvement on skirts, called "The Sansparell Skirt." Dec. 29, 1873.

2,957.—C. P. Leavitt, New York city, U. S. Improvement on hot air engines, called "Leavitt's Hot Air Engine." Dec. 29, 1873.

2,958.—J. F. Stairs, Halifax, Nova Scotia. Improvements in the art or process of preparing oakum, called "Stairs' Improved Oakum." Dec. 29, 1873.

2,959.—J. F. Stairs, Halifax, Nova Scotia. Improvements in tarring tow and oakum, called "Stairs' Improved Oakum Machine." Dec. 29, 1873.

2,960.—S. Smyth, Bridgewater, Susquehanna county, Pa., U. S. Improvements in grates for stoves and furnaces, called "Smyth's Stove and Furnace Grate." Dec. 29, 1873.

2,961.—F. J. Bowles, London, Middlesex, Ontario, assignee of J. H. Thorp, Chicago, Ill. Machine for the detection of burglars, being a portable burglar alarm, called "Bowles' Improved Portable Burglar Alarm." Dec. 29, 1873.

2,962.—J. Lanham, London, Eng. Improvements in the manufacture of boots and shoes and apparatus therefor, called "Lanham's Boots and Shoes, Heel Press and Last." Dec. 29, 1873.

2,963.—J. B. Pugh, Champaign, Champaign county, Ill., U. S. Improvements on hay presses, called "Pugh's Champion Double Press." Dec. 29, 1873.

2,964.—A. D. Crosby, Cuba, Alleghany, Pa., U. S. Improvements in buckets for chain pumps, called "Crosby's Improved Bucket for Chain Pumps." Dec. 29 1873.

2,965.—S. Morton and J. L. Smith, Toronto, Ontario Improvements on snow plows, called "Morton and Smiths, Improved Snow Plow." Dec. 29, 1873.

2,966.—T. B. Way, Springfield Clark county, O., U. S. Improvements on millstone picks, called "Way's Eccentric Mill Pick." Dec. 29, 1873.

HOW TO OBTAIN
Patents and Caveats
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PATENTS are now granted to inventors in Canada, without distinction as to the nationality of the applicant. The proceedings to obtain patents in Canada are nearly the same as in the United States. The applicant is required to furnish a model, with specification and drawings in duplicate. It is also necessary for him to sign and make affidavit to the originality of the invention.

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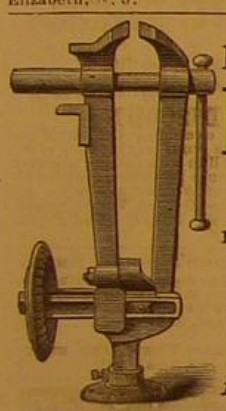

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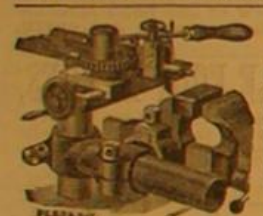

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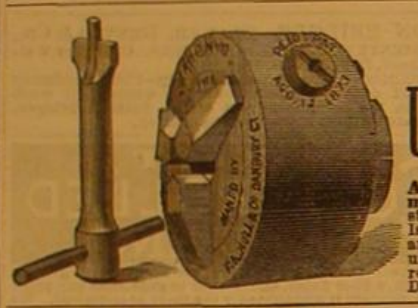

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THE CENTENNIAL TOWER ONE THOUSAND FEET HIGH.—[See page 50.]

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THE UTILIZATION OF IRON PYRITES.

The great number of specimens of this material sent to the office of the SCIENTIFIC AMERICAN for examination suggests a few words as to the characteristics and utilization of a very abundant and useful, but hitherto, in this country, much neglected mineral. That we have not put this important compound of sulphur and iron, which in Europe forms an important article of commerce, to more profitable account can be attributed only to our infancy in the art of manufacturing chemistry. We are still dependent upon foreign sulphur for our oil of vitriol, when stores of iron pyrites, containing not only sulphur but other valuable constituents, lie at our own doors. Pyrites is a term applied to various metallic compounds of sulphur, but the most abundant and well known are those of iron and copper. It is of iron pyrites or sulphide of iron that we propose to speak here, as a mineral worthy attention and study.

It was not until 1835 that the English, who used immense quantities of sulphur in the manufacture of oil of vitriol for the production of carbonate of soda from common salt, suddenly found their supplies of sulphur cut off, by an almost prohibitive duty laid on the exportation of the article by the King of Sicily, from which country most of the crude brimstone of commerce is obtained. The only available substitute was the subject of our article; and it was soon put to such useful account that, in 1861, statistics show that no less than 264,000 tuns were consumed in England. The amount used now must be vastly in excess of this, probably not less than 500,000 tuns per year.

Iron pyrites, though occurring under a variety of forms well known to the mineralogist, is still soon readily recognized, even by the inexperienced, from certain characteristic tests. How many unfortunate dupes has the bronze yellow variety deceived, in the hope that they had struck solid gold, when a few drops of hot nitric acid in the hands of the chemist, or a simple blow pipe test with charcoal, would soon have dispelled their illusion! And yet gold is not always absent. The auriferous pyrites of California, South America, and Siberia, have been profitably worked for gold. The valuable sulphur, however, in the roasting was driven off, as sulphurous acid, into the air to poison the surrounding atmosphere. Improvements are of slow growth. In our search after one valuable material, to which our attention is directed, we are apt to overlook equally valuable ones, until necessity or profit compels us to take account of them. It is but a year or two since the immense copper smelting works at Swansea, Wales, where copper is extracted from copper pyrites, have attempted to utilize the escaping sulphurous acid gas from the roasting ores. These fumes, that for generations settled down upon the surrounding country like a blight, have now been turned into a valuable commercial product.

A very common form of pyrites is that of a bright yellow mineral, which is a true bisulphide, containing iron 46·03 and sulphur 53·97 parts in 100. Iron pyrites is frequently, however, of a dark or bronze color, and sometimes resembles bell metal in its luster, this variety consisting of a mixture of protosulphide and bisulphide of iron. There is also a white variety called white pyrites, which, from its form of crystalization, is termed cockscomb pyrites. Magnetic pyrites also occurs. It is of a deep color and not very abundant. We pass over the numerous compounds formed by the combination and intermixture of other minerals, observing that, when the proportion of copper is considerable, the ore is called copper pyrites, and is distinguished by its brass yellow color, the rainbow colors on its surface, and its inferior hardness.

Iron pyrites is so hard that it will strike fire with steel, whence its name, from the Greek word for fire. It was once used in the old fashioned musket, instead of flint, for this purpose. This is an easy and inexpensive test for those who would confound it with gold. Gold is too soft to strike fire in this way, and its weight, bulk for bulk, is four times as much as that of pyrites. In the utilization of iron pyrites for its sulphur, the ore is either roasted in close vessels without access of atmospheric air, when a certain proportion of flowers of sulphur sublimes; or more ordinarily it is burned in the air, for the production of sulphurous acid in the manufacture of oil of vitriol. This is done in peculiarly shaped kilns; and when once ignited, the ore keeps up its own combustion. By this plan of burning, even under the most favorable conditions, two or three per cent of sulphur remains undecomposed. But by pulverizing the ore and roasting on the floor of a reverberatory furnace, not only is all the sulphur expelled, but the residue is in a suitable condition for the extraction of its copper, and the utilization of the remaining red oxide of iron. In England, the pyrites found in the coal beds (and called "brasses"), as well as that from Wicklow in Ireland, is largely burnt for the production of sulphurous acid gas in the manufacture of sulphuric acid. The ore after burning can be utilized as a common red pigment; but where the pyrites contains from one to three per cent of copper, as it frequently does, it is returned after burning to the copper smelter. It is this small proportion of copper that makes iron pyrites so economical a source of sulphur to the oil of vitriol manufacturer, the Spanish pyrites on this account being of late largely imported and used. Ores of this character are utilized at present in England to their fullest extent, their sulphur being first extracted in the manufacture of sulphuric acid, then their copper; and finally the red residue of oxide of iron is sold to the iron manufacturer for smelting. In spite of the abundance of iron pyrites in the United States, we know of but one establishment in this country where it is partially utilized in the manufacture of sulphuric acid.

Another important manufacture, in which pyrites may sometimes be economically used, is that of sulphate of iron or copperas. When pyrites is exposed to the influence of air and moisture, it undergoes decomposition. The two constituents of the pyrites, sulphur and iron, absorb oxygen, becoming converted respectively into sulphuric acid and oxide of iron; these from their chemical affinity unite and form sulphate of iron or copperas. In the manufacture of copperas, the ore is first stacked in large heaps on a clay floor or other waterproof foundation. It is then roasted to hasten its decomposition, and afterwards moistened with water from time to time as required. The resulting solution of sulphate of iron is then caught in suitable vessels, concentrated, and crystalized. In the South Lancashire district in England, over 80 tuns of copperas per week are thus produced; and in Stafford, Vt., copperas has been made in this way for at least half a century.

We have spoken of the "brasses," or yellow pyrites of the coal measures. These are readily decomposable; and during decomposition, so much heat is sometimes liberated as to inflame the remaining pyrites and finally set the coal on fire. When this happens, the workmen are compelled, at great expense and loss of time, to flood the mine to put a stop to the conflagration. The water pumped from coal mines containing iron pyrites is sometimes so strongly charged with the acid sulphate of iron, that the iron pumps used for its removal are rapidly corroded.

There are undoubtedly many localities in this country where the pyrites is sufficiently abundant and readily decomposable for the economical manufacture of copperas, a salt which is largely used in dyeing, as a disinfectant, and for the manufacture of ink and Prussian blue. Where the pyrites contains a small proportion of copper, it may be more economically utilized, in the way already shown, for the production of sulphuric acid.

THE INFLUENCE OF CARGOES OF MACHINERY AND HARDWARE ON SHIPS' COMPASSES.

In order to determine the local deviation of a ship's compass, due to the materials entering into the vessel's composition affecting the needle, it is usual, before proceeding to sea for the first time and at certain intervals thereafter, to swing ship and compare the indications of a standard compass, located in a position out of the sphere of attraction, with those of the ordinary steering instruments in the binnacle. By this means a correction for every point is found, which must be allowed for in steering a course per the binnacle compass.

While there is little question but that every captain of a sea-going steamer is in possession of the important data thus obtained, there is in our minds considerable doubt whether a similar allowance is made for the nature and storage of the cargo. A hold full of hardware would undoubtedly affect the compasses, and cases, of arms, for example, or any other articles of iron or steel, carelessly left near the binnacle, might throw the ship miles off her course and be productive of just such a disaster as that of the Atlantic. The captain of an English vessel, the Duke of Argyll, steaming between Liverpool and Dublin, a foreign contemporary informs us, found that a box containing six sabres and three scabbards, placed at a distance of 10 feet away, exercised a sensible influence on the needle, which, when the disturbing cause was removed, oscillated from side to side for fully five minutes before it resumed its normal position. Another instance is on record of a ship being thrown some distance from her proper position through the careless placing under the compasses of a case containing a couple of small sewing machines and a few packets of needles.

These instances show that serious consequences may be due to indiscriminate stowage of cargo composed of objects of iron or steel. In fact every shipper of hardware or machinery, or passenger having in his possession such articles, should, for his individual as well as for the general interest., advise the captain and, besides, have the cases conspicuously marked as to contents, so that every precaution may be taken to avoid their influence upon the compass. It can hardly be expected that a merchant vessel will swing ship every time that she goes to sea, but at least the danger of a guide, upon which the safety of the vessel depends, becoming unreliable will be materially lessened by a careful and intelligent disposition of the metallic portion of the cargo.

NEW IRON ALLOYS.

A new process of manufacture of alloys of iron with manganese, titanium, tungsten, and silicon, and of the agglomeration of these substances for treatment in a special furnace and in movable crucibles, has recently been patented in Belgium.

Up to the present time, as our readers are doubtless aware, but one of these alloys has been to any extent industrially manufactured and employed. This is ferro-manganese, which contains twenty-five to thirty per cent of manganese, with from 70 to 75 per cent iron and from 5 to 6 per cent carbon. In France and Germany, this alloy has attained some importance, and is stated to admit of the manufacture of certain qualities of cast iron with a regularity and surety not given by any other process. It has heretofore been produced either by the Prieger crucible system or by the Henderson process, both being based upon the simultaneous reduction in presence of finely divided charcoal of a mixture of the ores, pulverized, of iron and manganese. The presence of iron in the mixture determines the complete reduction of the oxide of manganese, and is indispensable to such reduction, a fact evidenced by the difficulty always encountered in obtaining metallic manganese during laboratory researches, and by the large expenditure of time and fuel usually required in effecting the reduction of the oxide. On account of the pulverulent state of the mixture, and of the poverty of the batch, which should contain an excess of charcoal, these two processes are able to produce in a given apparatus but small quantities daily of the alloy, and with an enormous consumption of fuel. The difficulty seems to have been to find a system which would answer all industrial requirements, work continuously, effect the reduction of the oxides successively and not simultaneously, and finally cause their complete fusion. A vertical apparatus, analogous to a high blast furnace, it would appear, might answer the require, ments, and it is stated that in certain localities, where ore has been found containing the proper proportion of iron and manganese, two smeltings have been produced, containing 18 per cent of the last mentioned metal. Unfortunately, however, such ores are very rare, for it is a necessity that they should be almost absolutely free from silex. Moreover, it is difficult to pass into a high furnace material reduced to a dust. The operation is productive of accidents, while it is hardly possible, subsequently, to preserve a regular working. Beyond this, the interior surface of the apparatus, incessantly in contact with the semi-reduced pulverized oxides which the blast drives into the very joints, becomes attacked with great rapidity.

The new process to which we refer in our initial paragraph and for the following description of which we are indebted to the *Chronique de l'Industrie*, appears to be based on a system of agglomeration, which permits of the introduction of the oxides no longer in a state of powder, but in the form of small bricks or lumps, containing the elements of the alloy to be produced. Many attempts, it may here be remarked, have already been made to agglomerate the rubbish of iron ore, which, in certain districts, exists in profusion, and which in its natural state is useless: but none have given satisfactory results. Lime, pitch, and fatty earth, have been successively employed, forming briquettes, which, though appearing of sufficient solidity when cold, disaggregated completely in the fire, or contained vitrifiable elements in such quantities that the ore became impoverished to an inadmissible degree. From the description of the new process, we learn that, if metal in granulated form, in the shape of filings, of iron or steel turnings, of spongy iron coarsely pulverized, or of any other *débris* of iron or steel in an analogous state of division, be mixed with ores containing manganese, tungsten, titanium, or a combination of these metals, or with quartz: the ores or quartz being finely pulverized and introduced in suitable proportions for the alloy: if this mixture be completely and regularly moistened with an ammoniacal solution, or with water slightly acidulated, and finally compressed in a mold of iron, a strong development of heat is produced; and at the end of several hours, if the mold be opened, a very hard compact mass will be found, which can be broken by the hammer into fragments of desired size. These pieces resist red heat perfectly, and do not commence to disaggregate until the point of fusion of pig iron. Their proper treatment in a high blast furnace affords the means, it is stated, of obtaining alloys containing iron and manganese, in all proportions ranging from 25 to 75 per cent of the latter metal, also combinations of iron and silicon, up to 25 per cent of silicon, and finally alloys of iron and tungsten or titanium, or even triple alloys of the different metals. These results are, however, obtained only at high temperatures, with a hot blast at strong pressure, and it is stated that the apparatus ordinarily rapidly deteriorates at its lower portion. To avoid this last mentioned defect, a furnace of especial construction is employed. The shaft is formed of refractory brick as hard as possible and

in which the aluminous element predominates. The hearth is of lime, magnesia or pure alumina, and the crucible is of carbon lime or magnesia. The latter portion is made in a single piece, by molding a mixture of pure graphite, gas carbon, or pure coke, in a cylindrical shaft or mold of bloom plate, and raising the whole in temperature to nearly a dark red heat for some hours. A very hard compact mass without fissures or joints is thus obtained.

The hearth is enclosed in a conical sheet iron shaft, secured by dowels to the pig iron plate which carries the tunnel. The crucible is movable, and simply rests against the lowe part of the hearth. It is held in place by small blocks. The entire arrangement is such that the working parts of the apparatus can be easily renewed or repaired in a short time. The blast is heated to at least 726° Fah. and its pressure equals from 5·07 to 5·85 inches of mercury.

AUGUSTE DE LA RIVE.

This distinguished philosopher, who was among the foremost of European *savans* for more than half a century, died on the 29th of November, at Marseilles, France. He was on his way to one of the numerous health resorts of the South of France, but was unable to reach it.

Among De la Rive's earliest investigations are to be found some important researches on the specific heat of many simple and compound gases, and here commenced his fame, and his influence in the Academy of Geneva, of which he was, up to the day of his death, the guiding spirit. The science of electricity was scarcely in existence at this time (1825), and its rapid development during the past 50 years has received much impulse from the labors of De la Rive, whose zeal in investigation was indomitable. In 1840, he discovered the value of the voltaic current in depositing gold on silver and brass, and at once published it, declining to make any profit from the invention. For this, the French Institute awarded him their premium of $600.

De la Rive was a man of almost universal culture, and his society was sought by literary men, politicians, and artists,as well as by his fellow scientists. The Swiss Confederation intrusted him with the delicate mission of laying before the British Government the danger that Switzerland was exposed, to by the absorption of Savoy and Nice into France,and he had the satisfaction of obtaining from Lord Palmerston a declaration that any attempt on the part of France against the independence of Switzerland or Belgium would be considered a *casus belli* by England.

The labors of De la Rive were universally recognized as of the highest value, and honors and distinctions from scientific bodies in all parts of the world were conferred upon him. He died in the 73d year of his age.

DEATH IN THE SCHOOL ROOM.

Despite the frequent casualties due to imperfect ventilation, together with the generation of noxious gases in largely populated buildings, though assisted by the oft repeated counsels of the best sanitary authorities as to the proper mode of remedying the evil, our progress in learning how to afford a constant supply of pure fresh air is, at best, sadly discouraging. The New York *World*, with commendable enterprise, has recently employed Dr. Endemann, of the Board of Health of this city, to make a careful chemical examination of the condition of the atmosphere in our public schools; and the results of that gentleman's investigations, as published with much detail in the above mentioned journal, point to a state of affairs that is simply disgraceful.

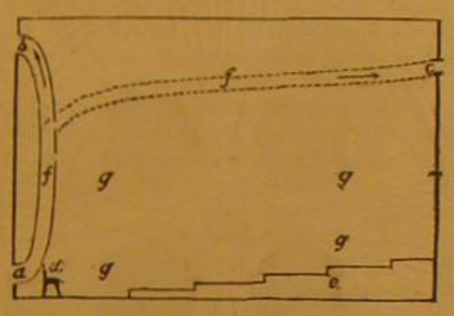
Graham and Liebig have pointed out that the mean amount of oxygen in the atmosphere is 20·9 volumes per cent, leaving a balance of 79·1 nitrogen, carbonic acid, and other constituents. The normal quantity of carbonic acid gas is, however, very small, and is estimated by De Saussure at 4 parts in 10,000. Dr. Parkes considers that an increase of this proportion to 6 parts in 10,000, or 0·06 of 1 per cent, is the highest permissible impurity. In analyzing the samples of air, Dr. Endemann used Pettenkoffer's method, by which the air is introduced into a glass globe, together with a solution of caustic baryta of definite strength. The alkalinity of the baryta solution is diminished in proportion to the amount of carbonate of baryta formed, and will be neutralized by a proportionally less quantity of a given solution of oxalic acid, thus furnishing the elements of an accurate calculation of the amount of carbonic acid in the air contained in the globe. A measured amount of lime water of known strength may be used instead of the caustic baryta solution. The effect of the carbonic acid is then to neutralize and precipitate a quantity of lime in the form of chalk, and the oxalic acid determines the proportion of lime subsequently remaining. The difference in the quantity of lime before and after the action upon the air enables the operator to calculate the existing ratio of carbonic acid.

Carbonic acid is the product of perfect combustion and of the breathing of animals, the oxygen in the latter case uniting with carbon in the system; and the air expired contains about 4½ per cent of carbonic acid gas. This, however, in open atmosphere, soon diffuses itself, but, if confined in circumscribed quarters, contaminates the air to such an extent that, if atmosphere containing one two-hundredth part of it be breathed, headache and lassitude result. Such a proportion is, however, far from fatal, for Berzelius points out that five or six per cent may be inhaled with safety, and that life may continue for some time in an atmosphere containing thirty per cent. This latter assertion, we imagine, must be based on an extreme case, as it is generally conceded that twenty-five per cent of carbonic acid is sufficient to cause speedy death. Dr. Endemann, in his report, exemplifies the mortal effects of the gas in a statement that children breathe about fourteen cubic feet of air per hour, and this air, when exhaled, will contain 430 times the normal amount of carbonic acid. If 100 persons be placed in a room, say 18 feet square by 11 feet high, and the doors and windows be hermetically closed, so that there could be no circulation, in about two hours and a half all the air would be inhaled and probably not a soul would be living.

Space necessarily forbids our following the carefully prepared details of the report before us, but the citation of a few cases will serve to show the flagrant neglect which must characterize the sanitary regulations of our schools:

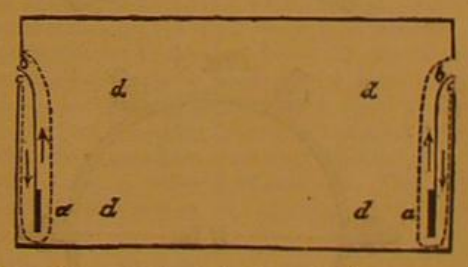
(1) Rooms 18 by 16 feet: 42 scholars; temperature, 63° Fah.; carbonic acid in 10,000 parts, 26·1, or 6·6 times the normal amount. The air was described by the inmates as generally oppressive. (2) Large class room, 20x18 feet: Odor very foul; 47 scholars; 4 times the normal amount. (3) Class room on top floor: 65° temperature; air described as constantly bad, and very correctly, as analysis showed 8·1 times the normal quantity of carbonic acid. In the next two tests, this proportion is 7·5 and 5 times.

The annexed engraving is a specimen of the heating and ventilating arrangement in the well known 12th street school, an establishment accommodating 1,200 female scholars. *a* is the register, and *b* the ventilator. The heat,entering, roasts



the back of the teacher at *d*, ascends, and immediately escapes at *b*, or, in case the window is open, diverges into another current, *p*. The cold, heavy carbonic gas is, as is evident, totally unaffected by the draft, and settles down upon the children at *c*. Mr. Lewis W. Leeds made a report regarding this school some time since, which, for some occult reason, the Board of Education saw fit to suppress. He pointed out the difficulties above indicated, and also explained a neat arrangement of the janitors, in converting the fresh air ducts to the furnaces into hen roosts, partitioning the same off, so that the air supply was obstructed; but a copious odor of poultry was added to the hot current. "Fowl"air, he very truly remarks.

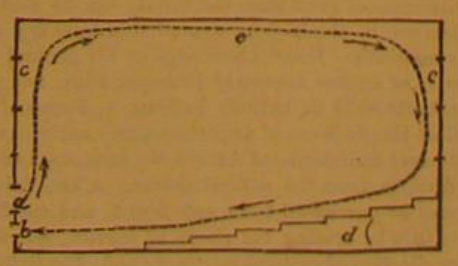
Example 6 consists in analyses made in a room heated by steam; teacher and children all complaining. The temperature was 60°, and 8·3 times the normal proportion of carbonic acid was indicated. Passing over succeeding tests, none of which show a larger percentage of carbonic acid than last mentioned, we notice repeated cases of the most dense ignorance displayed in the steam heating arrangement. In one school the ventilators were shut, choked by rust, and the janitor had no conception of their use. In another the steam heaters were arranged after the fashion indicated in the next



engraving. The current of air from the heater, *a*, escapes through the opened window, while the cold air from the latter pours down. There is a constant circulation, as indicated by the arrows, at the sides of the room, while the center of the apartment becomes packed with foul air.

There is no necessity of entering into further minutiæ. In this city there are 59 grammar schools, 43 primary schools, and 6 schools for colored children, and the number of pupils thus subject to the dangers we have noted is estimated at from 80,000 to 100,000. There is unquestionably a decided need for simple and efficacious plans of ventilation, which may be promptly put in practice in these institutions at no very large expense. Dr. Endemann suggests the following system:

Here the warm fresh air, flowing in at the register, *a*,



ascends to the top of the room. The windows being closed, it cools gradually and descends, returning to the ventilator, which is either below or on a level with the register, where it is drawn off and escapes through the flue.

The New York *World* has done good work in thus exposing the shameful condition of our schools, and parents would do well to profit by the warning. It supplies the explanation of many a pale face and aching head, if not of severer maladies, engendered by a system of slow poisoning. Other cities may take the hint, and investigate their own educational buildings. To architects and builders generally, the subject expressly addresses itself for a speedy and efficient solution.

TO OUR FRIENDS.

In dealing with our legions of friends, it is our earnest desire to give satisfaction to every one of them. But should any suppose that we have overlooked their requests or slighted their interests, we hope they will at all times promptly inform us. Postal cards only cost a penny. Speak plainly, and do not hesitate to complain.

Our mail writers and folders are under special injunctions to write our subscribers' names upon the envelopes legibly, and fold each paper neatly. We shall be glad to be informed if anybody receives slovenly work from this office.

At the beginning of the year, many thousands of subscriptions are renewed, new clubs formed, etc. If any person fails to receive the paper, or any premium to which he is entitled, we will thank him to inform us promptly.

If, by any chance, any editor or publisher, who by any agreement is to receive our paper, should fail to receive it, we shall be glad to be informed.

Persons who have written to us upon business or sent enquiries for the paper which have not been answered, are requested to repeat their enquiries. Letters sometimes fail to reach us. Be particular to mention the State in which you live. In some cases we are perplexed to know where to direct, when no State is given and there are many post offices of the same name.

SCIENTIFIC AND PRACTICAL INFORMATION.

FOG SICKNESS AMONG ENGLISH CATTLE.

The recent heavy fogs about London and its vicinity have been productive of an unusually large outbreak of sickness among the cattle gathered at the Smithfield Club show. The sufferings of the animals are described as very great, and are so clearly traced to the peculiar state of the weather as to excite apprehension that some similar malady may attack the stock on this side of the water, if the dense mists, which have prevailed to such an extraordinary degree during the present winter, continue. The *Field* says that, on the third day of the show, which opened with every appearance of a successful exhibition, and with a fine variety of prize cattle, ninety of the animals were removed, seemingly choking, and it was found necessary to slaughter fifty immediately. The illness was not confined to the single locality, but affected the horned cattle in the markets and in the suburbs; so that it was not, as has been suggested, due to foul air or lack of ventilation in the Smithfield Club building. Sheep and pigs, moreover, were not affected. The treatment used was an abundant supply of pure air and a sedative tincture of aconite. The sickness lasted for about five days, until the dissipation of the fog.

NEW OBSERVATIONS OF STELLAR MOTION.

Dr. H. Vogel, at the new observatory at Rothkamp, near Kiel, Germany, has recently made some researches into the movements of certain stars with relation to the earth by observing the position of the rays of their spectra. The stars thus examined are *α Lyræ* and *α Aquilæ*. It appears that *α Lyræ* is approaching the sun at the rate of 52 miles per second, a result which accords with previous observations made by Huggins, in which the speed was estimated at between 45 and 54 miles. *α Aquilæ* is moving in similar direction at the rate of 48 miles per second. Dr. Vogel applied his method to the constellation of *Orion* some time ago, and determined that it receded from the sun at a speed of about 16 miles per second.

DECORATING WOOD BY PRINTING.

Mr. Thomas Whitburn, at a recent meeting of the English Society of Arts, described a process, recently patented by him, adapted to express, on flat surfaces of wood, effects of light figures on a dark ground, or of dark figures on a light ground, or of figures light and dark in parts on a ground intermediate in shade. The designs or patterns are engraved in the ordinary way on box wood, and, from the blocks, the wood is imprinted on a common hand printing press with printer's ink. The process is capable of being used with two or more colors, and is designed for the ornamentation of door panels, furniture, etc.

NEW PHOTOGRAPHIC PROCESS.

We have heretofore mentioned a recent improvement in dry plate photography which consists in using gelatin instead of the ordinary collodion. The nitrate of silver, for sensitizing the gelatin, is mixed with the gelatin solution. The only drawback to this new process was the fact that the gelatin solutions could not be long preserved, especially in warm weather. This difficulty has been lately overcome by Mr. Burgess of England, who prepares the sensitive gelatin solution in any quantity that may be desired, and, after preparation, desiccates or dries the same by spreading the solution on glass plates. The dried film is then broken up into small bits and packed away in dried condition for use. Thus prepared, it will always keep good and only requires to be dissolved in water, to form an excellent sensitized solution.

THE ALIGNMENT OF THE HOOSAC TUNNEL.—Mr. Charles Fosdick, of Fitchburg, Mass., writes to say that the credit of the calculations in boring the Hoosac tunnel and the almost perfect alignment is due to Mr. Frank D. Fisher, the first assistant of Mr. B. D. Frost, the chief engineer. Mr. Fisher is a native of Massachusetts, and was educated at the Institute of Technology in Boston.

THE CENTENNIAL TOWER ONE THOUSAND FEET HIGH.

Near the modern village of Hilleh, in Asiatic Turkey, and on the river Euphrates, at about 300 miles above the junction of that famous stream with the Tigris, stands a huge irregular mound, rising abruptly from the desert plain. Masses of vitrified brick are heaped about its base, and its interior, so far as excavations have progressed, prove the whole vast pile to be of similar material. Cuneiform characters, imprinted upon the sun-dried clay, have told to the archæologist the long forgotten history of this ancient ruin, carrying the mind back to the glories of Babylon the Great, back to the reign of Nebuchadnezzar, and, yet still further into the mists of antiquity, to the days when "the whole earth was of one language and of one speech." Equaled in age only by tradition itself, the first monument erected by human hands yet remains, and though its lofty pinnacle is overthrown and prostrate, it fulfils the purpose of its builders: "To make us a name."

It is but natural for the mind to wander back to this earliest attempt of our race to make for itself a written history, and to commemorate a great event by the erection of a colossal structure, in connection with the subject of the present lines. As did the descendants of Noah, so propose we to do. The oldest of ancient nations formed brick and made mortar, and built for themselves a tower to record their existence; we, youngest of modern peoples, build us a tower to celebrate the close of the first century of our national life. And to its prototype, Babel, a pile of sun-dried clay which authorities assert, at the hour of the confusion of tongues, had not attained an altitude of over one hundred and fifty-six feet, the graceful shaft of metal, rearing its summit a thousand feet above the ground, forms a fitting contrast, typical of the knowledge and skill which intervening ages have taught mankind.

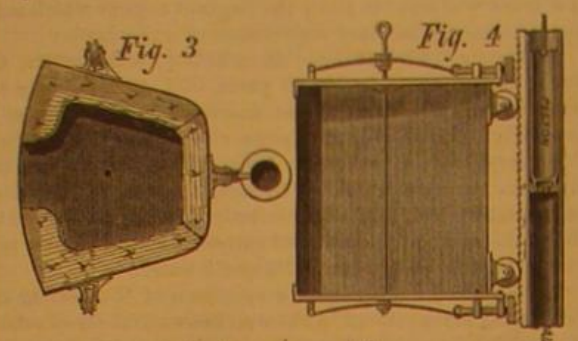
"But how high, comparatively speaking, will this thousand foot structure appear?" doubtless is a question already in the mind of the curious reader. Beside the mighty works of Nature, we answer, infinitely small; beside the works of man, colossal. Compared with the vast peaks of the Himalayas, twenty-five thousand feet above the sea, ten hundred feet is but a pigmy elevation; beside the loftiest spires which exist upon the earth, it is as are the giant trees of California to the tallest maples and elms, which join their leafy arches over our streets and doorways.

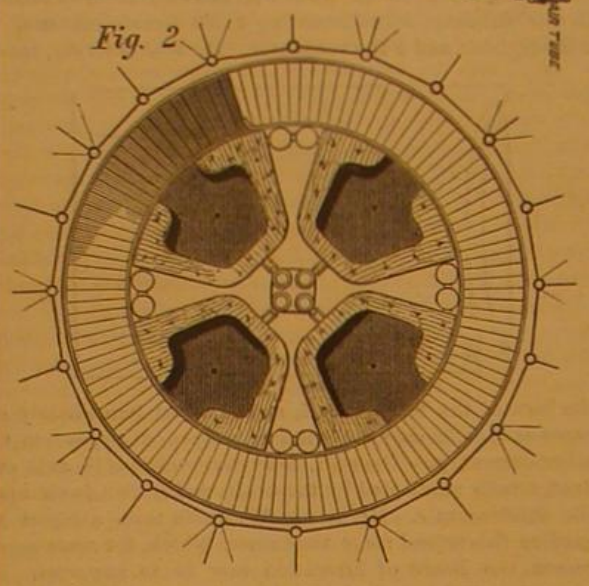
The reader can draw the contrast for himself, by a glance at the admirable effort of both artist and engraver, to which our initial page is devoted. Here are grouped the highest structures in the world; and in the center and springing far above them all, is the airy network of the great tower. Many of the edifices depicted will be recognized at a glance. First in point of altitude is the graceful spire of Cologne's far famed cathedral, rising to a hight of 501 feet above the marble pavement of the sanctuary below. Next is the Great Pyramid of Cheops, beneath the crest of which lie 480 feet of stone before the vast foundation is reached. And then another fane, spared by the fate of war, though not unscathed, Strasbourg's minster, towers 468 feet from earth to pinnacle. Michael Angelo's grandest work, the dome of St. Peter's, the gilded cross surmounting which, from its hight of 457 feet, seems to watch over the Roman campagna, is closely followed by another pyramid, that of Cephren, brother and successor to Cheops, the summit of which is 454 feet from the desert sands which continually drift about its foot.

Rivaling the glorious vault of the Italian architect, Sir Christopher Wren's masterpiece, St. Paul's, rears its symbol, 365 feet above the crowded streets of the great city at its base, overtopping, by comparison, the dome of our own Capitol at Washington, to which our artist invites the contrast, by fully 78 feet. Representative structures from three of our principal cities complete the picture. Trinity church steeple, in New York city, 286 feet from foundation to apex, then Bunker Hill Monument, its granite column towering 221 feet above the scene of the conflict which it commemorates, and, lastly, St. Mark's church, in Philadelphia, an edifice of no small architectural beauty, the spire of which springs to an altitude of 150 feet above the curb.

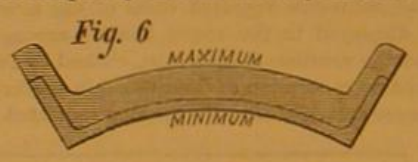
So much for relative hight. And now a word as to who is to build the great fabric, and how they propose to carry out their task. The designers are Messrs. Clarke, Reeves & Co., civil engineers and proprietors of the Phœnixville Bridge Works, of Phœnixville, Pa., a firm represented by its productions throughout the whole country, and regarding whose ability to carry through an enterprise of this kind no corroborative assertions on our part are at all necessary. The material is American wrought iron, made in the form of Phœnix columns, shown in section in Figs. 5 and 6, united by diagonal tie bars and horizontal struts. The section is circular, and is 150 feet in diameter at the base, diminishing to 30 feet at the top. A central tube, 30 feet in diameter, shown in section in Fig. 2, extends through the entire length, and carries the four elevators, shown in plan and section in Figs. 3 and 4. The latter are to ascend in three and descend in five minutes, so as to be capable of transporting about 500 persons per hour. There are also spiral staircases winding around the central tube.

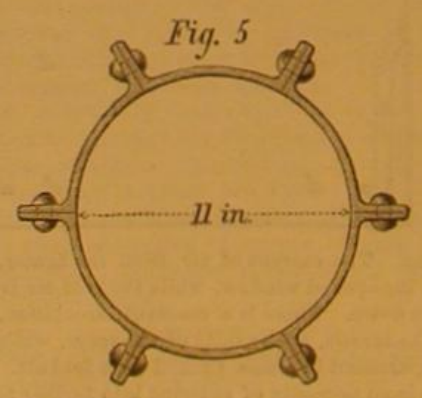
The bracing above noted, as will be observed from our large engraving, runs in every direction, so that the tower will be as rigid as if made of stone, and yet will expose very little surface to the wind. The proportioning is such that the maximum pressure resulting from the weight of the structure, with persons upon it, and a side wind force of 50 lbs. per square foot, will not strain the lowest row of columns over 5,000 lbs. per square inch. The four galleries are roofed over and protected with wire netting, in order to prevent accidents. The estimated cost of the fabric is one million dollars, and the necessary time for construction, the designers tell us, need not exceed one year. The site has not been as yet definitely located, but it will probably be in Fairmount Park, Philadelphia, in proximity to the buildings of the Centennial Exposition. By calcium and electric lights from the tower, it is suggested that the latter, with their adjoining grounds, might be brilliantly illuminated at night. The summit of the spire would also form a magnificent observatory, while the view of the surrounding country would be unparalleled.





It is hardly necessary for us to point out the very appropriate character of the design in connection with the object of its erection. That the hundredth anniversary of our national existence should not pass without some more permanent memorial than that of an exposition, which, within a few months from its close, will have disappeared, seems to us eminently proper. It is clear that, within the coming two years, no monument of so imposing a nature, or of so unique and original conception, can be constructed of any other material than iron, nor, indeed, can we hope to erect a fabric more completely national in every feature. Not only





then shall we commemorate our birthday by the loftiest structure ever built by man, but by an edifice designed by American engineers, reared by American mechanics, and constructed of material purely the produce of American soil.

Making Wax Flowers.

Our lady readers will find the imitating of natural flowers in wax a very agreeable amusement for long winter afternoons and evenings. The work is not difficult, and with a little practice ornaments of great taste and beauty can be made. The materials can be obtained for a small sum from any dealer in artist's materials. Some knowledge of the general form of flowers is of course necessary to begin with, nor should a little artistic skill be entirely lacking. Forms of various leaves, of tin, to be used as patterns, may easily be obtained, but the best imitations of nature we have ever seen were made directly from the natural flower. A handful of blossoms may be purchased from any florist, and carefully dissected; then by tracing the shape of leaves,, etc. on paper, quite a collection of patterns may be gained. *The British Trade Journal* says that the best white wax is required for the art—pure, and free from granulation. The consistency may need to be modified, according to the state of the weather, and the part of the flower to be imitated; it may be made firmer and more translucent by the addition of a little spermaceti, while Venice turpentine will give it ductility. In preparing the wax for use, it is melted with Canada balsam, or some kind of fine turpentine, and poured into flat tin molds; these give it the form of quadrangular blocks or slabs about an inch thick. These blocks are cut into thin sheets or films, in one or other of several different ways—by fixing them flat, with screw and a stop, and slicing off layers with a kind of spoke shave; or holding a block in the hand, and passing it along a carpenter's plane, having the face uppermost; or causing the block to rise gradually over the edge of the mold, and cutting off successive slices with a smooth edged knife.

The coloring of the wax is an important matter, seeing that in some instances the tint must penetrate the whole substance; whereas in others it is better when laid on the surface, as a kind of paint. The choice of colors is nearly the same as for other kinds of artificial flowers, but not in all instances. The white colors are produced by white lead, silver white, and one or two other kinds; for red, vermilion, minium, lake, and carmine; for rose color, carmine, following an application of dead white (to avert yellowish tints); for blue, ultramarine, cobalt, indigo, and Prussian blue; for yellow, chrome yellow, massicot, Naples yellow, orpiment, yellow ocher, and gamboge; for green, verdigris, Schweinfurth green, arsenic green (the less of this the better), and various mixtures of blue and yellow. For violet, salmon, flesh, copper, lilac, and numerous intermediate tints, various mixtures of some or other of the colors already named. Most of these coloring substances are employed in the form of powder, worked upon a muller and stone with essential oil of citron or lavender, and mixed with wax in a melted state; the mixture is strained through muslin, and then cast in the flat molds already mentioned; or else a muslin bag filled with color is steeped for a time in the melted wax. The material dealers sell these slabs of wax ready dyed, to save the flower-maker from a kind of work which is chemical rather than manipulative. Some flowers require that the wax shall be used in a purely white bleached state, color being afterwards applied to the surface of selected spots.

The wax is, of course, the chief material employed in wax-flower making; but it is by no means the only one. Wire bound round with green silk, tinting brushes and pencils, shapes or stencil patterns, molds and stampers, flock or ground up woolen rag, and many other implements and materials, are needed.

The patterns of leaves and petals are made from paper or of thin sheet tin, copied from the natural objects; and the wax sheets are cut out in conformity with them. Only the smaller and lighter leaves are, however, made in this way; those of firmer texture and fixity of shape are made in plaster molds. The patterns are laid on a flat, smooth service of damp sand; a ring is built up round them, and liquid plaster is poured into the cell thus formed. Generally two such molds are necessary, one for the upper and one for the lower surface of the leaf. Sometimes wooden molds are employed, into which (when moistened to prevent adhesion) the wax is poured in a melted but not very hot state. Occasionally the entire mold is dipped into molten wax, to produce petals and leaves of peculiar size and shape. The stems are made by working wax dexterously around wires, with or without an intervening layer of silken thread. By the use of flock, down, varnishes, etc., the leaves are made to present a glossy surface on one side and a velvety surface on the other. A singular mode of preparing films of usual thinness is by the aid of a small wooden cylinder, like a cotton reel, or rather a ribbon reel: this is dipped and rotated in melted wax until it takes up a thin layer, which layer, when cold, is cut and uncoiled; the difference of smoothness which the two surfaces presents fit them to represent the upper and lower surfaces of a leaf or petal. The combination of all these materials into a built-up flower is a kind of work not differing much from that exercised in regard to textile flowers.

The Proposed Tunnel under the British Channel.

The feasibility of this project, and the advantages and disadvantages of various localities proposed for it, are still being discussed. Mr. Joseph Prestwich, an eminent engineer and geologist, has recently investigated the conditions of the strata between the continent of Europe and the coast of England. These researches extend from Ostend, Belgium, to St. Valery, in Normandy, France, and from Hastings to Harwich on the English side; and by them it was ascertained that a deposit of the London clay extends from the mouth of the Thames to Dunkirk, on the northeast point of France. This deposit is from 200 to 400 feet thick; and the impermeability and homogeneity of the clay, as shown in the works of the subway under the Thames in London, point out the line between the mouth of the Thames and Dunkirk as one of the most practical routes for the tunnel. But the distance (80 miles) is an important consideration, against which, again, must be set off the very great depth at which a tunnel between Dover and the neighborhood of Calais would have to be made. But the probability of striking coal in the last named work would be an additional inducement to take the shorter route; added to which must be considered the fact that the traffic between England and the continent lays chiefly between London and Paris, in the direct line of which the Dover tunnel would lie.

A Remarkable Boiler Explosion.

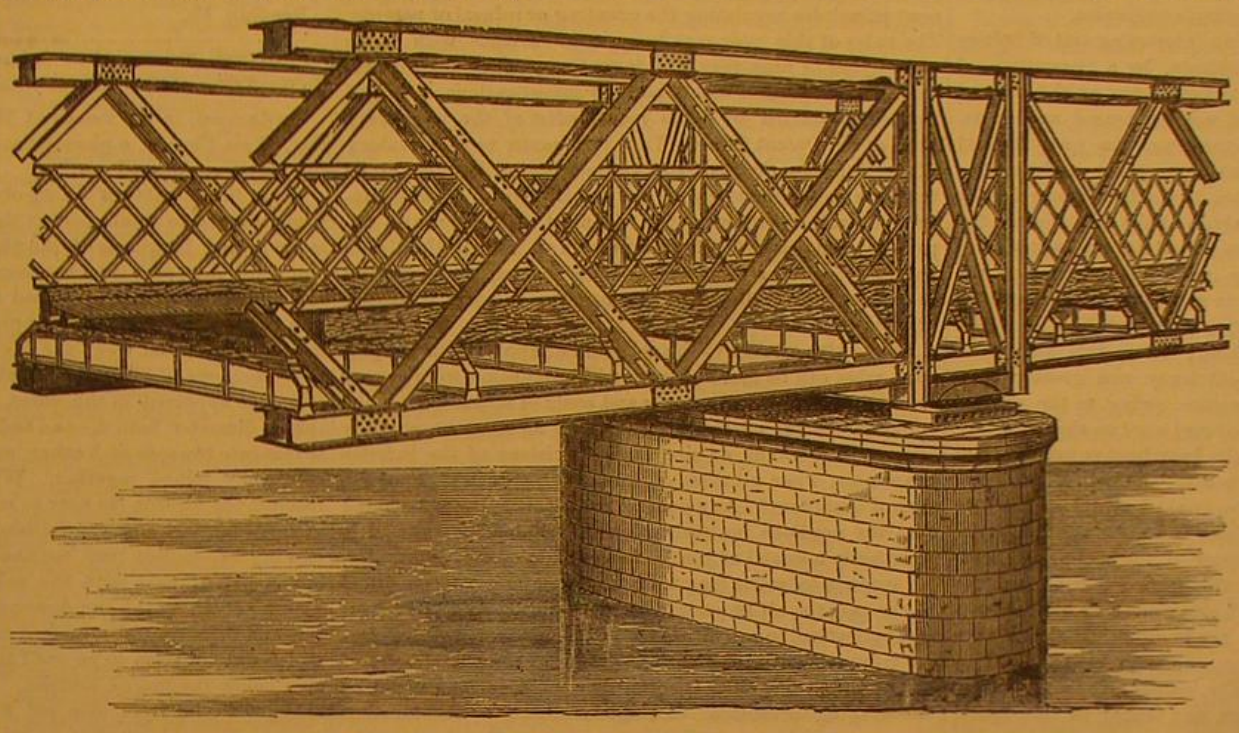
The boiler of a locomotive belonging to the Baltimore and Ohio Railroad exploded recently at Newark, Ohio, while moving slowly with a passenger train. The smoke stack was thrown some distance, and the cab splintered into minute fragments; the shell of the boiler entirely disappeared, the flues being twisted in all directions. The destruction was considerable, having taken place in a crowded freight yard. The engineer was instantly killed, being terribly mangled; the fireman escaped, almost miraculously, with a slight wound on his head. The local reports give no clue to the cause of the explosion.

RECENT IRON BRIDGE CONSTRUCTION.

We illustrate herewith a road bridge recently constructed by Mr. R. M. Ordish, over the river Pruth, at Czernowitz, Austria.

A cross section of the bridge, with a view in perspective of the girders and their resting point upon one of the piers, is also shown in detail.

The bridge is 762 feet long, and carries a roadway and two foot paths, making a total width of 15 feet between the centers of the girders. There are six openings over the river, each 126 feet from center to center of piers; the five piers and two abutments being of masonry, on concrete foundations. The main girders are continuous, double Warren girders, 11 feet 10 inches deep. The flanges are trough shaped, composed of two large trough irons, 10 inches deep, and a flange plate riveted to them. The diagonals are placed at an angle of 45°, and consist of a pair of flat bars which form the ties, and a pair of trough irons braced together which form the struts. Except at the piers, the main girders have no verticals, nor are they anywhere braced across the top flanges.



SECTION AND GIRDER OF IRON BRIDGE, CZERNOWITZ, AUSTRIA.

Lateral stability is given to the girders by a special arrangement of the parts to maintain the top flanges in position against side bending. In the first place, the girders are continuous over six spans, and certain parts of the top flange (those over the piers) are always in tension, so that only the intermediate portions have to be held in position laterally. Secondly, at each pier the two main girders rest in strong trough-shaped frames, which resist lateral movement and stiffen a certain length of the girder on each side. Thirdly, the top flange of the girder is made specially broad (2 feet 2 inches, which is 7 inches more than the bottom flange), so that the proportion of length to width in the remaining part of the flange is not excessive. Lastly, all the diagonal struts, which are constructed as girders, and which occur most frequently where, for this secondary purpose, they are most wanted, are connected to the cross girders of the platform by means of a trough-shaped flange, in a manner specially suited to resist any twisting action.

The cross girders are of wrought iron, 1 foot 6 inches deep in the center, and are placed 5 feet 6 inches apart throughout the bridge. The parapet railing is of wrought iron lattice work, bolted at intervals to the main girders, and finished with a wooden handrail.

The roadway of the bridge consists of longitudinal timbers, 7 inches by 6 inches, placed about two feet apart upon the cross girders. Upon these timbers is laid, transversely, 4½ inch planking, and upon this, again, rest oak blocks, 5 inches thick. The footway is laid with 3 inch oak longitudinal decking, upon which the wearing planks are spiked. This forms a somewhat heavy roadway, but timber is exceedingly cheap at Czernowitz.

The two main girders rest upon roller bearings at each of the piers, each of these bearings being composed of three castings. The first or upper portion is fixed to the girder between the trough frames, the under side of the casting being concave, and resting upon the second or intermediate casting, to which a corresponding convex shape is given. This arrangement allows for oscillation in the bridge from moving loads, and also insures the central action of the load upon the rollers, and consequently upon the pier. The second casting rests upon eight cast iron rollers, each 4 inches diameter, the rollers moving upon a cast iron bed plate, bolted down to the masonry of the pier. The rollers are omitted from the bearings over the central pier, while the convex form is retained to provide against oscillation. The main girders being thus prevented from moving horizontally at this point, the expansion from increase of temperature radiates outwards from the center, and extends the bridge equally at each end.

IRON BRIDGE AT CZERNOWITZ, AUSTRIA.

The iron work was made in England. The bridge was not thrown open for traffic until it had undergone a careful and searching test at the hands of the government engineer. All the spans were tested individually and collectively. The test load appointed by the Austrian Government, says *Iron*, to which we are indebted for the engravings, for bridges is 30 cwt. per square fathom, or 96 lbs. per square foot, English. This is considerably higher than the proof load used in England, which may be taken at from 70 lbs. to 80 lbs. per square foot of road surface. On account, however, of the increased weight of timber introduced into the platform during construction, the test load was reduced to 25 cwt. per square fathom, or 80 lbs. per square foot. According to the test originally proposed, the load brought upon the iron work of the structure would have been 6 tuns per square inch of sectional area.

Hardening Steel and Regenerating Burnt Iron.

Lieutenant Colonel H. Caron publishes in *Iron* the following account of his investigations, mentioned in brief on page 405 of our volume XXIX:

A piece of steel is first hardened, then softened more or less, according to the hardness or elasticity desired. The hardening, as it is ordinarily practised, that is to say, the hardening of the red hot metal in cold water, frequently has the grave inconvenience of developing rents and cracks disadvantageous to the powers of resistance of the metal. The process of softening then gone through does not cause these defects to disappear; later, in the using, these fissures, invisible at first, increase little by little, and finally end in a serious rupture. It is already well known that, to obviate in part such a danger, it is better to make the steel less hard, and soften it more lightly. A spring heated red hot, hardened in cold water and softened with burning oil, possesses the same elasticity as a similar spring hardened with cold oil (a weaker hardening than the first) and softened with "smoking" oil (a lesser softening than the preceding); only the latter method is more advantageous, because there is less fear of cracks from a too rapid cooling of the metal. Wishing to go farther, I asked myself if it was really necessary to commence by hardening the steel beyond measure just to reverse the process and soften it by a second operation. With this in view, I have sought a hardening of such mildness as to remove as much as possible the chances of cracks, and produce in the steel, at a single operation, the effects of hardening and softening combined.

I have found a very simple method, namely, by warming the water in which the red hot metal is to be thrown. After some experiments, a temperature of about 55° has found to be sufficient to give the above mentioned springs (springs of needle guns) an elasticity and resistance equal to that produced by the best hardening followed by an after softening. Necessarily the temperature must vary with the size of the piece and the uses to which it is destined. The degree of warmth of the bath is easy to determine by trying it beforehand. Hardening with very hot water, and better still, boiling, singularly modifies soft steel containing 0·002 to 0·004 of carbon. It increases its tenacity and elasticity without materially altering its softness; the grain changes in nature; and often where there is a breach, it is found to have become fiberous instead of granular or crystaline, as it was before.

In a communication inserted in the report of the Academy of Science last year, I have demonstrated that the crystaline texture presented by the fracture of pieces of iron is neither due to the action of the cold nor to that of prolonged vibration, but that it existed in the metal previous to its being used. After my experience, that particular formation I found to result from an incomplete forging, leaving the metal still burnt, crystaline, and full of cracks. I saids, besides, that it was possible to give the iron thus deteriorated the fiberous texture or the tenacity which it would have had if the operations of the forge had been gone well through, and that without having recourse, as was formerly done, to a new hammering, which results in a loss of time, of metal, and often in the wasting of the piece itself. The means which I employ to regenerate burnt iron is like that of hardening red hot metal in warm water. I shall cite but one example to prove this.

A bar of Berry iron, 1·2 inches in diameter, easy to break, without a crack, cleft, or flaw, was burnt, that is, warmed in such a manner that, pressed in a screw vice, it could be broken without bending. The fracture was strewn with brilliant facets of many thousand squares. A boiling liquid, strongly impregnated with ordinary salt, was prepared; a piece of the burnt iron, heated red hot, was plunged in this liquid during the time necessary to bring the metal to the temperature of the bath (about 110°). It immediately produced a rather curious phenomenon; directly it was plunged in the salt solution, the red metal was covered with white salt, which detached it from water, and certainly contributed to diminish its cooling. The piece of iron thus hardened was capable of being bent back upon itself, as the bar had been before being burnt. Pure water, boiling, can be employed as well, but its effects are less marked.

Now it is known that boiling salt water can regenerate burnt iron, it will be to the interest of the manufacturer to apply this operation to pieces after being finished at the forge, as the hardening will not damage them at all; if, on the contrary, they have suffered from too much or too prolonged heat, it will give them the qualities which a good forging imparts. Just the same applies to steel.

It is likely that there may be other liquids and other solutions which will produce the same results as the saline solution, but I have only mentioned this one because it appears to me to be the most economical and the most easily procured at the same time.

Steam Engine Accident.

At the spoke works of Messrs. Hoopes & Darlington, West Chester, Pa., the governor belt of a forty horse engine recently slipped off, and the engine ran away at a terrific speed. The engineer promptly shut off the steam, but already considerable damage had been done. The cutter head of a facing machine, being unable to resist the velocity, burst, throwing a piece of metal, weighing 13 lbs., through the wall of the building and across the street; three other fragments were scattered in divers directions, and another machine was similarly disabled.

New Imitation of Silver.

A patent has been obtained by M. Pirsch-Baudvin for a metallic alloy which is declared to resemble silver better than any other yet known with respect to color, specific gravity, malleability, ductibility, sound, and other characteristics. The new alloy is a compound of copper, nickel, tin, zinc, cobalt, and iron. The following proportions are said to produce a very white metal, perfectly imitating silver:—Copper 71·00 parts; nickel, 16·50 parts; cobalt, 1·75 parts; tin, 2·50 parts; iron, 1·25 parts; zinc, 7·00 parts. A small quantity of aluminum, about 1½ per cent, may be added. The manufacture is rather peculiar. The first step is to alloy the nickel with its own weight of the copper and the zinc in the proportion of six parts to ten of copper. The nickel alloy, the iron, the rest of the copper, the cobalt, in the form of black oxide, and charcoal are then placed all together in a plumbago crucible. This is then covered over with charcoal and exposed to great heat. When the whole is melted, the heat is allowed to subside, and the alloy of zinc and copper is added when the temperature is just sufficient to melt it. This done, the crucible is taken off the fire and its contents stirred with a hazel stick; the tin is then added, first being wrapped in paper and then dropped into the crucible. The alloy is again stirred and finally poured into the molds; it is now ready to be rolled and wrought just like silver. A great portion of the zinc is volatilized in the act of fusion, so that a very little remains in the alloy. The superiority of this metal is said to depend principally on the cobalt, to which is due its peculiar argentine luster.

W. R. says, in reference to an article which we recently published, entitled Electricity *vs.* Yellow Fever: "The observer is right, as far as electricity goes. During storms accompanied by lightning and thunder, ozone is formed, and this electric oxygen is a quick and efficient destroyer of all organic substances in the air. A small stick of phosphorus half immersed in water will form ozone."

One fifteenth of the length of the St. Gothard tunnel has already been excavated.

Correspondence.

The Relative Efficiency of Engines and Boilers.

To the Editor of the Scientific American:

I am somewhat surprised at seeing the matter of the relative efficiency of engines and boilers presented for discussion by a "Consulting Engineer," as if it were an open question. The late Professor Rankine, in his "Treatise on the Steam Engine," has gone into this subject thoroughly and fully, showing clearly the immense losses that occur in the use of steam, in the most perfect engines that have yet been built, and showing, too, the requirements that must be fulfilled if greater efficiency is desired. I suppose it is generally known to engineers that the greatest losses in the use of steam do occur, and must occur, in the engine. If you will allow me the space in your valuable paper, I will endeavor to illustrate this fact by two simple examples.

In 1871 an unusually careful and interesting test of boilers was made at the American Institute, by a committee of judges. In order to determine the efficiency of the boilers, all the steam that was generated was condensed and measured, together with its temperature, and the quantity and temperature of the condensing water, in order to determine the total amount of heat imparted to the feed water by the combustion of the coal. An analysis of the coal showed the amount of heat it would have imparted to the water if it had been burned without waste, and in this manner the efficiency of one of the boilers was shown to be between 70 and 71 per cent of the total heating power of the fuel. The other boilers gave results differing from this but little. While it is probable that this efficiency was greater than would be realized in ordinary practice, owing to the skillful firing and the excellent quality of coal used on that occasion, it is not unlikely that these results have been equaled, if not exceeded, in other cases. So much for the boiler.

In 1869 there was a competitive trial of steam engines at the American Institute Exhibition. An account of this trial will be found in the Annual Report of the American Institute for 1869. It appears from this record that one of the engines developed an indicated horse power by the evaporation of 20·25 pounds of water per hour, using steam at a pressure of 81·69 pounds per square inch by gage. This performance, though occasionally surpassed, is far better than generally occurs in practice, and it may be interesting to determine what per cent of the steam furnished by the boiler produced useful effect in the engine. The feed water entered the boiler at a temperature of 47° Fah., and was converted into steam having a pressure of 81·69 pounds per square inch, so that each pound of water received 1213·1 — 47 = 1166·1 units of heat from the coal. The amount of water used per indicated horse power per minute was 23·25 ÷ 60 = 0·3375 pounds, so that 0·3375 × 1166·1 = 393·56 units of heat were furnished by the boiler for each indicated horse power of the engine. If all this heat had been converted by the engine into work, it would have produced 393·56 × 772 = 303,828·32 foot pounds, or 303,828·32 ÷ 33,000 = 9·21 horse power. As actually used in the engine, however, it only produced one horse power, so that the efficiency of the steam in the engine was (1 × 100) ÷ 9·21 = 10·86 per cent of the efficiency of the steam furnished by the boiler.

I have not gone into the theory of the subject, because it would occupy too much space, and the matter has already received far abler treatment than I could hope to give it, in the work by Professor Rankine, referred to above. If I might venture to make a suggestion, in conclusion, it would be that probably more profit would be derived from the discussion of improvements in the use of steam, than from arguments on a question which is only too well understood by those who are familiar with the theory of the steam engine.

RICHARD H. BUEL.

80 Broadway, New York.

Administrative Reform in the Patent Office.

To the Editor of the Scientific American:

While every competent person will probably admit the immense benefit to the American people and to mankind of the enlightened and liberal principles which have always guided Congress in its relations to inventors, it is nevertheless obvious that considerable dissatisfaction now exists with respect to the administration of the patent law. For proof of this, it is only necessary to refer to the general and scientific press. In reply to these strictures and complaints, it is not a sufficient answer to say that the United States patent law is superior to that of European communities, the practical question being whether it is so administered as to carry out in the right spirit the patriotic and noble objects of its founders, such as the encouragement of genius, the promotion of arts and manufactures, the development of the national resources, and the utilization of those great natural reservoirs of power surrounding man on every side and only awaiting the vivifying force of his intellect to become the fruitful sources of prosperity. In the following remarks my only object is to offer a few suggestions for the improvement of the system of administration, and I have not the slightest wish to impute blame to any individual.

The first evil presenting itself is the temporary organization of the Patent Office. It is apparently considered as merely part of the ordinary executive machinery of government rather than as national and neutral ground from which all political considerations should be excluded. Why should not the *personnel* of the Patent Office be placed on the same footing as that of the Supreme Court of the United States? Is it not evident that the incessant changes resulting from its subserviency to the Executive of the day tend in the highest degree to impair the efficiency of Patent Office administration? It is always found that men appointed for a lengthened period, independently of party or political considerations, will get through more work and do it infinitely better than those who feel insecure in their official position. For such highly qualified officers the present salaries appear to me inadequate.

The first point, then, in Patent Office reform would be to reduce the number of employees, and to substitute a few highly qualified, well paid, permanent officials for a crowd of temporary, half paid, half satisfied, and half competent men and women, selected chiefly through political influence, and seldom having had any suitable previous training for the duties which they are called on to discharge.

In connection with the permanency of the officers should be the permanency, as far as practicable, of the rules guiding the transaction of business in the Patent Office. As it is at present, there seems to be an utter absence of any permanent principles regulating the granting or refusal of patents. The rules of this year may be quite at variance with those of last year or next year, and inventors on applying for patents, after expensive and laborious investigations, may find themselves ousted by some recent edict of the temporary head of the Patent Office. To revert again to the analogy of the Supreme Court of the United States, how could its business be satisfactorily carried on, if, instead of well considered, well understood rules, founded on reason and experience and principle, its suitors from all parts of the Union had to encounter a mere chaos of personal caprice, reflecting the ephemeral fancies of an amateur *pro tempore* dispenser of justice?

Then, with respect to the rejection of applications for patents, what can be more unjust and burdensome to inventors than to cast on them the *onus* and costs of appealing to the superior officers of the Patent Office against the possibly erroneous, ignorant, or inequitable decisions of the inferior examiners, when all these officers are already paid out of the fees of inventors? As a general rule, it will always be found that the needless multiplication of tribunals of appeal is practically a denial of justice to the mass of the community, for it tends to make length of the purse and not goodness of the case the all important consideration. And in a rejected application, to constitute that expensive series of successive tribunals out of the various grades of the bureaucracy of one and the same office is certainly a most curious mode of encouraging invention. A single crotchety or incompetent primary examiner may thus at present really obstruct the progress of a whole range of industries, and so directly defeat the objects of Congressional legislation on this subject. Such a man may see in the most recent steam engine simply a reproduction of the principle of the œlopile as it existed 2,000 years ago; or may find in the most improved lamp or stove only the same process of combustion known of old to the vestal virgins. The fact is that, in considering an application for a patent, something more than mere expertism, as it may be termed, is required in the examiner. He should not only be acquainted with the laws of science, but also be capable of discriminating between the relative claims of individuals and the essential features of their respective plans. But the records of the Patent Office show clearly that many of the primary examiners and some of the examiners in chief have given decisions subsequently pronounced by their superior officers erroneous and unjust. Why then is there not, in the regular machinery of the Patent Office itself, suitable provision for the equitable settlement of such cases, instead of casting the burden of appeal on individual inventors?

It is evident from these facts alone that one of two results ought to follow: Either all applications for patents complying with certain simple conditions should be granted (a course advocated by so high an authority as the SCIENTIFIC AMERICAN), or before any application is rejected the adverse decision of the primary examiner should be revised and confirmed by the judgment of the superior officers, and that revision should be, not as at present on technical points indicated by the examiner appealed from, but on the substantial merits of the invention.

As it is at present, no sensible man who could possibly avoid doing so would apply for a patent for his invention; he would rather be disposed to try to secretly manufacture the article or carry on the process. Many improved chemical processes are indeed already kept secret in consequence of the inadequate protection afforded by patent laws. For in making his application, the inventor discloses all that he may have learnt from his studies and trials; the information is henceforth no longer his own exclusive property, and possibly all that he would now receive from the Patent Office in return would be a permission to institute a series of appeals to the consecutive officials constituting it, at an expenditure of time, trouble, and money, which might be more usefully employed. The appealing part of the patent law, as it now exists, is therefore obviously a source of injury rather than of benefit to the inventors, and should either be changed or abolished. I believe that these principles of Patent Office reform, fairly and fully carried out, would conduce to the interest of the best officers of that important national institution, while they would at the same time benefit inventors and harmonize, more intimately than the present practice, with the known intentions and desires of every American statesman from the time of Washington.

A PATENTEE.

An Accidental Discovery.

To the Editor of the Scientific American:

About two years ago, I heard that phosphide of calcium, thrown upon water, would take fire instantly but not being able to procure it, I postponed the experiment. I afterwards found that I could make it by distilling phosphrous over red hot chalk in a covered crucible; as I had no earthen cover for the crucible, I substituted a copper dish, which contained red lead. When the chalk was heated to almost a white heat, I dropped the phosphorus in by degrees until I had used half an ounce, to 3½ ounces chalk, keeping the fumes in the crucible and letting the whole stand till cold. I then tried to produce a light by throwing some on water, but it would not ignite. I put the remainder of my phosphide of calcium(?) in a phial, and forgot all about it till a few weeks ago. I went to my chest, and, on closing it, I heard a sweet ringing tone within. I opened it again and searched for a bell. I was certain I had no bell in that chest, but I looked until I got the old crucible lid; and as I threw it aside, it gave another clear ring, and I discovered that, instead of making phosphide of calcium, I really produced a new phosphor bronze without fusing the copper. It is of a dark bluish cobalt color.

Reading, Pa. W. H. RODGERS.

Curious Instance of Atmospheric Refraction.

To the Editor of the Scientific American:

I witnessed, in the month of May, 1852, at Crystal River Bay, West Florida, a phenomenon of which I will give you the best description I can.

Being in the habit of taking observations whenever opportunity offered to obtain correct time, and thereby (having the latitude and longitude of the place) ascertaining chronometer error rate, etc., I took observations, every thing being clear in the west, and with good results. The sun's altitude was 10° or 15°. As the sun approached the horizon, I used my spy glass; and when the sun's lower limb was a little more than one of his diameters above the horizon, his reflected image appeared in the water. When within a little less than a diameter, both the sun and reflected image commenced to elongate towards each other; and when within a semidiameter, they joined together. When the sun's lower limb reached the horizon (as near as could be seen), a perfect conglomeration took place and spread out at least two diameters, looking like molten iron, too dazzlingly bright to look on for any length of time with the naked eye or a common spy glass. Then, as the sun descended below the horizon, the size and brightness diminished until it finally disappeared, which did not seem to be until the upper limb was considerably below the line of horizon. At the last, occurred the change of color from pale red to purple, blue and bluish green. These observations continued from May 8 to May 28, 1852, covering twenty days, with like results, with one exception, which was when sunset followed a tremendous thunder shower which occurred about the middle of the afternoon. At sunset the line of horizon was as well defined as I ever saw it, and the sun's contact as readily discovered.

This clearing up of the air by the thunder shower satisfied me that the cause of this phenomenon was, in a great degree, density of the atmosphere, but not wholly, or the same would often occur in other localities. I do not remember ever seeing the same elsewhere, though I have often taken sundown observations in various places.

Stratford, Conn. TRUMAN HOTCHKISS.

The Utilization of Coal Dust.

To the Editor of the Scientific American:

I notice several articles in your journal on the preparation of slack or waste coal for fuel, and would suggest a plan for its preparation, especially applicable to this great Northwest, where coal is dear and corn cheap:

Grind very fine one half bushel of corn, boil it in one barrel of water until it is like prepared starch. Mix it with one tun of fine coal dust in a mortar bed; as soon as it is stiff, cut it out, and pile under cover to season. As a fuel, this cannot be beaten.

Stellapolis, Iowa. RICHARD LONG.

The Canal Navigation Problem.

To the Editor of the Scientific American:

I should suggest that the New York Legislature grant the right of way, on both sides of the canal, to a company for building and operating a railroad which shall, during the season of canal navigation, tow all canal boats at the prices now charged by horse towing companies. During the suspension of navigation, the company should be allowed to carry freight, making it wholly a freight route during the year. I think there should be a company formed as soon as the Legislature grants it the right of way. The railroad could be built very cheaply, as there would be no grading, at least upon the tow path, and very little on the heel path.

I think that steam power in a vessel cannot be made to compete with the horse power on the tow path. A strong man on the tow path, with tow line over his shoulder can move a heavily loaded boat at a good speed; but put the man in the water to swim with the tow line, and how much will he move? The same principle holds good in the horse and steam power. Two horses on the tow path will move a loaded boat, carrying 200 tuns of freight, 2½ miles per hour; to accomplish the same speed by power acting in the water, you have to use about 20 horse power. The difference between the power to propel a boat acting on the land or upon the water is too great to allow steam power in the boat to compete with horse power used upon the tow path.

Geneva, N. Y. W. B. D.

Friction Gears.

To the Editor of the Scientific American:

I once wanted to run two lathes from a drum on the water wheel shaft, which was 8 feet in diameter and 10 inches on face, lagged up and turned off in the ordinary way. There was no space to use a belt to any advantage, and cog gearing

would have been very expensive, as well as making a disagreeable noise; so I built a wooden pulley by taking scraps of plank, 6 inches wide and 10 inches long; I cut them diagonally, making each piece full width at one end, the other being brought to a sharp point. I formed a circle in this way, by putting all the sharp points to the center. The pulley was 20 inches in diameter, and 12 of the pieces formed a circle, allowing for jointing. The first section can be laid down on a face board, such as pattern makers use; the second course can be put on by halving the joints, using nails or glue; but glue is best. The joints should be broken alternately. Building pulleys in this way takes much less plank than in the usual way; besides, it brings all the wear on the end grain of the wood; it wears equally; there is no side grain to cut out as is the case with a pulley built in the ordinary way, and you can use up small scraps of wood. Now for the result. I built such a pulley 20 inches diameter by 10 inches face, turned it off smooth and hung it on a line shaft. I arranged it so that I could attach it to or detach from the drum at pleasure. The drum made 10 revolutions a minute. I ran one of my lathes up to 1,760 revolutions a minute, without a belt or cog wheel, and with no noise.

B. N. C.

REMARKS BY THE EDITOR.—This is a good, practical method of constructing friction wheels, not novel but probably not generally known.

Preventing Collisions of Ships at Sea.

To the Editor of the Scientific American:

It seems to be more dangerous now than ever to go to sea, as vessels are so much more numerous, and sailing so much faster causes a great increase of danger. Is there not a remedy? I think there is. I believe the Ville du Havre and Loch Earn might still have been afloat if they had been provided thus:

Put a chain of the same weight as the anchor chain round the ship outside, supported by iron brackets with rings in the ends of them to pass the chain through and keep it in place. These brackets or chain supporters should be 18 inches long and from 1 to 4 feet below the main deck, according to size of ship, and about 8 feet apart. Large passenger steamers might have two such chains, one 1 foot below the main deck and the other 4 feet below it. Such ships, in colliding, would have to break or pass through the chains before making holes in each other's sides. Level with main deck, have two beams, running out from 8 to 15 feet beyond the cutwater, one on each side of cutwater, 8 to 12 inches in diameter, so constructed that, when they come against a vessel or any outside object, they would yield and spring back slowly to within a foot of cutwater.

F. JAMES.

A New Theory About Comets.

At a recent meeting of the Lawrence, Kansas, Academy of Science, a paper entitled "Speculations on the Nature of Comets' Tails" was read by Professor F. W. Bardwell, who took the ground that a comet's tail is no more a part of the comet than is a shadow a part of the object which gives it form. He supposes that the resisting medium surrounding the sun for a great distance is itself self-luminous in a degree, as indicated by the zodiacal light; that the nucleus of a comet is merely a large meteorite; that in its rapid motion through the resisting medium near the sun, great heat is thereby developed, increased by the heat of the sun, causing some of the elements of the nucleus to become volatilized, and thus to present the phenomena of the coma with its glowing gas; and, finally, that the bright train called the tail is merely an effect of an increased luminosity of the portion of the resisting medium behind the comet, caused by the action of the sunlight and passing through the glowing gas of the coma, and projected beyond in a form usually approaching that of a conical surface. He predicts that, on the appearance of a comet with a bright train, the tests of spectrum analysis will show that this train is not nebulous, as Bessel and others have supposed, and not of a meteoric character like that of the nucleus, as Schiaparelli and Le Verrier suppose, but chiefly of a zodiacal nature, and probably, in a slight degree, reflecting sunlight.

Car Coupling Dangers.

T. W. H. says: I know by experience that the danger of coupling cars can be almost entirely avoided by care on the part of the engineer. I have seen engineers (or rather men who had charge of engines) "get mad", as the expression goes, in coupling cars, and send the cars together with such fury that no man living could attempt to make the connection with any kind of safety; herein lies the danger. Many brakemen pride themselves on coupling cars when they are sent back too quickly for any safety to life and limb, to say nothing of the injury to the cars and drawheads. Yet they make the attempt, though warned by the conductor that they could not make the coupling. Once, when I remonstrated with an engineer for his reckless backing up, he replied: "I am in a hurry." Note how he succeeded in gaining time. He drew ahead and backed three times before the connection was made; whereas, if he had come back first time as a sensible man should have done, the connection would have been made with time to spare. Whenever you see a large number of broken drawheads around the car repair shops, you can be assured that somebody has been in a hurry.

I. P. W. says: "I have in my possession a live fish which has the body and tail of a dog fish, and the head of a cat fish. Its habits are those of a cat fish, sleeping in the day time and waking at night. I presume that it gets this habit from the head. It is clearly a hybrid of the two kinds. Here is something for the development theory."

Probable Cause of the Destruction of Boiler Tubes.

Dr. J. S. Kidder, U. S. N., communicates to *Van Nostrand's Eclectic Engineering Magazine* a paper pointing out the probable cause of the destruction of boiler tubes, and describing experiments which show the deterioration or pitted condition, of those portions of the generator which are immersed in the water, to be due to the action of oleate of copper. The presence of this substance is accounted for by the decomposition of the olive oil, used in lubricating the piston, into oleic acid and glycerin, a sufficient frictional heat being raised to thus act upon the thin film of oil between the surfaces. In the condenser, the brass tubes are exposed to the powerful comminuting impact of steam at a high temperature and pressure, and this substance is thus finely divided and placed under the most favorable circumstances for union with the free oleic acid which the steam brings with it. Oleate of copper is then formed in the condenser, and appears in bright green, greasy masses which are carried from condenser to boiler. A quantity of this substance, settling upon one of the iron boiler tubes and adhering thereto, causes both a deposition of copper and absorption of iron. Being insoluble, its action is confined to the surface of contact, hence the small holes characteristic of this kind of injury. Copper, however, it is found, will adhere only to perfectly smooth iron, and since boiler tubes are never in this condition, each deposit is quickly removed and a fresh iron surface continually exposed.

Selden's apparatus, mentioned in the report of the Engineer of the Navy as a preventive of this difficulty, consists in a long iron box fitted with a steamtight cover and placed between condenser and boilers. The box is divided into compartments by diaphragms of felting, pervious to water, and the compartments themselves are filled with coke. In referring to the placing of alkalies in this filter, Dr. Kidder remarks that soda is of questionable advantage, and that lime is theoretically the best, but then only when used in connection with a fresh water boiler.

At Hecker's mills, the condensed water, after leaving the filter, is treated with atmospheric air forced through it from below. The resulting water is perfectly free from taste or odor, and quite palatable. It seems possible that the hitherto insuperable difficulties in the way of freeing condensed water on shipboard from a certain unpleasant empyreumatic odor may be overcome by similar treatment.

A New Mode of Marine Propulsion.

Mr. John T. Bowman, of Dallas, Texas, favors us with sketches and description of an ingenious and quite novel mode of propelling vessels, which he has lately contrived but does not propose to patent. An opening is made through the cutwater of the ship under the water line, whence, by a suitable conduit, a large stream is allowed to pass to two athwartship revolving blades, which are modeled in form and arrangement after those constructed inside the Root blower, and which are situated in a suitable inclosure in the forward portion of the hold. From this casing, and leading aft, are three passages, one extending downwards, at an incline, to the keel, and the others leading to each side of the ship. Suitable valves are arranged, whereby the water drawn in by the blower may be diverted into either passage, so that by this means the vessel may be drawn ahead or steered in either direction at will.

The Emerson Stone Saw.

We are informed that one of Messrs. Emerson, Ford, & Co.'s stone saws, 28 inches in diameter, carrying 14 steel chisels, making 22 revolutions per minute, recently cut lengthwise through 9 blocks stone each measuring 4 feet $6 \times 10 \times 10$ inches. The saw cut 1 inch ahead at each revolution = 1 foot per minute. The 9 blocks were cut in 87 minutes, being 28 feet of linear cutting and 56 feet of surface. The machine was driven by a four inch belt from a 12 inch pulley. A fresh set of chisels was inserted for each block, the time occupied in changing being two minutes for each shift. The chisels weigh 200 to the pound, and cost half a cent each. The cost of splitting the 9 stones was $1.50, power included. The stone was a hard, sharp gritted sandstone, much used in Pittsburgh for building purposes; and 45 cents per superficial foot is paid for hand dressing the same stone.

Much Butter from Little Milk.

The recipe for making a pound of butter from a pint of milk, says the *Inter-Ocean*, is as follows: Take four ounces pulverized alum, ¼ ounce pulverized gum arabic, and 50 grains of pepsin; place it in a bottle for use as wanted. A teaspoonful of this mixture, added to the pint of milk, will, upon churning, make a pound of butter. It is true that the butter will seem to be a near relation to pot cheese, but call it butter and that will make it so. This recipe is selling through the country for from $1 to $5; and as we give it without charge, it may considered as equivalent to the chromos of our religious contemporaries.

The Hours of Labor.

"One who is not afraid of work" writes to say that men who are idle during a day of eight hours will be equally so if the nominal time be ten hours, and that a compulsory lengthening of a day's work will not cure the dilatory or indolent workman. We believe this to be true; and we desire for every man the right to work as long as he likes. If he is healthy and sober, and has a family to support, ten or even twelve hours may not be more than he can do. At all events, he should be allowed to do it if he chooses, without fear of unions or other forms of petty tyranny.

PROFESSOR DANA states that, during the Helderberg era, the Connecticut valley was a wide coral-growing sea, separating eastern from western New England.

Burning Bricks with Non-Explosive Oil.

An old subscriber states that the saving in burning by this method is not less than 33 per cent. One hundred dollars worth of oil will burn 60,000 hard burnt, beautiful, facing bricks, and 40,000 hard burnt ordinary bricks, giving a brick equally burnt from top to bottom. End, side and heart of the whole pile all present the same hard burnt, beautiful looking bricks. There is no smoke, neither is there any soot or dirt arising from the fuel during the process of burning by this method; but one continual heat from the beginning until the bricks are sufficiently burnt. After the "water smoke" has passed off the bricks, the heat is regularly increased to any pitch which may be required; and in 48 or 50 hours, a regular, equalized, high pitch of heat is obtained, sufficient to melt cast or wrought iron if required, with little or no loss in burning, producing a hard unshaken brick, imperishable in water or atmosphere, and proof against change of temperature.

But in order to make a brick of this character, it must be borne in mind that all does not depend on the manner in which the bricks are burnt, whether with wood, coal, gas or oil. To make a brick proof against the changes of temperature, the first thing to be done, after it is ascertained that the material of which the brick is to be made is of the right quality, is to dig and cast up loose, in the fall of the year, as much stuff as it is intended to make into bricks in the following season, in order that the rain, snow, frost, thaw, and atmospheric air may decompose and mature every particle possible, and prepare it, ready for the tempering machine in the forthcoming spring.

Bricks, whether of clay or clay loam, prepared in this manner and burnt with non-explosive oil, are vastly superior, as to quality, beauty, and durability, to bricks made of immature raw material. There being neither smoke, dust, nor soot entering the kiln during the process of burning, the bricks, when taken from the kiln, have the appearance of newly planed small blocks of wood.

This method of burning bricks and other clay articles is most certainly destined to revolutionize the whole system of burning clay, throughout the whole of the United States.

Fletcher's New Low Temperature Burner and Foot Blower.

We have previously had occasion to notice some of Mr. Fletcher's improved appliances for the production and application of heat from gas. The "new low temperature burner," by the same inventor, seems likely to be not less widely appreciated. It gives a range of temperature varying, at the will of the operator, from a mere current of warm air to bright redness, and so perfectly under control that it may be advantageously used for drying, for prolonged digestion and evaporation, and a variety of other operations. It is considered likely to supersede to a great extent hot air baths, water ovens, sand, oil, water, steam, and solution baths—apparatus which are all, from well known reasons, more or less objectionable. We learn, in proof of the regular and equable character of the heat, that a common glass bottle may be placed on the tripod above the wire gauze at the top of the apparatus, and heated to any temperature that may be desired without the risk of breakage. When very low temperatures are required, below or not much exceeding the boiling point of water, the gas is lighted through the aperture in the side of the furnace, and burns below the wire gauze. If a red heat is wanted, the light is applied above the wire, where the gas burns with a clear blue flame. By means of a specially adapted "blast tube," the temperature can be raised to a bright yellow heat, bordering upon full whiteness, being regulated by the respective quantities of air and gas supplied. The "foot blower" is an improved bellows which may be used with any kind of table blowpipe or laboratory blast furnace; it appears convenient for working, well arranged, and not likely to get out of order.—*Chemical News.*

The Proposed Great Telescope.

J. T., of Jersey City, writes to suggest that the great telescope should be a reflector. "I believe it to be possible to construct a reflector, of from 10 to 15 feet diameter, of the regular speculum metal, or to silver and polish a speculum of that size after the manner of Foucault. It should have a focal distance of not less than 150 feet, and be mounted without a tube. I have myself successfully tried this way of mounting a reflector. It was first suggested by the celebrated Dr. Dick, who made many different kinds of reflectors. The speculum could be worked at one end by clock movement, and the eye piece at the other by separate clock work, each end being kept as steady as possible and without either tube or any connection between them. The eye piece should be fixed right opposite the speculum, on what is called the front view system. There would thus be very little light lost. I should be glad for such a gigantic reflector to be attempted; and although of small means, I will give $25 towards it."

The Detection of Blood Spots.

M. Sonnenschein employs, for this purpose, tungstate of soda, strongly acidulated with acetic or phosphoric acid, which throws down albuminoid matters from very dilute solutions. These precipitates, insoluble in a large excess of water, dissolve in alkalies, especially if hot. If defibrinated blood is treated with this salt, a red brown precipitate is formed, which becomes clotty on boiling. All the coloring matter is thrown down. To detect blood spots by this means, on clothing, etc., the suspected portion is cut off, and, after having been treated with distilled water, the filtered solution is precipitated with the above reagent. The precipitate, washed and treated with ammonia, takes a reddish green coloration. If phosphoric acid is present, it must be carefully washed away before treating the precipitate with ammonia.

WARDWELL'S ADJUSTABLE BENCH JACK.

Carpenters, cabinet makers, and other workers in wood are, by the invention herewith illustrated, supplied with a convenient and novel form of bench jack, intended for use in connection with the common screw vise, and which may be readily adjusted to hold boards of any width or thickness, while the same are being jointed. Our engravings represent the apparatus as applied to the bench, both in perspective (Fig. 1), and in section (Fig. 2).

A is a metal bar, slotted longitudinally, and provided with ratchet teeth on its forward side, which is let into and secured to the front part of the bench. Projecting at right angles to and passing through the slot in this bar is the jaw B, on the upper side of which ratchet teeth are also formed. The shank of the jaw enters the frame or spider, C, the forward end of which is so constructed as to slide upon ways formed upon the rear side of bar, A. D is a rest which has shoulders on its forward part to take against the front side of the bar, A, and a crosshead on its rear extremity, which is received in a transverse notch on the lower side of the spider, C. The shank of the jaw, B, therefore, holds the piece, D, in place, and also rests thereon, while the piece, D, in turn, secures the frame or spider in proper position in rear of the bar, A. Pivoted to the forward end of the rest, D, is a pawl, E, which is so formed that its own weight may hold its lower or engaging end against the ratchet teeth in A, so as thereby to support the rest, spider, and jaw in any position in which they may be adjusted, the parts of course all moving together. Upon the top of the spider, C, and pivoted in lugs, are two hook pawls, F, so set that the hook of one is in advance of that of the other by a distance equal to about half that included between two of the ratchet teeth on the jaw, B, in which they engage. By this means the jaw may, it is claimed, be accurately adjusted in accordance with the thickness of the board to be held. The forward extremities of these pawls project into the slot in A, so as to be conveniently accessible for adjustment.

In practice, the bar, A, is fastened to the bench at a suitable distance from the vise; and the jaw, B, by means of the pawl, E, is quickly set at the proper hight to receive the board. The latter is then inserted, and the jaw is pushed in, when the pawls, F, engaging in the ratchet teeth, hold it firmly in place.

When desired, two or more of the jacks may be attached to the bench at different distances from the vise, so as to accommodate long or short work. But a single set of the smaller working portions need, in this case, be employed, as they can be readily removed and shifted from one bar to the other, and when out of use may be laid away in the tool chest.

For further particulars address the inventor, Mr. J. B. Wardwell, Box G, Lawrence, Mass.

Fig. 1

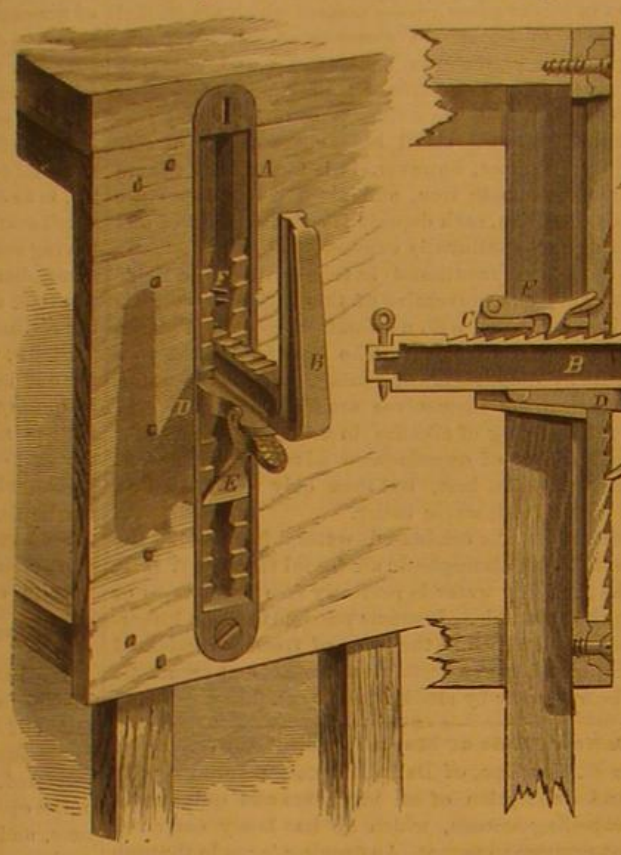
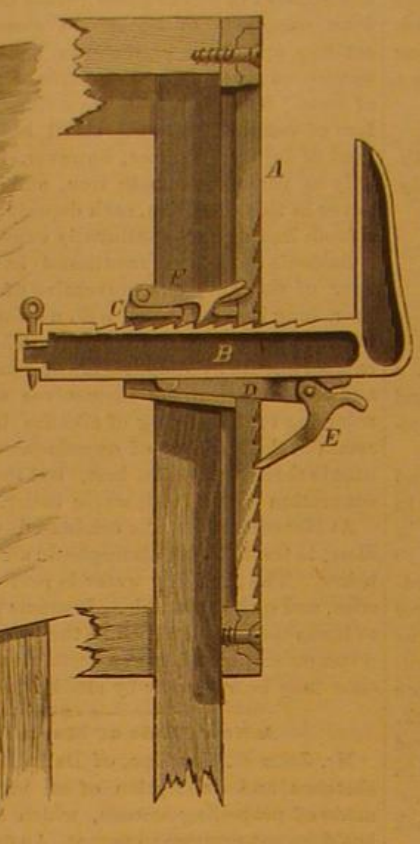


Fig. 2

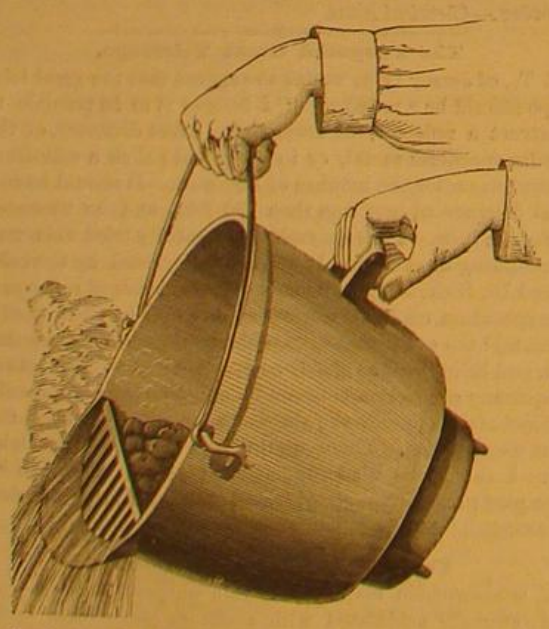


WARDWELL'S ADJUSTABLE BENCH JACK.

IMPROVED COOKING VESSEL.

Messrs. L. P. and J. S. Bodkin, of Brooklyn, N. Y., have recently patented an improved cooking vessel, herewith illustrated, which is so constructed that its liquid contents may be readily poured off while the solid material is retained.

The device consists of a lip, formed upon one side of a boiler, to guide the fluid into a receiving vessel, and also of a grate formed upon the inner side of the edge of the forward part of the receptacle, the bars of which are connected with



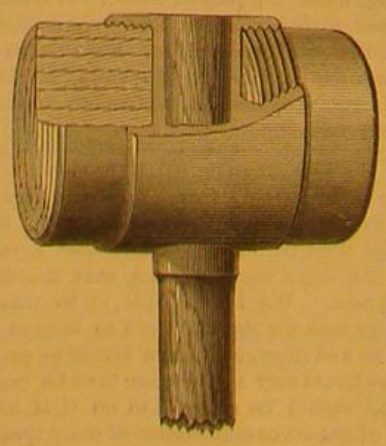
each other at their inner ends. These bars are made in triangular form, and, while offering the least possible obstruction to the escaping liquid, serve to hold the cooked substance within the pot. A handle is provided on the rear side for convenience in tipping. In other respects, the vessel is of the ordinary description in common use.

Yankee Notions.

Incited thereto by certain domestic annoyances, classed here under the generic title of "servant-gallism," the inventive faculties of our American kinsmen have developed many curious and useful household implements. The SCIENTIFIC AMERICAN recently gave a description and engraving of a "combination corn sheller, bootjack, hammer, hook claw, tack drawer, pot lifter, and wrench," which, it is suggested in another transatlantic journal, is open to improvement, so as to serve also as a toothpick, corkscrew, pocket pistol, baby rattle, and hypodermic syringe. This, however, and every other similar specimen of Yankee ingenuity, except, perhaps, that wonderful pig-killing machine into which the unclean animals were driven in herds and taken out at the other end as bacon and sausages, are eclipsed by a baby washer, just patented, and thus described by its inventor: "You simply insert the begrimed and molasses-coated infant in an orifice which can be made any required size by turning for ten minutes a cog wheel with electric attachments. The child glides gently down a highly polished inclined plane; his lips are met at its terminance by an india rubber tube, from which the infant can draw lacteal nourishment of the purest and most invigorating character, secured for the special purpose, at great expense, from a choice breed of Alderney kine, raised on the estate of Her Majesty Queen Victoria, in the Isle of Wight. While in this compartment, which is lined with plate glass mirrors, the perturbed spirits of the infant are soothed by its frantic efforts to demolish its own image, reflected in the glass, with a nickel-plated combined tooth cutter, nail knife, rattle, and tack hammer, which is thrust into the baby's hand by an automaton monkey. Fatigued by its destructive efforts, the infant falls to sleep, while the organ attachment plays softly the ravishing melody of 'Put me in my little bed.' Then it slips into the third compartment. Here the baby is washed. Another small tube administers a dose of soothing syrup, and the infant glides from the machine, its nails pared, its hair combed, if it has any, ready for the habiliments rendered necessary by the fall of our first parents." Truly, there can be no better labor savers than Yankee inventors!—*Iron.*

IMPROVED MALLET.

Machinists will be interested in the improved form of rawhide mallet, herewith illustrated, and recently patented by Mr. Albert Holbrook, of Providence, R. I. The body is of metal and solid, and the handle is secured in the ordinary manner. In each end of the body is a recess which receives a head made of rawhide, coiled up and dried and then turned to the desired size and shape. The heads are secured in the socket by means of a screw therein, as shown in the engraving.



Blows given with this mallet are said to leave no dents on metallic surfaces, so that it will doubtless prove a convenient tool for putting together wrought iron, steel, and brass work, driving keys, and for all purposes where it is desirable to avoid the marks of a hammer.

Skampfjelding.

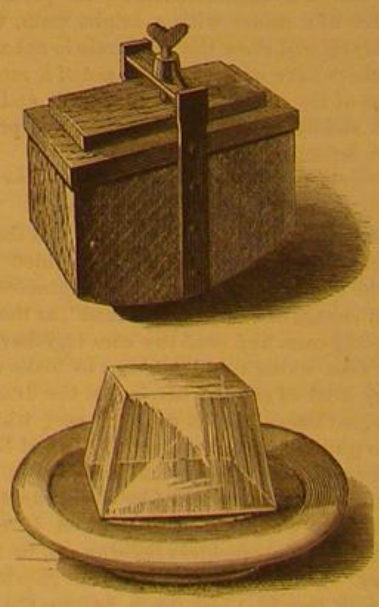
A rule, or custom, obtains on board Norwegian ships, known as skamfjelding, which is simply this: Every morning at daylight, as soon as the decks are washed down, the officer in charge details each individual of his watch to some particular part of the ship, skampfjelding: Johannis goes over the mainmast and yards, from the truck to the topmast head; Jem takes the main topsail yard and topmast; Tellog takes the main yard, top, and lower rigging, and so on. Thus the whole ship is parcelled out, each man takes a few rope yarns, or "Spanish foxes," and spends the next twenty minutes or half hour in examining the part allotted to him; every seizing, splice, iron, bolt, rope, mat, even the stitching of the sails and condition of the paint, come under his consideration. A slight matter he repairs at once; anything for which he is not then prepared is, on returning to the deck, reported fully to the officer, and, if needing immediate attention, men and material are at once sent to the spot: in many cases the officer goes himself, or sends his second in command, to superintend the work. Things not requiring such immediate attention are noted; and when the other watch comes on deck, after breakfast, they are detailed to repair what has been reported, before commencing the day's work. In this way B repairs what A reported, and gives a look for himself, in going and coming. Again, if anything breaks during the day, the captain asks: "Who went there skamptjelding this morning?" He is known and asked why he did not report; in some cases he gets a disagreeable job as punishment, while each man feels a personal responsibility and interest in giving an accurate report lest he lose his character for seamanship, which requires not only the knowledge of how to do things, but also good judgment in regard to materials.

This custom is not found in American or English ships, but could be copied there with good effect. And a similar system, applied to engineers, oilers, and firemen, would save more boilers and machinery than an army of government inspectors. Very little machinery breaks without some warning, very few pieces of modern work are equal to the wonderful one horse shay, and a little of the care mentioned is never wasted. Railroads have attempted something of the kind, but the same man, running the same engine day in and day out, will, in time, take risks that he would not if another man were to take the machine the next day. So of track inspectors, train starters, and the whole host of workmen; rotation in office, with a regular system by which each inspector's location for each day would be always known at headquarters, would here find its true place.

The real value of such a custom lies in the fact that it would beget habits of thought that would make every man an inspector of what is near him, thoughtful not merely for his own safety, but for others also; thus the bridge may be perfectly safe on the footway where he passes, but that rotten plank in the roadway may break a horse's leg; he reports it, or marks it at once. But perhaps the greatest recommendation of such a habit to the American mind, albeit an unworthy one, is that while it would save much it would not cost a dollar.—*Engineering and Mining Journal.*

A SIMPLE FREEZING MACHINE.

This is an apparatus designed for producing ice in small



quantities. It consists, simply, in a hollow sided receptacle, having a rounded bottom, so that it can be easily rocked to and fro. In the sides is placed any suitable freezing mixture, and, in the inner space, water. The covers are then secured by the set screw, as shown, and the machine oscillated until freezing takes place, an operation requiring, it is said, about ten minutes. The chief recommendation of the ice is its purity, suitability for the dessert table or sick room, and the ornamental form of the block. Ice cream can easily be made by the apparatus. The blocks of ice are hollow, of about one fourth of an inch in thickness, and weigh some six ounces.

A MODERN ORCHID HOUSE.

The beautiful tribe of orchids, are deservedly favorites with all lovers of graceful foliage; and we present herewith a view of a greenhouse devoted to their cultivation. A correspondent of the *Gardener's Chronicle*, who recently visited the extensive grounds in which this house is situated, states that in this garden (which, among other curiosities, compels fuchsias to do duty as bedding plants), there are at least 20,000 species of plants, grown in the garden, in some form or another. Every nook and corner, every house, every pit, every rockery, every border, teems with interesting plants of some sort or other.

Of orchids, the number is legion, and several houses are assigned to them. The owner, Mr. Saunders, does not confine his attention to the large flowered showy species, but includes in his collections a veritable host of the smaller flowering kinds whose blossoms yield in nothing but size to their larger compeers. Their beauty is, when looked for, quite as striking, often more so; while their conformation is very generally more interesting and extraordinary. These orchids swarm everywhere; above, below, on each side; and to make room for more, an ingenious device is adopted: that of erecting curved or bowed wire trellises along the sides of the houses near the glass; on these bows the tiny orchids cluster. Too thick, we hear some one say; not a bit of it. They are in the finest condition and vigor; the plants are not large, but they are in perfect health; and what roots they make!

If we were to describe literally a *catasetum* of no great size which we saw hanging in a basket from the roof, we should scarcely be believed. Equally remarkable is the manner in which the roots in other cases cover the pots with a perfect network, creeping from pot to pot, more as *Creeping Jenny* would do than like an ordinary orchid. The secret of this unusually luxuriant root growth, Mr. Saunders believes, lies in the due aeration of the roots. He is a great advocate for the free access of air to the roots; and when the peculiar habit of orchids is considered, and the special structure of their roots borne in mind, there can be no doubt as to the soundness of his physiology.

A writer in the *Garden* recommends that every one who has convenience should grow the cool or mountain orchids. There are two distinct classes of amateurs who affect orchid culture, namely, the class who really love the plants for their sweetness and beauty, and those who grow them on account of their rarity and value. The latter strive mainly to possess rare plants, of which there are only a limited number in the country, and willingly pay high prices for them; while the former grow only the most beautiful, and think that the cheaper they can be obtained, and the more they are growing, the better. To the latter class the author claims to belong, and he says that he commenced orchid growing three years ago in a little lean-to fernery, on the north side of a high brick wall; and the house being naturally humid, his first pair of plants—*odontoglossum cordatum* and *o. Bictonense*—grew and flowered so vigorously that he was induced to add plants from time to time, until his little collection now numbers upwards of fifty species, and occupies the whole of the front shelf, the back of the house being formed of rockwork and planted with half hardy exotic ferns. No fire heat is used during the summer months, and the temperature rarely exceeds 55° during winter, except by means of sun heat, while it frequently descends as low as 40° on sharp frosty nights. In potting, small pots, well drained, should be used, and the compost is fiberous peat, coarse sand, and about one fifth of living *sphagnum*. The moss grows freely on the pot tops, and not only gives them a neat and clean appearance, but also keeps the roots of the plants moist; while at the same time, it keeps the compost clear of slimy confervoid growth, to which wet peat is generally subject. The plants require a liberal supply of water at the root nearly all the year round.

A MODERN ORCHID HOUSE.

The Lava Overflow of Oregon.

Professor Le Conte, at a recent meeting of the California Academy of Sciences, stated that the great overflow of lava in the West proceeded from the Cascade Mountains in Oregon which were of themselves one vast mass of lava. From this point, the lava overflowed a great portion of Oregon Washington Territory, all of northern California, and vast sections of Nevada, Montana and Idaho. The lava floor covered an area of at least two hundred thousand square miles, as far as explored, and it would probably be found to extend over a surface of three hundred thousand square miles, as its limit northwest had never been determined. The depth of the lava crust varied from upwards of three thousand feet in the Cascade and Blue Mountain region to one and two hundred feet and less at remote points on the outer edge of the overflow. Where the tremendous gorge of the Columbia river cut through the lava bed, it had a depth of three thousand five hundred feet. The eruption was comparatively recent, belonging to the latter part of the miocene period, extending perhaps into the post tertiary.

Splicing Railway Carriages.

Mr. W. H. Mills, the general manager of the Mexican Railway (from Vera Cruz to Puebla and Mexico), finding the short English cars unsuitable to the sharp curves of a newly opened extension of the line, decided to splice them together in couples, with a four wheeled American bogie truck under each end.

The carriages offered special advantages for this splicing together. The main frames, which are of rolled wrought iron, have been spliced or fished together with strong wrought iron joint plates 3 feet 6 inches long, well riveted, thus making each of the main frames in one continuous piece or girder. To assist in stiffening these frames, three tension or truss rods 1¼ inches in diameter have been placed and carefully adjusted under the carriages. The carriage bodies, which are of teak, have also been strongly bolted together at the sides and roof. A four wheeled center pin bogie truck built by Gilbert, Bush & Co., Troy, N. Y., has been placed at each end of the carriage. In addition, the Westinghouse air brake is fitted up on all the carriages of the Mexican railway; one brake placed on the top of the carriage applies the brake shoes, which are of iron, to all the eight wheels at once.

The result of this splicing of two carriages together has been a perfect success, and all those that have been thus treated are now by far the easiest and smoothest running carriages on the line.

THE DIAGNOSIS OF LIPOMATA.—An excellent suggestion is made in a French journal. A character peculiar to lipomata resides in the property, belonging to all fatty tumors, of hardening under the action of cold. When, after the use of ice or the ether spray, in the case of a doubtful tumor, the growth becomes harder, the presumption is that it is lipoma.

MR. THOMAS SUTTON, the photographer, states that, if calico is dipped for an instant in dilute sulphuric acid, it is rendered waterproof.

The Causes of Decay of Teeth.

It has been charged against our brethren of the dental specialty, says the *Lancet*, that they are wofully at fault in regard to knowledge of the commonest of all things—caries of the teeth. That they extract teeth with skill, and stop them with even more skill, and in a nobly conservative spirit, is admitted; but the causes of decay in the teeth have remained obscure. The investigations of Leber and Rottenstein into this subject have at least the charm of pointing to definite conclusions. They admit, of course, that there are differences of teeth, constitutional and connected with race, making teeth more or less resistant to the great influences which determine decay. These are not, according to these authors, internal and vital so much as external and chemical. The process of decay begins from the surface, and if it can be controlled or arrested at the surface, it is entirely controlled. The great causes of caries are two, namely, acids and a certain fungus found abundantly in the mouth, *leptothrix buccalis*. This latter agent is characterized by certain microscopic appearances and by its reaction with iodine and acids, which give to the elements of leptothrix a beautiful violet tinge. Under the microscope the fungus appears as a gray, finely granular mass or matrix, with filaments delicate and stiff, which erect themselves above the surface of this granular substance so as to resemble an uneven turf. The fungus attains its greatest size in the interstices of the teeth. No one can deny nowadays the action of acids on the teeth, even weak acids, in dissolving the salts of the enamel and the dentine. All acids, both mineral and vegetable, act promptly on the teeth Various experiments as to the action of acids on dental tissues are given, making the enamel, naturally transparent, first white, opaque, and milky, and, in a more advanced state, chalky, and then the dentine more transparent and softer, so as to be cut with a knife. The acids which may actually effect the first changes in the production of caries are such as are taken with food, or in medicines, or such as are formed in the mouth itself by some abnormality in our secretions, which should be alkaline, or by an acid fermentation of particles of food. But acids alone will not account for all the phenomena of caries in the teeth. They play a primary and principal part, making the teeth porous and soft. In this state, the tissues having lost their normal consistency, fungi penetrate both the canaliculi of the enamel and of the dentine, and by their proliferation produce softening and destructive effects much more rapid than the action of acids alone is able to accomplish. It is not pleasant to think that fungi exist in the mouths of all but the very cleanest of people. Bowditch, in examining forty persons of different professions, and living different kinds of life, found in almost all vegetable and animal parasites. The parasites were numerous in proportion to the neglect of cleanliness. The means ordinarily employed to clean the teeth had no effect on the parasites, while soapy water appeared to destroy them. If this be a true version of the causes of caries—the action of acids, supplemented by the action of fungi—then it follows that the great means of preserving teeth is to preserve the most scrupulous cleanliness of the mouth and teeth, and to give to the rinsing liquids a slightly alkaline character, which is done by the admixture of a little soap. This is not so pleasant a dentifrice as some, but it is effective and scientific. Acids not only dissolve the salts of the teeth, but favor the increase of the fungi of the mouth. No increase of fungi and no action on the dental tissues occurs in solutions slightly alkaline, such as a weak solution of soap. The good effects of stopping teeth, in the light of these experiments, are intelligible. The penetration of acids and fungi is prevented.

That $40,000 Cow Again.

It seems that the sale of the celebrated Eighth Duchess of Geneva, a shorthorn cow, recently referred to in our columns, knocked down at the New York Mills auction to Mr. R. Pavin Davis of Gloucestershire, England, at the enormous price of $40,000, was effected through a mistake. The agent of the purchaser, during the excitement of the bidding, became confused as to the relative value of the pounds sterling and dollars, and offered far beyond his authorized limit. His principal immediately, on learning of the bargain, ordered the sale of the animal, which was recently consummated to Colonel Lewis G. Morris, of Fordham, N. Y., report says for the sum of $30,000. The highly valued animal, therefore, remains among the American breeders.

THE NEW EXPLORATION OF THE AMAZON RIVER, BY PROFESSOR ORTON.—OVER THE ANDES.

No. 7.

THE COMMERCE OF PERU.

It would be quite as easy to ascertain the revenue of Atahualpa as to find out the present exports and imports of Peru. Both are impossible. The wildest confusion prevails in the custom houses, as well as in the minds of the people, regarding the commerce of the republic. But better days are coming, as the government has just established a statistical bureau.

Peru under the Incas was essentially an agricultural nation, without trade and with few mechanical arts. In many respects it resembled the Hebrew nation. The empire must have been a magnificent shell, that should so suddenly collapse on the appearance of a hundred Spaniards. It is a signal proof that agriculture alone will not preserve a people. Roads there were, but for military communication, not for commerce. Pizarro had sense to see that Cuzco was too far inland; so he founded Lima, the most lasting monument of his wisdom.

Peru no longer leads the South American republics in enterprize and thrift, for Chili now bears the palm. Peru has reached her level for the present. By a system of official stealing and reckless financiering, she has brought herself to the verge of bankruptcy. Everybody seeks office to sap, not to serve, the government. Every city hangs on the skirts of Lima. Arequipa, the second city in Peru, stands like a beggar at the door of the public treasury, receiving $80,000 annually; and even imperial Cuzco holds out her hand for $30,000. Employees distant from the head center (as Iquitos, for example) go unpaid. Yet Peru has immense capabilities. She is the France of the continent. With the great Pacific on her left and the navigable sources of the Amazons on her right, with mountains of mineral wealth untouched, with highland valleys like the hanging gardens of Babylon for beauty, and with plains and reclaimable pampas which might equal Egypt in fertility, Peru is potentially one of the richest countries on the globe. But she must have a more substantial and permanent basis of prosperity than guano and saliter. The wealth thus suddenly acquired has diverted the people from the slow but surer sources of national growth. Whoever heard of an original patent taken out by a Peruvian? Where is the vessel that was built in Peruvian waters? What manufactures thrive in Peru? We can think of only one success, the powder factory at Lima, which the government runs, dispensing the "villanous saltpeter" at thirty cents a pound. There was once a woolen factory at Cuzco, but it is now silent. Commerce is almost entirely in the hands of foreigners. Take out what foreigners have done for Lima, and little would be left but the bull ring.

The annual revenue from guano (including saliter) and customs is about $25,000,000. To the railways now nearly completed by Mr. Meiggs, Peru must look for an advance. It is a fact that the receipts at the custom house in Callao have increased by one million of soles every year since the beginning of the Oroya railroad.

In eastern Peru, hats, aguardente, salt, turtles, salsaparilla, tobacco, and hammocks are the main exports. Trade has vastly improved since the establishment of steam navigation on the Amazons. But until there is a better outlet than miserable Balsa Puerto, it must be inconsiderable.

On the coast, the majority of the sailing vessels are Anglo-Saxon. There are a few French steamers; but the Pacific Steam Navigation Company, founded by an American, the late Mr. Wheelwright, is the most prosperous navigation company in the world. It has a fleet of seventy steamers, some of them the largest afloat, with an aggregate tunnage of over 200,000. The six best harbors of Peru are Payta, Chimbote, Callao, Islay, Arica, and Iquique. But all are roadsteads opening to the north; and of each it can be said, as a captain sarcastically remarked of Mollendo, "the harbor is entered as soon as the ship turns Cape Horn." The wealth of Peru lies mainly in the following productions:

GUANO.

This valuable fertilizer, whose virtues were known to the Incas, comes no longer from the Chincha Islands, which have been pretty thoroughly scraped. It is now shipped from the Guañape Islands, where the deposit will last about eighteen months. The principal deposits yet untouched are those of Macabi Island, Lobes Island, Viejas Island, Lobillo Island, Huanillo Island, Huanillo Point, White Point, Pabollon de Pica, and Chispana Bay. The guano now in the market is inferior to that of Chincha, containing five per cent less of ammonia. Peru owns but four millions of tuns (the rest being mortgaged to Dreyfus & Co.), worth $35 a tun where it lies, or £13 a tun in Liverpool.

SALITER (NITRATE OF SODA).

This formidable competitor with guano is found in the Province of Tarapacá, especially on the Pampa del Tamarugal. The average yield is 4,000,000 quintals; but were the senseless restriction on its exportation (25 cents per quintal) removed, the quantity would be tripled. It is mainly exported from Iquique, where the price is about $2.50 a quintal. Mixed with guano, saliter (or "caliche" as it is called in the crude state) is the best compost for cereals. In the deposit at La Peña Grande, fossil birds have been discovered nine feet below the surface.

SUGAR.

In many respects, this is the most important production of Peru. All along the coast, wherever the land is watered by streams or irrigation, the cane grows luxuriantly (from 15 to 20 feet) and yields 85 per cent of juice, having 12° or 15° Baumé. The green and ripe are seen in the same field; men are cutting at one end and planting at the other. The cane requires replanting but once in ten years, and gives a crop every fourteen months. It is exported mainly from Eten (12,000 tuns annually)—the richest agricultural region in northern Peru—Pacasmayo (800 tuns), Malabrigo, Huanchaco, Chancay, and Pisco. The bulk goes to Europe to be refined. A superior quality is grown in the interior at Abancay, which is sent to Bolivia.

COFFEE.

A small quantity is produced at Guadaloupe near Pacasmayo, which is second to none in richness of flavor. Its excellence is due to the fact that it is grown in the shade, and with the greatest care. This "Goyburu" coffee, as it is called, brings fifty cents a pound at the hacienda. A very choice article (valued at $1 a pound) is made by selecting the smallest Goyburu; but it is not in the market. Fine coffee grows also at Huanuco and Urubamba.

COTTON, GRAIN, AND LIQUORS.

A very fine article, next to sea island, has been grown at Pacasmayo; but the yield, only 50 or 60 lbs. to the acre, is not encouraging. It suffers from mildew. The points from which cotton is exported are Pacasmayos (100,000 lbs.), Payta, Eten, Chancay, Lomas, and Pisco.

Rice is now imported from China direct and from India *viâ* England, so that little is raised. The usual yield is 200 fold. Its production is nearly confined to Eten, Pacasmayo, and Huanchaco.

A prime article of corn, quite different from the short, particolored ears on the highlands, is grown to some extent on the coast; 700,000 lbs. passed through the custom house of Pacasmayo last year.

The best cacao comes from the Department of Cuzco, especially from the hacienda of Echarati. It brings 60 cents per pound in Lima, or double the price of the Guayaquil.

The province of Moquegua is the Bordeaux of Peru; and a large amount of rum and wines are exported from Pisco. The "Italia" is the leading brandy. Ordinary "Pisco" is worth $1 a bottle; "Locumba," $2.

TOBACCO.

This grows luxuriantly at Eten and Pacasmayo, sometimes standing eight feet high with leaves four feet long. It is sent chiefly to Chili. Pacasmayo exported 100,000 lbs. in 1873. Tobacco is also grown along the Urubamba and Utcubamba.

Coca is almost confined to the Urubamba province, and is not exported from the coast, as it is consumed in Cuzco, Puno, and Arequipa. It is considered inferior to the coca of Yungas, Bolivia.

CASCARILLA BARK.

Less and less of this is exported every year, as the hunters have to go farther and farther into the interior for it. The greater part now goes down the Amazons from Bolivia. It is shipped from Payta (coming from Loja), Pacasmayo (coming through Cajamarca, nearly 200,000 lbs. in 1873), Islay, and Arica (coming from Cuzco and Bolivia). At Arica, it is worth $90 a quintal.

WOOL.

After guano and sugar, alpaca is the great export. It comes almost entirely from the departments of Puno and Cuzco; and the outlets are Pisco, Islay, Mollendo, and Arica. But Arequipa is the great center of the alpaca trade. Such is the reputation of the Arequipa brand that the wool is generally taken to that city from other points to be re-assorted and re-packed. The alpacas thrive best in the black, almost barren, boggy lands from 13,000 to 14,000 feet in elevation. Shearing time begins, December 15; but an individual is sheared only once in two or three years. A fleece of three years is of course the largest and commands the best price. It is now worth in Arequipa $70 a quintal. Vicuña wool brings $100 a quintal: but little is exported. The sheep's wool of Peru ("cholo") is of middling quality, inferior to the "mestigo" of the Argentine Republic. It brings twelve pence in England. It is exported from Arica and Islay.

About 4,000 goat skins are exported annually to the United States from Payta, and a few chinchilla skins from Arica.

MINERALS.

Arica, being the main port of Bolivia, ships the most metal, especially bar silver (at $12.4 per mark), copper barilla or powdered ore (at $18 a quintal of 70 per cent), and tin barilla (at $19 a quintal of 70 per cent). Pacasmayo and Chimbote will ere long export considerable silver ore and bituminous coal, the latter having been discovered of excellent quality and in large quantity near the line of the Chimbote railroad.

Besides these exports, Tumbez yields petroleum, Huanchaco, starch, Quilca, olives, and Amotape (near Payta), cochineal. Orchilla was formerly sent from Payta; but a better article has recently been found on an island off Mexico.

JAMES ORTON.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Connecticut.

PATENT CARRIAGE WHEEL.—SARVEN *vs.* HALL & CO.

[In Equity.—Before Woodruff, Judge.]

A patent for a carriage wheel in which the spokes have tenons inserted in the hubs, and are sustained against pressure endwise by the shoulders of the tenons, and laterally by collars on each side bolted together, is infringed by a similar wheel in which the spokes are made tapering without shoulders, and enter into corresponding mortises in a solid collar and in the hub, and are sustained endwise on the inclined sides of the mortises.

The defendants were led into adopting this form in consequence of their employment of the shoulders having been urged by the patentee's counsel in a former suit as constituting the breach of the patent; and though an injunction was ordered against them, it was without costs.

John S. Beach, Samuel S. Fisher, Charles Keller and Charles F. Blake, for complainant.

Charles R. Ingersoll and Benjamin F. Thurston, for defendant.

The Turner Car Brake Patent.

For some time past, an actively prosecuted litigation has been going on against several railways in Illinois and elsewhere for alleged infringement of the late Charles B. Turner's patent, of which Batchelder and Thompson are assignees, dated November, 1848, and extended on November, 1862. Henry W. Bishop, Esq., Master in Chancery of the United States Court in Chicago, recently determined that the railway companies, who have associated together for the purpose of defence, must pay damages to a very large amount, over $60,000. A bill of exceptions to the Master's ruling was filed and the case argued before Judge Drummond, who sustained the Master in all particulars, and confirmed the report.

Judge Drummond decrees that the Batchelder and Thompson patent is good and valid; that the inventors never neglected or abandoned such patent; that the patent covers the connecting of all the brakes of a car with windlasses so that a brakeman, by operating any one of the windlasses, can apply brakes to all the wheels; and that the Stevens' brake (used by the railroad companies in question) contains the covered combination.

Judgment for the plaintiff for $67,314.09.

Recent American and Foreign Patents.

Improved Pipe Joint.

John Demarest, Mott Haven, N. Y., assignor to himself and Jordan L. Mott, of same place.—The invention consists in pipes having corresponding end enlargements, with two annular recesses to form chambers, the former to receive an extension, and the latter to form a close chamber for packing, so that the packing will not be exposed to the water or acid, and thus gradually be forced out of its place into the pipe.

Improved Combined Shutter and Window Fastener.

William T. Fry, Brooklyn, N. Y.—This invention consists in fastening the catches of a shutter and window by the same lever, but so that they may be unfastened separately. The arrangement is such that, when the shutter or door is fastened, all parts, except the inside handle, are concealed from view, and access from without for forcible entry is effectually prevented, and the fastening and unfastening of shutters can be effected without opening the windows. A spring is arranged with the shutters to throw them open when they are unfastened. It may also be used with gates and doors, if required. The spring catch is provided with a metal case made in two parts, which form a lining for the mortise through the sill or frame. The parts of the said casing are contrived so that, when they are placed together preparatory to being put in the mortise, they receive the pivot of the catch in opposite holes formed for it, and are held together to confine the catch by the walls of the mortise. The said lining may be provided with a flange on the inside of the sill, to prevent it from being pulled outward. The invention also consists in utilizing this shutter fastening for locking the window sash by means of a stud catch on it, projecting down from the lower edge, and engaging the spring catch.

Improved Cooking Stove.

Solomon Long, Mayville, O.—This invention is an improvement in the class of stoves whose fire boxes are provided with movable or adjustable backs. The improvement relates to the arrangement of two pivoted or hinged plates, one forming, when elevated, the back of the fire box and supporting the other, which thus forms the horizontal inner top plate of the stove.

Improved Spring for Chairs, etc.

William T. Doremus, New York city.—To the lower part of the seat is attached a centrally slotted metallic plate. Through this passes the screw, by which the chair seat is raised and lowered. The seat slot is elongated to admit of the oscillation of seat. Two rubber blocks are placed one upon each side of the plate, and may be kept from turning by toes, said toes entering notches in them. The toes, when the chair is oscillated, press laterally against the rubber, and thus make the spring more efficient.

Improved Fishing Stake.

John O. Campbell, Alpena, Mich.—This invention consists of a fishing stake composed of two parts connected together by a socket and spring catch, in such manner that the upper portion can be readily detached from the lower portion, just above the ground when the season is over, to be preserved, and then be readily attached again at the beginning of another season.

Improved Mangle.

Ernst Gundlach, Hackensack, N. J.—The mangle is firmly secured by suitable clamping screws to the table. The standards, of cast iron, support the mangle rollers. The shaft of the upper or pressure roller turns in a frame which is pivoted to the standards above the clothes roller. The upper roller is made of larger diameter than the lower, both being made of cast iron. The frame is also made of cast iron, in forked or U shape, with a central lever, extending toward the person mangling, which is supplied with a handle for pressing the roller down, or with a weight suspended at its end for producing the necessary pressure on the lower roller. The frame is applied to standards eccentrically, so that the pressure of the roller, when brought down to act on the clothes roller, is in proportion as the degree of eccentricity to the length of the lever and the weight applied, which may be increased or decreased according to the power desired to be exerted. By holding with one hand the lever of the pressure roller, and turning the crank with the other as long as desired, the clothes are rapidly mangled. They are then taken off and replaced and run through the roller again, and so on till they have all passed through the mangle.

Improved Rock Drill.

William Roberts, Jr., Copper Falls, Mich.—This invention consists in fastening drills in a solid chuck, stock, or head by a couple of half boxes and tapered bolts, the said half boxes having the shank of the drill between them, and entering the socket of the stock. The bolts pass through the stock on opposite sides, and bear against the back of the boxes in grooves, so as to wedge them tight against the shanks of the drill, and hold it in the boxes, and also hold the boxes from working out by the notches in the back.

Improved Shaving Conductor for Planing Machines.

William Weaver, Burlington, Vt.—The object of this invention is to produce an improved shaving conductor for wood working machinery, by which the shavings are carried off by the force imparted by the rapid revolutions of the cylinders and side cutters, and transmitted to elevators or other receptacles, whether used with or without suckers or blowers. The conductor, covering the machinery, protects the gearing against the accumulation of shavings, leaves every part of the machine fully within view of the workman, and permits readily any repairing of the same at any desired moment. The invention consists, mainly, of a hood-shaped conductor, adapted in form to a cylindrical planer and side cutter, combined with an extension casing leading to the opening of the blowers, suckers, or receptacles, and turning in a circular sleeve, so as to be lifted off the machinery. The chip breaker of the side cutter is suitably enlarged and recessed for the passage of the shavings into the conductor, which may also be arranged separately for the side cutter.

Improved Curtain Fixture.

Charles C. Moore, New York city.—This invention has for its object to improve the construction of the shade roller described in letters patent No. 75,446. Upon each end of the roller is slipped a metallic tube, which tubes are made with dies, so as to be exactly of the same size and perfectly true. The tubes are designed to receive the side parts of the shade, and cause it to roll up true, thus obviating the annoyance in hanging and using shades arising from the rollers not being exactly true. In the sides of the tubes are formed small holes, to receive tacks, which at the same time fasten both the shade and tube to the roller. A broad beaded screw is screwed into the ends of the roller, which, in connection with the end of the tube, forms the spool upon which the suspension cord is wound. By this construction the length of the spool upon which the cord is wound may be adjusted as required by simply turning the screw in and out. Upon the outer edge of the end of the tube is formed a flange or bead, projecting outward, and upon the outer edge of the head of the screw is formed a flange or bead, projecting inward. These flanges or beads are designed to bear against the cord when it comes to either end of the shank of the spool in being wound thereon, so that it cannot make more than one coil upon itself, and to cause it to at once begin to pass back along the spool.

Improved Riding Attachment for Plows.

Andrew H. Ballagh, Bowensburg, assignor to himself and Martin McNitt Mound Station, Ill.—This invention is an improvement in riding plows; and consists in an arrangement of plow beam with a triangular frame, supported on caster wheels, the parts being so connected that the same rods which serve to brace or hold the plow beam in proper position serve also as draft rods.

Improved Carriage Spring.

Robert Walker, Harrisville, Ohio.—The upper and lower halves of an elliptic spring are of uniform size, and composed of three leaves. Flanged plates are on the outside of these halves, the flanges of which project inward. A knee joint stay is grooved, the ends of which are attached by joint pins to forked bolts passing through the plates and through the halves. The joint in the stay forms the arc of a circle, which places the center of the joint outside of a straight line drawn from one to the other of the joint pins at the ends of the stay. When the spring is compressed the joint gives, and when the spring reacts, the stay limits the motion and prevents breakage. Springs of angular form at the ends of the elliptic are confined to clevises at their angles, with their ends resting on the plates within the flanges. Springs of oval form are also similarly confined to the clevises, with their other ends separated and extending inward. Pads of rubber are attached to the inside of one of the ends of each of these springs. When the elliptic is compressed, these ends are brought in contact with each other, and the pads prevent noise. These springs may be so arranged that, at ordinary pressures, they will not act, and so that they will not be brought into requisition, except when the pressure is sufficient to jeopardize the safety of the elliptic; but they are designed to act as a safeguard at all times.

Improved Vibrating Propeller for Vessels.

James D. Fraser, Pictou, Canada.—This invention is an improvement in the class of propellers formed of paddles or buckets hinged to horizontal shafts or arms, which vibrate on a vertical axis. A hollow vertical crank shaft extends from inside down through the bottom, and is stepped at the bottom of the keel. Below the bottom of the boat this shaft carries two arms extending from opposite sides nearly the width of the bottom of the boat. The buckets are hinged upon these arms to swing freely between short secondary arms, which project laterally in two sets at right angles to each other, so that the said buckets are only swung a quarter of a revolution. Any suitable number of these crank shafts and propellers will be used in a boat, being arranged at intervals throughout her length, and the power may be connected to them in any approved way.

Improved Saw Set.

Jerome N. Briggs, South Adams, Mass.—The body of the saw set is made in two parts, the rear parts of which are secured to each other by a screw bolt which holds them together, and by a pin that prevents latera movement. The lower part is made with a downward projection to enable it to be held by a vise. Two arms, projecting at right angles from the opposite sides of the lower part, and the bases of which project along the sides of said part, are secured to it by a bolt which passes through it and through slots in the bases of the said arms. The parts of the bolt that pass through the slots in the said bases are flattened so as to hold the arms exactly in line with each other. Upon the upper sides of the bases of the arms are formed projections, to enter the spaces between the teeth and stop the saw plate in proper position for the tooth to be operated upon, while the arms support the saw plate in a horizontal position, so that it cannot spring or bend By loosening the nut of the bolt, the arms may be readily adjusted according to the size of the saw teeth.

Improved Grain Conveyer.

Constantin Lazarevitch, Brooklyn, N. Y.—The object of this invention is to obviate the necessity of shoveling grain in the holds of vessels, for the purpose of distributing it and properly trimming the vessel. A shell wheel is arranged, composed of a bottom plate and an inclined annular upper plate, separated by vertical partition plates, which latter divide the space between the two plates into a series of compartments which have their outlets at a space between the outer edges of the upper and bottom plates. This wheel is placed below the hatch and given a rapid revolving motion, and the grain, supplied by suitable hoppers and conduits, is thrown from the wheel, through the compartments and space, by centrifugal force against the sides of the vessel and bulk heads. The grain is thus distributed, as fast as the elevator delivers it, it is claimed, without hand labor, and in the most perfect manner. The speed of the machine may be regulated by means of cone pulleys or otherwise, so as to simply clear the wheel and allow the grain to fall nearly vertically for filling the middle of the hold.

Improved Liquid Measure.

Willis L. Wever and A. Wallace Johnson, Plattsburg, N. Y.—This invention consists in arranging a measure of suitable size with a vertical central slide gate, which is provided with a horizontal subdivisional sheif, so that, at pleasure, the whole half or other subdivisional measure may be filled.

Improvement in Hardening the Surfaces of Iron.

Robert T. King, of Pana, Ill.—The object of this invention is to furnish a suitable compound for case-hardening iron, or converting the surface into steel; and it consists in lamp black, sal soda, muriate of soda, and black oxide of manganese. The iron is heated in any suitable forge or furnace, and, having been wrought into the shape of the implement or article to be used, the surface thereof is prepared by grinding. The compound is applied by sprinkling or sifting, or by immersing the iron therein. The effect is to carbonize and steelify the surface of the iron.

Improved Bolt for Doors and Gates.

Josiah Smith, Southold, N. Y., assignor to himself and L. F. Terry, same place.—The inner plate of the fastening is cast with two keepers to receive the bolt, which has a loop cast upon it to serve as a handle for operating it upon the inner side of the door. The rear keeper is cast with a transverse slot through its middle part, to allow the handle to pass through when slipping the bolt into place. The outer plate is cast with a flange to overlap the edge of the door. A loop or handle, the stem of which passes through a slot in the outer plate, a slot in the door, and a slot in the inner plate, enters a hole in the bolt, where it is secured in place so that the bolt may be moved back and forth from the outer side of the door or gate. Upon the outer plate is cast a loop, which is made exactly like the handle in size and form, and which serves as a guard to prevent the bolt from being pushed back by accidental means.

Improved Mitering Machine.

Christian Loetscher, Dubuque, Iowa.—This invention is an improvement in devices for forming miter joints, wherein the bar, against which the stuff is fed to the saw, is pivoted to another bar adapted to slide in a groove in the saw table. The sliding bar may be reversed, and is designed for use as a stop when a number of pieces of the same length are to be sawn.

Improved Table Knife.

William Henry Andrew, Sheffield, England.—This consists in a simple and effective mode of securing the handles of cutlery to their holding tangs; and it consists in the employment of a bent piece of metal, angular plate, or cap, made of any suitable metal and configuration, applied to the handle next to the bolster, or at its lower end, and provided with an opening for the insertion of the holding tang, which is secured in position by a rivet or pin passed transversely through the cap plate, handle, and tang.

Improved Paint Compound.

Carl August Sitzler, Eitzingen, Germany.—This invention is especially designed for protecting stone walls and outer surfaces of all kinds, cellar and stable walls, machinery, etc., and is for painting wood, and producing wall and roof papers. The compound is impervious to moisture and air, of great durability, and, though pliant and elastic, of great hardness after having thoroughly dried. It consists, mainly, in silver litharge ground with sesquioxide of manganese, to which balsam of sulphur turpentine is added Said balsam is produced by dissolving sulphur and linseed oil in turpentine, the dissolution being accelerated by heating. Zinc white is then added to the foregoing, thoroughly ground, and then combined with soluble glass Venice turpentine, spirits of turpentine, oil varnish, pulverized metallic iron, and Portland cement. The whole compound is then thoroughly mixed and ground together, producing a bluish gray paint, which may be colored to any desirable tint by adding the coloring pigments in suitable quantity.

Improved Toy Putty Blower.

Nathan Joseph, San Francisco, Cal.—This invention consists of a putty-blowing tube for children, constructed by simply rolling up the sheet into cylindrical form, and overlapping the edges for the joint, without solder or other fastening, with a mouthpiece, whereby the lips are protected from the sharp edges of the metal.

Improved Fireplace Lining and Front.

Edwin A. Jackson, Union Square, New York city.—Heretofore it has been a difficult matter to construct an ornamental lining for grates and fireplaces that would stand the continual expansion and contraction to which such linings are exposed from repeated fires without breaking the tiles or blocks of which it was composed, or breaking them loose from the wall to which they were attached. This ornamental lining has usually been fastened with cement, but the tiles or blocks have been set like window panes in metallic frames. These difficulties are designed to be overcome by the present invention, in which tiles of any form or description, or metal blocks of any design, figure, or size, are securely bolted or fastened to a metallic backing made in the form desired for the fireplace or grate, room being allowed for expansion, so that the lining is not damaged by the heat. The same inventor has also devised a novel means for holding an ornamental tile front for fireplaces in its proper position. The tile is confined to a cast metal frame by means of border moldings. The outer edges of these moldings are flush with the outer flanges of the frame. The inner edges lap on the tile so as to securely hold it in place, and bolts are cast into the moldings, which pass through the frame by which the moldings are held,

Improved Car Coupling.

Allen Strain, Greenfield, Ohio.—The drawbar has vertical slots at the sides for the admission of a lever. One slot has at its upper end a notched recess toward the open side of the drawbar, which supports the lever when raised to admit the coupling link. The latter is provided with two notches, wedge-like ends, and a higher central part. When the link enters the drawbar it passes, with its end, below the raised lever till the central bar strikes the same and causes it to drop into the notched part of the link. A pivoted triangular plate presses by its own weight, with its base, on the lever, to prevent the escape of the coupling link, in consequence of the jerks and vibrations of the car. To a lever extension of the plate, and also to the end of the lever, is connected a wire rope which connects with a treadle on the platform of the car, so that the attendant may easily raise the plate, and with it the lever, into the recess, in readiness for coupling.

Improved Apparatus for Compressing Cast Metals.

Horace W. Mann, Omaha, Neb.—The object of this invention is to provide a portable convenient apparatus for solidifying cast metals in their liquid state by compressed air, which is forced directly on top of gate in flask after the metal is poured. This invention consists of a portable reservoir for compressed air, with a pump attached, which latter is connected by rubber hose with a cylindrical cap that is fitted and clamped to a cylinder that is fastened to the top of flask. Both cylinders are coupled together by projecting flanges and clamps. The flask cylinder is provided with a clay wash, and, previous to the pouring of the liquid metal, with a ring or cap piece, set on top to prevent the hot metal from coming in contact with the clay wash. The ring is removed as soon as the metal is poured, the cap is then clamped on cylinder and a stop cock opened, so that the compressed air is let directly on top of metal through the gate of flask, compressing thereby the metal in the molds.

Improved Car Coupling.

Xaver Krapf and John F. Boerckel, Allentown, Pa.—The drawhead is rounded off at its front part and provided with a backwardly curved hook, over which the coupling link slides easily, and is then retained without being disconnected by the jerking of the car. The coupling link is pivoted to the drawhead, and at one side of the latter are arranged a series of upwardly inclined holes of different hights. A bell-crank-shaped lever with a treadle is pivoted, sidewise of the link, to the link pivot bolt, projecting with its curved extension hook under the link and lifting the same into horizontal or inclined position when lever is turned. When in inclined position for coupling, it is secured therein by placing a pin into one of the holes before mentioned, selecting the hole required for producing such an inclination of the link as the hight of the platform of the car to be coupled renders necessary. The coupling link strikes then, on the approach of the adjoining drawhead, the curved hook of the same, and is thereby gradually raised, allowing the pin to drop out, and passes over the hook, dropping on the drawhead back of the hook and coupling the cars. The uncoupling is quickly performed, as merely the lifting of the link above the drawhead, by pressure on the treadle, is required.

Improved Utensil.

John C. Garmsey, New York city.—This invention consists, mainly, in a vessel of broad oval base and flat shape, with a handle arranged at the top, in such a manner that the center of gravity falls to the rear of the same. The rear part is covered under suitable inclination, so that the upsetting is prevented, while the forward projecting pointed spout in front of the handle facilitates the use, and furnishes an opening of sufficient size for thoroughly cleaning.

Improved Milk Can.

James F. Cass, L'Original, Canada.—This invention consists in a conical cover for the can, with openings at or near the base, and tubes in connection with them; also, an opening at the top and a tube in connection with it, for ventilating the can and carrying of the animal heat and the odors of the milk. Fresh cool air is carried in at the lower holes by blowing against the cover, and forces the warm air out through the tube at the top, so as to cool the milk efficiently as it is in waiting on the stand at the farmer's gate, or when being conveyed to market. This milk can is intended principally as a carrying can in connection with the cheese and butter factories.

Improved Churn Dasher.

Andrew J. Hudson, Camden, Tenn.—The dasher is made in the form of a two-armed bar. Upon the upper side of one arm is formed a rounded hollow, or concave groove, inclining outward and upward, and in the under side of the other arm is formed a similar groove inclining outward and downward. Upon the upper side of one arm and upon the upper side of the other, respectively below and above the other grooves, is formed a recess having a convex bottom and vertical sides. The outer shoulder of the recess is curved and extends from the forward side of the dasher arm to about the center of the rear side of said arm, where it terminates in a notch. By this construction the dasher, in its movement, throws the milk in currents in different directions, which currents collide with each other and with the sides of the churn, throwing the milk into violent agitation, and bringing the butter in a very short time.

Improved Ventilator and Pipe Hole Plate for Tents.

Robert Brien and William Brien, Jersey City, N. J.—This invention consists of a metal plate having a hole for ventilation, or for the projection of a stove pipe fastened in a large opening in the tent cloth, and provided with a valve for closing the ventilator or pipe hole. The plate supports the valve and the stove pipe protects the cloth from the heat of the pipe.

Improved Carriage Top Joint.

William B. C. Stirling and John W. Pohlman, Batavia, O.—The object of this invention is to provide, for the purpose of raising and lowering the tops of carriages of all kinds, an improved joint or prop, by which the braces are effectually extended and rigidly supported when the top is thrown up, and neatly and compactly arranged when folded down. It consists of a combined joint for the braces of a carriage top, so that the same folds easily into parallel position, together with an abutting extension of the supporting brace, which locks a projecting rib into a corresponding recess of the extended brace, for keeping it rigidly in position when the top is opened.

Improved Machine for Building Earthworks.

Harvey Morey, Cameron, Texas.—This invention consists of a strong frame, mounted on casters or wheels, for moving along the ground readily, and having an elevated platform hinged at one side, and held down at the other side upon powerful springs, on to which the earth is scraped up an ascending way, or otherwise delivered upon it. The earth is finally discharged in the direction of the place where it is to be spread by tripping the platform and allowing the springs to throw it up with sufficient force to project the earth from it. A windlass is employed for forcing the platform back again for reloading, with ratchets and pawls for holding it. This machine is more particularly designed for levee building and, it is believed, will be found very serviceable in building up banks of considerable hight, by saving much of the labor of the animals in moving themselves and the scrapers up and down the banks.

Improved Latch for Gates.

George N. Sharp, La Plata, Mo.—This invention has for its object to improve the construction of the latch for which letters patent No. 128,075 were granted to the same inventor June 18, 1872, so as to make it more reliable in use and less expensive in manufacture. The catch moves up and down through a slot in the bottom edge of the case, and has hooks formed upon the outer and inner ends of its upper side. The inner arm of a lever passes through a slot in the top edge of the case and enters the cavity of the catch and its lower end is so formed that, when moved inward, outward, or upward, it may raise the catch and unfasten the gate or door. The upper arm of the lever projects upward, to serve as a thumb piece for operating. Upon the lever is a plate, so formed as to wholly cover said slot or opening, and thus prevent the entrance of rain and snow into the case. A partition is formed in the inner part of the case, and its upper part is curved to serve as a stop to the catch when thrown upward by the slamming shut of the gate, to cause the catch to drop before the gate, in its rebound, can carry the catch bar out past the catch.

Improved Hub Boring Machine.

David B. Wright, South Amesbury, Mass., assignor to Cynthia A. Wright of same place.—The frame of this hub boring machine consists of a larger base part and the vertical standard supported thereon. The larger part is laterally connected by pieces which support the wheel to be bored in horizontal position, forming a platform for the same, to which it may be rigidly fastened. A lower lateral piece carries centrally a vertical, to which are pivoted the toggle levers, which have jaws at their upper ends, which take hold of the hub at diametrically opposite sides, and center it accurately below the boring mandrel. Jaws are adjusted to the hub by a link connecting the toggle levers and screw, which is placed vertically below the axis of the mandrel, securing thereby the exact central position and bore of the hub. The mandrel is set, in the usual manner, in vertical position on the standard, and driven by hand or other power.

Improved Shoe Last.

Parker P. Paul, Brooklyn, N. Y.—This invention consists of detachable plugs of wood and a fastening device composed of a screw threaded bush and roller screw in the bottom of the last, for driving the tacks into and temporarily fastening them on the soles. The object of this is to remove the plugs and fit in new ones from time to time as they wear out, and thus always have solid substance for the tacks. This part is applicable to the soles, having a metal plate on the bottom for riveting or clinching the tacks by which the insole is fastened to the upper in the process of making machine-sewn shoes.

Improved Sleeping Car.

G. Herrmann Lindner, Brooklyn, N. Y.—The seats of the lower berths are constructed of three pivoted cushions, the main cushion forming the seat, and the others the back. The seat can be swung out to make the middle part of the berth. A lug-shaped extension limits its motion, and it is suitably supported when drawn out for the berth. The back cushion is folded down into horizontal position into the place made vacant by seat. Either back cushion may be slightly elevated into an inclined position for head rest, and secured. The seat frame dividing each section extends slightly above the top cushion when in position as back cushion, and allows thereby a full view of the car and a free passage of air through the same. When the top cushion is locked in its upward position it serves as support for the upper berth, which is arranged immediately under the top of the car, supported in front by horizontal projections, and in the rear by bolts, which lock into nosings provided at the upper end of guide grooves. When it is desired to lower the upper berth, rear bolts are withdrawn, so that the rear side of berth slides down in grooves while the front part swings in pendent arms. The berth assumes thereby an inclined position. Front bolts are then withdrawn from pendent arms till the berth, swinging on pivots, assumes a horizontal position, resting on the up turned top cushions. The same operation is reversed when placing the berth back in its old position, the front and rear bolts locking by mere pressure by the action of their spiral springs.

Improved Machine for Facing Cylinders.

Thomas M. Henderson and Frank L. McDonald, Omaha, Neb.—The object of this invention is to provide means for facing the ends of steam cylinders, and cylinders for other purposes where steam or watertight joints are required, and it consists in a cone which is rigidly fastened to a central shaft. Four arms pass through a projecting flange near the top of the cone. There is another cone through which the shaft passes, and to which it is connected by a groove and a feather, but neither the shaft nor the cones revolve. This cone forces the arms outward against the cylinder. The outer cone is so arranged that the arms bear at or near the end of the cylinder. The lower end of the shaft is supported by the spider, which is adjusted in a central position in the cylinder. On the top of the inner cone is a bevel gear through the medium of which the feed screw is revolved. A frame is arranged, consisting of a hub and the two projecting arms which support the feed screw and cutting tool. The cutter is attached to a crosshead which moves from and toward the center of the cylinder in grooves in the arms. The feed screw works through the crosshead as through a nut, and when revolving it carries the crosshead and cutter over the end of the cylinder. The frame is revolved by means of a spur gear wheel and pinion, the gear wheel being rigidly attached to the hub of the frame, and the pinion being on the end of the crank shaft. As the crank is turned the frame (carrying the cutter) is revolved around the shaft, and at the same time the screw is turned for feeding up the tools.

Improved Gate Fastener.

Joseph H. Nichols, La Fayette, Ill.—This invention relates to the class of gate fastenings so contrived that the gate closes under the catches, and is then lifted up into them and held by a suitable arrangement of levers. A weighted eccentric lever is employed, which effectually secures the gate while it remains down; and only releases it on being lifted up.

Improved Subsoil Gang Plow.

Christian Myers, Marysville, Cal., assignor to himself and Francis J. Schaeffer, Davenport, Iowa.—To make the plowshare detachable, it is produced in one piece with the point, and the latter is extended back to the full length of the landside. A hook is welded to the lower side of share in the longitudinal direction of the same, and slightly rounded off at the lower side to offer less resistance to the earth. The rear part of point is provided with an oblong aperture which corresponds with a similar one of the landside. The land side is recessed for the extension of point, and the under side of the plow is extended forward, and provided with an oblong aperture, through which the hook is introduced. The share is then carried toward the landside till the hook closes firmly on the under side and the rear part of the point into the recess of landside. A wedge or key is then driven through the holes, fastening thereby the share rigidly and strongly to the supporting parts of the plow, allowing at the same time the ready taking off, sharpening, or replacing of the share.

Improved Ice Creeper.

Reginald H. Earle, St. John's, Newfoundland.—Upon the upper side of a narrow plate, which reaches across the sole of the boot and along its side edges, are formed grooves to receive the side edges of two plates, the inner parts of which are halved, so as to overlap each other without producing any extra thickness. The movements of the last mentioned plates, as they are slipped out and in, are limited by pins which project through short longitudinal slots. The outer ends of the plates are bent upward at right angles, and have spikes attached to them to enter the edges of the boot soles. A set screw passes up through the narrow sole plate, so that its forward end may press against the plates and hold them against the flanges that form the grooves in which the edges of the said plates work. To the under side of the sole plate are attached short spikes to take hold of the ice, and thus prevent the wearer from slipping.

Improved Water Wheel.

Mordecai H. Heyiman, Oshkosh, Wis.—This invention consists of a horizontal reaction wheel, receiving the water in the top and discharging at the periphery, for which purpose it has issues formed in parallel circles. In front of the latter, at a distance suitable beyond them, in order to allow the water to freely enter the circle in which the issues are formed, is a curved or angular shoulder, from four to six times larger in area than the issues, against which the reactionary force of the water is delivered, in a manner alculated to give the best results in respect of power.

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

ANSWERS TO CORRESPONDENTS

R. A. C. is informed that the manufacture of rubber stamps has been already patented.—T. S. is informed that we have not heard of M. Lebarre's experiments on hydrogen.—B.'s mathematical query is not intelligible to the general reader. What are the relative values of *a* and *b*?—W. J. will find full directions for the preparation of nitro-glycerin on p. 138, vol. 29.—P. will find full explanation of the bisulphide engine on pp. 199, 247, vol. 27, and p. 144, vol. 29. The reports he asks for have not been received.—S. R. S. will find directions for plating brass and copper with silver on p. 320, vol. 24. Nickel plating is described on p. 177, vol. 25, and p. 91, vol. 29.—S. S. should address President Morton at the Stevens Institute of Technology, Hoboken, N. J.—G. B. O'N. will find a recipe for aquarium cement on p. 267, vol. 25.—H. M. P. is informed that the pressure resulting from the fall of a body has been fully discussed in these columns, and we do not propose to re-open it.—W. F. B. will find directions for tempering files on p. 235, vol. 24, and in the answer to F. W. H., on page 59.

P. S. asks: How can I get rid of vermin which infest the plumage of my canaries? A. Give the birds a bowl of water to bathe themselves in occasionally. Do not use very cold water.

J. A. H. says: I want to obtain a large quantity of pulverized metallic zinc, as fine as it is possible to make it. Please suggest a suitable means of accomplishing it. Its granulation by melting and pouring into water does not afford me a sufficiently fine product. A. Zinc becomes very brittle at high temperatures, and can be reduced to a fine powder by pounding.

H. G. Y. asks: Can I obtain a rapidly moving current of air through a 4 inch tube 100 miles long, the power being a 50 horse power engine at each end of the tube, with an 8 x 4 feet cylinder containing a fan, to produce force at one end and suction at the other? I propose to use a fanning mill which admits air at the side, to obtain the suction. If not one hundred miles, please state how far I can do it. A. We do not know of any experiments that give data for the conveyance of air to such a distance. You will find the subject treated in Weisbach's "Mechanics and Engineering."

A. G. asks: 1. What is the best liquid for dissolving India ink for drawing? 2. Would chlorine bleach a drawing without injuring the ink? The paper is brown through excessive handling. A. 1. Water, or water to which a little alcohol has been added. 2. We would advise moistening the drawing and then exposing to the fumes of burning sulphur, and finally passing through pure water. Any treatment of this kind of course requires great care.

K. W. M. asks: In reference to your answer to J. M., on page 316, vol. 29, I would ask: 1. What number should the wire for the respective helices be? 2. What number should the iron wire for the core be? 3. What causes the iron bar to revolve? 4. Could not a tube, made of baked wood and varnished, be substituted for the glass tube? 5. Could I make the helices of common copper wire by placing cotton cloth between each layer of wire? A. 1 and 2. You can easily find the number, which is a trade matter, and the cost, from a hardware dealer. The outside helix should be made of the finest copper wire you can manipulate, and the interior one of ordinary stout wire. 3. The successive attractions of the interior bar. 4. Yes. 5. Not so as to make an effective apparatus. You ought to get the wire already wound from a philosophical instrument maker.

M. E. H. says: I am building a small pleasure boat 25 feet long. With machinery in, she is to draw but 6 inches water. Is there any form of a propeller that can be used with advantage in 6 inches water, and yet have power enough to drive a boat of that size four or five miles an hour? Her machinery is to be worked by hand. A. Possibly you can manage it with two screws, partly submerged.

J. F. says: I have seen a clock, which appears to consist of a glass plate, 24 x 30 inches, three sixteenths thick, set on two wooden bases. There is a gas burner over this glass plate and two fine wires leading from the gas pipe to the wooden bases. There is nothing on the glass but the two hands, one on each side of the glass. How is its action maintained? A. We have seen a clock answering to this general description, which received its motion from a weight in the end of one of the hands, this weight being moved by delicate mechanism, so that its leverage was continually changing.

C. N. J. asks: 1. What is the usual width and depth of the water in canals? 2. Is steam ever used to propel canal boats, and in what manner? 3. What objections are there to the general use of the ordinary propeller wheel, of a size to suit a canal boat? 4. What is the average speed of a loaded canal boat drawn by two horses? 5. What horse power would it require to drive such a boat, loaded, at the same speed, with steam applied to a proper sized propeller wheel? A. 1. The dimensions of different canals vary from 6 to 9 feet in depth, and from 56 to 70 feet wide. 2. Yes, both by tugs and by engines in the boats. 3. None that we know of, except the excessive slip usual with canal boats of the ordinary form. 4. One and a half miles an hour, we believe. 5. Probably from three to four times as much.

L. W. E. asks: What is carbolate of lime? A. Carbolate of lime is a compound formed by the union of carbolic acid and lime. Although not a powerful acid, carbolic acid combines with bases, as carbonic, sulphuric and nitric acids do, forming salts called carbolates.

W. P. asks: How can I color the wool on tanned sheep skins for making mats? A. You can use any of the ordinary dyes for wool. For blue, use Prussian blue with a persalt of iron or tin as a mordant. For red, use cochineal, madder, or logwood with a tin mordant. For yellow, use turmeric or annatto. Splendid shades may be obtained by using the aniline colors.

G. F. P. D. says: 1. What is the cost of Gramme's electric light machine illustrated in your journal, page 351, vol. 29? 2. You say (in describing Mr. A. Ladiguin's exhausted glass tube, in which he produces the light) that he makes use of but one carbon point. Is the other terminal metallic, and is it near the carbon tip, as is the case when the usual two carbon points are used? A. 1. We do not reply to questions of a business nature. 2. There is no other terminal. Our description is perfectly clear on this point.

E. L. asks: 1. How can I estimate the percentage of acetic acid (approximately) in a given weight of the common gray commercial acetate of lime? 2. Is acetate of lime used indirectly in the manufacture of Paris green? A. 1. You can estimate approximately, if sufficient care be used, as follows: To a filtered solution of the commercial acetate, add carefully a solution of oxalic acid until a precipitate ceases to be produced. Pour off the solution of acetic acid and carefully neutralize with a weighed amount of dry carbonate of soda, in powder, adding by degrees until effervescence ceases. Every 54 grains of dry carbonate of soda used are equivalent to 51 grains of anhydrous acetic acid. It is necessary, of course, to weigh accurately the sample to be tested. 2. It is used indirectly in the manufacture of what is known as Schweinfurt green.

A. W. C. asks: How can I dissolve iodide or bromide of potassium in absolute alcohol and concentrated sulphuric ether mixed in equal proportions, without using more water than just enough to dissolve the iodide or bromide, or (better still) without any water at all? I can succeed in dissolving the salt in the alcohol; but no matter how carefully I add the ether to the solution, the salt will be precipitated. I wish to dissolve 4 to 10 grains of salt in each ounce of the ether and alcohol. A. If potash is the essential ingredient desired in solution, you might try other salts of potassium, bearing in mind the properties peculiar to each particular salt.

W. R. S. asks: How can I make gold and silver ink, that can be used in a pen or a hand stamp? 2. Can I use the Tom Thumb battery for learning telegraphy? 3. Can you furnish me with back numbers of your paper? A. 1. A gold ink is made by grinding fine gold powder with a little gum water. The yellow bisulphide of tin or bronze powder may be used instead of gold. Silver ink is made in the same way, by using powdered silver. 2. Yes. 3. Yes, generally.

A. L. McC. asks: Is there any instrument or chemical preparation which will enable me to discover buried gold and silver? A. There is no known means of indicating the position of your treasure. Your only chance of success is to keep digging.

A. R. asks: What metal expands most with least heat? A. Mercury.

C. C. F. asks: How can I make variously colored fires? A. Red fire: Sulphur 1 part, sulphuret of antimony 1 part, niter 1 part, dried nitrate of strontia 5 parts. Blue fire: Tersulphuret of antimony (orpiment) 1 part, sulphur 2 parts, dry niter 6 parts. This is the Bengal blue light. Green fire: Boracic acid 10 parts, sulphur 17 parts, chlorate of potash 73 parts. Yellow fire: Sulphur 16 parts, dry carbonate of soda 23 parts, chlorate of potash 61 parts. Violet fire: Charcoal 8 parts, sulphur 10 parts, metallic copper 15 parts, chlorate of potash 30 parts. Orange fire: Sulphur 14 parts, chalk 34 parts, chlorate of potash 52 parts. Purple fire: Lampblack, realgar and niter, of each 1 part, sulphur 2 parts, chlorate of potash 5 parts, fused nitrate of strontia 16 parts. By parts are meant equivalent proportions, ounces, pounds, etc. The different ingredients are to be separately reduced to powder, sifted through lawn, and kept in well corked wide mouthed bottles until used. Care must be exercised in handling, especially the chlorate of potash, when in contact with combustible materials. The materials must be carefully mixed on a sheet of paper with a wooden stirrer with a light hand, avoiding excessive friction. They should not be mixed long before using, as they are apt to deteriorate by long keeping and even to inflame spontaneously. The nitrate of strontia, alum, saltpeter and carbonate of soda, before being weighed, should be heated until their water of crystallization is driven off and they fall to powder.

J. T. says: 1. Supposing we have two boilers, both connected with a steam chest. The steam in both is to be at 40 lbs. pressure. If the steam is admitted from one boiler to the steam chest, the pressure, of course, will be 40 lbs. A friend of mine contends that if the steam be now admitted from the other boiler in addition, it will raise the pressure to 80 lbs. I, however, maintain that the volume will be increased but not the pressure, by the addition of one or any indefinite number of boilers. Who is right? 2. Supposing that the first boiler is amply large enough to drive a certain engine, and the feed pipes, valves, etc., in proper proportion, could the addition of another boiler increase the power? 3. I happened to state to the same party that a certain piece of machinery in a cotton mill revolved at the rate of 1,200 to 2,000 revolutions per minute. He thought that nothing could be made to stand such a speed. I say that that speed has been more than doubled. Please to state what is the greatest speed that has been attained by an object of say 12 inches diameter. A. 1. You are right. 2. No. 3. Circular saws of 12 inches diameter are frequently run at a speed of 3,000 revolutions per minute.

S. B. asks: If a man takes out a patent for a washing machine, can another make it himself and use it in his own house for his own use only? Has he the right to do it without being liable to an action for infringement of the patent? A. No person has a right to make or use a patented article for his private purposes without consent of the patentee.

E. C. O. asks: 1. Does such a thing exist as a perfect vacuum? 2. A friend claims that a window 6 x 6 gives more light than two windows 3 x 3. I claim that they are equal. Which is right? A. 1. See article entitled "A Perfect Vacuum," on page 400, vol. 28. 2. Other things being equal, your friend is right.

S. S. asks: How can I make the best violet ink? A. Make a weak decoction of logwood and add a little alum or chloride of tin. When the decoction of logwood is strong, the ink is purple.

H. W. M. asks: How can I drill holes in plate glass? Answer: Keep the cutting edges of your drill wet with turpentine.

J. F. A. asks how to make malt vinegar. A. Make a mixture of malt and barley, mash with hot water, and ferment as in brewing. Put in barrels placed endways, and tie over the bungholes with canvas; keep in the dark in a well ventilated place, moderately warm. Leave till the acetous fermentation is complete; this will take some weeks or even months. Then run off into two large casks, and put in some green twigs or cuttings of grape vines. Fill one of the casks wholly, and let the other be ¾ full. The fermentation will recommence and the acetification proceed more rapidly in the last named cask, consequently it will be the sooner ready for use. As you consume it, replace the quantity drawn off with vinegar from the other cask. If you make it on a large scale, you can use several pairs of casks in this manner

D. C. says: I have two boilers, connected together. I wish to supply the second with steam from the first, in which the pressure is 100 lbs. I want 50 lbs. pressure in the second. The connecting pipe has an area of one square inch. How large a hole should I cut in the second to keep it at 50 lbs., allowing for pressure of atmosphere? Would the velocity of steam through pipe be that due to 50 or 100 lbs. pressure? Are two volumes of steam at 50 lbs. as powerful as one volume at 100 lbs.? A. See article on "Efflux of Steam," page 113, vol. 29. Two volumes of steam at 50 lbs. pressure are more powerful, or are capable of doing more work, than one volume of 100 lbs.

C. I. asks for a recipe for bronzing green. A. Dissolve 2 ozs. nitrate of iron and 2 ozs. hyposulphite of soda in 1 pint water. Immerse the articles in the pickle till the required shade is obtained; wash with water, dry, and brush.

C. C. asks: 1. Is there a salve that will cure corns in a short time? 2. What is a good polishing powder for house use? A. 1. Take powdered verdigris 1 dram, savin ointment, 7 drams. Mix and apply on soft rag. 2. For polishing plate, take jeweller's rouge ¼ lb. prepared chalk ¼ lb.: mix and use with water.

A. J. C. says: I suffer very much from cold feet; the soles seem to be the most affected. My woolen stockings get damp, but I hardly think it can be sweat. A. A vigorous walk of a few miles every day would probably remove your difficulty.

J. A. L. asks: Is there any residual magnetism in Gramme's electric light machine, producing resistance and necessarily heat, as in Wilde and Ladd's machine? The armature is retarded and heated by the above machines, which is a serious defect. A. We think not.

J. C. D. wants us to illustrate Siemens' steam motor, believed to be very applicable to the minor industries, such as sewing machines, the lathe, etc. A. We published an engraving of it a few weeks ago.

H. U. says: I have been a subscriber to your valuable paper for a considerable time, and I find all sorts of questions answered through your columns. I have a green parrot, one of the yellow headed kind, with red wing butts. What is the best way to teach it to talk? Is there any other way than merely talking to it? A. You might use the speaking machine to teach your parrot. Set the machine so that it will repeat "how do you do," and keep it slowly running all day with the parrot in the same room. Next day set the machine on "good morning:" and so on, changing the words daily. Your parrot, if a good talker, would soon become well educated. An enterprising person might do a good business, we think, by opening an institution for the instruction of parrots. A class of a hundred birds might be simultaneously taught by means of a single machine.

T. C. asks: 1. How many species of moles are there known to naturalists? 2. Have all of them eyes? 3. Have snails eyes? 4. Have fishes, that live in watery caves, eyes? A. 1. The best known are *talpa*, found in Europe and Asia; *scalops* and *condylura*, in North America; *chrysochloris*, in Africa; and *urotrichus*, in Japan and North America. 2. Yes. 3. Yes, situated at the extremities of the longer tentacles. 4. Fishes and all other animals lose their eyes if they are perpetually in the dark.

W. H. S. asks: How can I remove stains from marble? A. Make a paste of equal parts of carbonate of potash and whiting with boiling water, apply, and leave on for three days. Then wash off with soap and water. To re-polish, use tripoli in water, and then putty powder in water.

J. H. T. asks: 1. How is gunpowder made? 2. What is oil of rhodium? A. 1. Take powdered saltpeter 75 parts, powdered willow charcoal 15 parts, sulphur 10 parts, mix well, add enough distilled water to make a paste, and grind till thoroughly incorporated. Leave in a cake to dry; granulate and dry by a steam pipe at a heat not over 130° Fah. 2. This is derived from the wood of a species of *rhodorina*, and is much used for adulterating other essential oils. Its preparation on a small scale is not likely to be successful.

W. T. V. asks: What kind of sizing can be applied to the surface of cloth to smooth the surface, stiffen the cloth, and at the same time render it waterproof? A. Try the elastic varnish described on p. 282, vol. 29.

J. M. B. asks: Is there such a thing as an adding or an adding and multiplying machine? A. The British government has now in operation a "difference engine," for facilitating calculations of averages, etc. We do not know of any other which is at work.

W. R. asks: What proportions of bismuth, block tin, and lead are required to make bismuth solder, for plumbers' joints on block tin pipe? How hot can I use the solder without melting the pipe? A. You can make a solder of two parts, by weight, of lead and one part of tin, which melts at about 100° below the point of fusion of tin.

J. F. A. asks: How is heel ball made? A. Melt together beeswax 1 lb., suet 4 ozs., and stir in ivory black 4 ozs., lamp black 3 ozs., powdered gum arabic 2 ozs., powdered rock candy 2 ozs. Mix and, when partly cold, pour into tin or leaden molds.

H. B. asks: How can I make sailors' clothing waterproof? Answer: There are various processes for waterproofing cloth: 1. Moisten the cloth on the wrong side, first with a weak solution of isinglass, and when dry with an infusion of nut galls. 2. Moisten with a solution of soap, and another of alum. 3. A simple method of rendering cloth waterproof without being airproof is to spread it on a smooth surface and to rub the wrong side with a lump of beeswax (pure and free from grease) until it presents a slight, but even, white or grayish appearance. A hot iron is then passed over it; and the cloth being brushed while warm, the process is complete.

H. G. T. asks: Is there anything better and cleaner than black lead and tallow as a lubricant for friction wheels or brakes? A. We think not.

J. M. C. asks: What work gives the best information on the working and setting of slide valves so as to obtain the best results? A. Auchincloss on "Link and Valve Motions." We have never seen the other work you mention.

F. A. M. replies to J. H. M., who has difficulty in firing his boiler with saw dust: I have been firing under boilers, very similar to yours, but not so large, in a steam saw mill. I burned all the sawdust that was made. The chimney is sheet iron of 18 or 20 inches diameter, 60 feet high; the furnace was not intended for burning sawdust; but as the draft is very strong, it burns freely. In places where a strong draft cannot be had with a chimney of that hight, 10 or 15 feet should be added, with about ¼ more grate surface than for wood; and if the grate bars are cast in half cylinders of 6 inches diameter, full of ¾ or ⅝ inch holes, and the sawdust thrown in moderately, with now and then a piece of slab, I think you will find no difficulty in burning the sawdust. The furnace does not need to be any different in construction (otherwise than having more grate surface) from ordinarily built furnaces, unless the sawdust is so wet and the draft so poor that it would be necessary to use the wet tan furnace. 2. You say in answer to a correspondent that the S shape of a pipe between a steam governor and boiler is to hold water; is it absolutely necessary that it be bent at all? I see that the gage will work when there is nothing but steam in the pipe; but have not had time to experiment on it. A. 1. These remarks about burning sawdust will probably be very useful to many of our readers. 2. The object of having water in the pipe is to prevent the heating of the spring of the gage, which is apt to become injured if the steam is brought into direct contact with it.

M. H. says: I wish to place a fountain in front of my house, to throw a jet 3 or 4 feet high. How can it be worked? A. Probably your simplest plan will be to have a tank in an elevated position, such as the upper part of your house, to supply it.

P. & B. say: In a worm wheel and worm, the worm to be 8¼ inches on pitch line, and the wheel to be 30 inches diameter, with 4 inches face and 1 inch pitch. The tops of the teeth and bottom space are to be circled for worm to fit. Small sized wheels are made in this way, but we think it impossible to make so large a one as this. What do you think? A. It depends entirely upon your shop facilities.

L. C. D. asks: What do you mean by the mean pressure in pounds per square inch, in calculating the power of steam engines? A. The steam pressure in a cylinder ordinarily varies at different parts of the stroke, and the mean pressure per square inch during the stroke is the mean of all these various pressures.

T. C. H. asks: 1. How can I explode four blasting charges, placed 3 feet apart, at a depth of 12 feet, simultaneously, using either powder or dualin? 2. Will you give me a recipe for making and using dualin for blasting rock? 3. How many tons of gold and silver quartz will four stampers crush per day of 10 hours? 4. Is copper found in any kind of granite rock? A. 1. If you use powder, you must arrange the trains or fuses so that they will all explode at the same time. If dualin is used, it can be exploded by electricity. 2. Dualin is made from paper stock, saturated with nitrate of potassium, and dried in a furnace, then ground and mixed with nitro-glycerin. 3. They are made of different sizes. By writing to a manufacturer, you can obtain full information as to capacity. 4. We think not.

F. W. H. asks: How should files be properly tempered? A. In tempering files, it is necessary to make some provision so that the delicate teeth shall not be injured by the heat. The following method is frequently employed: The files are covered with some sticky substance, and drawn through common salt. They are then heated, until the salt just begins to melt, when they are plunged into cold water. This is an operation requiring care and experience, as the file is apt to become bent. It is finally cooled in oil, to prevent rusting.

F. B. asks: Do you know of a standard work on windmills? Could I construct a small one to drive a circular saw about 14 inches diameter? A. You will find information on this subject in Fairbairn's "Mills and Mill Work," Professor Rankines "Steam Engine and other Prime Movers," and Weisbach's "Mechanics and Engineering."

A. C. asks: What would be the value of a two carat diamond? A. It is difficult to give a general price for diamonds, as they vary much in quality. A good diamond weighing one carat, will cost, perhaps, two hundred dollars; one weighing two carats, from six to eight hundred dollars; three carats about one thousand dollars. We recently saw a very beautiful diamond, weighing nine and a half carats, which was valued at ten thousand dollars.

J. A. H. asks: How much engine power shall I require for a boat 28 feet long, 7 feet wide, to draw about 2 feet of water? I want to run it at 12 miles per hour. A. Probably from 25 to 30 horse power.

J. T. C. asks: What are the advantages or disadvantages connected with the use of superheated steam? A. Nearly any standard work on the steam engine treats of the subject. We could not discuss the matter intelligibly in this limited space.

J. R. asks: What would be a perpetual motion? Some say it is a machine that runs for ever without repairs, and others that it is a machine that creates its own power by itself, and starts itself. A. A perpetual motion machine, in the common acceptation of the term, is a contrivance that contains its motive power within itself. For instance, if a lathe, that was formerly driven by an engine, should suddenly start up without any assistance and continue to move, that would be a veritable case of perpetual motion.

J. B. B. asks: 1. What are the objections to using hydrogen, with or without oxygen, as a substitute for coal gas for illuminating purposes? 2. Does the gas produced by the decomposition of water by means of magneto-electricity contain an approximate equivalent of the power expended in producing it, in light, or potential power, if used in a gas engine? A. 1. We do not know of any objection to its use in connection with oxygen. Used by itself, it lacks illuminating power. 2. Yes.

W. L. B. asks: What will be the force be square inch upon a water pipe when the motion of the water is instantly stopped, the pipe being horizontal, 50 feet long and 2 feet in diameter, and filled with water under a pressure of 50 pounds per square inch, moving at the rate of 2 feet per second? What will be the force of the shock, if the water is instantly stopped, in pounds per square inch? A. Disregarding friction, the shock at the bottom of the pipe will be the same as that given by a trip hammer moving with the same velocity, and having a weight equal to the weight of water in the tube plus the weight due to the additional pressure of the water.

C. O. says: A friend has a mining operation in his control, which is now run by a twelve horse steam engine, which hoists a bucket of ore, weighing 600 lbs., 200 feet to the surface: it also works a lift pump rod 200 feet. He is going to sink the shaft 100 feet, making the total depth 300 feet. In discussing the feasibility of the 12 horse engine to perform the extra work, it was claimed by one of us that the extra work to be performed by the engine is merely the weight of the extra 100 feet of wire rope attached to the ore bucket and the extra weight of raising the 100 feet of water in the pipes, and that the engine would not feel any greater strain on its ability to do the work than it has at present. The other party claims that if it takes 12 horse power to raise 600 lbs. ore 200 feet, and to pump 200 feet water up through 200 feet of pipe, it will necessarily take 50 per cent more, or 18 horse power, to raise 600 lbs. of ore 300 feet, and to pump the water 300 feet. It was agreed to submit it to your decision, and to abide by it, the loser to pay one year's subscription to your journal. A. The very important question of time seems to have been lost sight of in this question. If 50 per cent more work is to be done in the same time, it will take 50 per cent more power, but if the work is to be increased 50 per cent, and the time is increased in the same proportion, the original power will suffice.

J. T. asks: 1. What is the best packing for a piston rod? The engine runs 120 revolutions per minute. 2. What makes a safety valve hang or stick, and prevents it blowing off? It is set to blow off at 100 lbs., but does not do it. If I push it up a little, it blows off right. A. 1. Probably an ordinary packing obtained from a reliable manufacturer will work satisfactorily. 2. From your statement, it would appear that the weight is not properly adjusted, since by raising the valve a little, you increase the area upon which the steam acts.

S. F. H. says: It is said that the same amount of water will drive a water wheel more powerfully in night time than in day time. Is it so? If so, why? A. We have never seen this statement verified.

J. S. P. asks: How can I season staves in a short time? A. There are quite a number of methods for seasoning timber rapidly, acting either on the principle of removing the sap, or forcing in some chemical that will coagulate the albumen. Creosote is used in England to a considerable extent.

J. E. B. asks: 1. Is it practicable to use the slide rest of a small lathe as a plane for light small work, brass and steel, by means of a tool set perpendicularly to the bed of the lathe? All motions of the lathe are given directly by hand. 2. Would such occasional use be apt to overstrain or rapidly wear out the feed screw, or the nut of the slide rest through which it passes? A. Such work is occasionally done on lathes, but it is apt to injure the slide rest.

R. M. R. says: I have an engine of 2 x 4 inches, set up to run a 10 inch swing lathe, and a grindstone. 1. Do you think the engine is large enough for the work? How many revolutions should it make per minute, and how heavy a pressure of steam will it require to do the work? 2. I have a boiler 10 x 20 inches with cast iron heads ⅝ inch thick, the shell being three sixteenths inch thick. I do not think it is large enough to run the engine, and the maker says that it would be unsafe to put tubes into the cast iron heads. Can you advise me what to do under the circumstances? A. 1. The engine might do the work, if run with a pressure of 50 or 60 lbs., at a speed of from 200 to 300 revolutions per minute. 2. Probably you cannot make the present boiler answer your purpose.

W. B. L.—To provide yourself with a mineral rod, cut a suitable forked sapling, and make it of weight and length to suit your hand. They are all alike, and are of no value.

C. M. asks: 1. What is the difference between chloride of lime and chloride of calcium? 2. What is the difference between washing soda and the soda used for making soda powders? 3. What is Spanish pepper? 4. How is gun cotton exploded? 5. What are the proportions of alcohol, ether and pyroxylin used in making collodion? 6. How is binoxide of manganese procured? 7. How can I make phosphide of calcium? A. 1. Chloride of lime is a misnomer. It consists of a mixture of hypochlorite of lime, chloride of calcium and water. Chloride of calcium is a combination of chlorine and calcium only, without the hypochlorite of lime, which gives to chloride of lime or bleaching powder its peculiar properties. 2. Washing soda is a monocarbonate of soda, containing but one equivalent of carbonic acid, while the other, called the bicarbonate, contains twice as much carbonic acid. 3. You probably mean Malegueta pepper, a name sometimes given to "grains of Paradise" or Guinea grains. 4. Gun cotton will explode at a heat of 300°. 5. Pyroxylin and rectified alcohol of each 1 part, rectified ether 19 parts. 6. It is an abundant mineral production, and is ground for use. 7. By passing the vapor of phosphorus over small fragments of lime, heated to redness in a porcelain tube. Use care.

T. D. McC. says: On page 385 of volume 29, you give a recipe for a fertilizer. How much should be applied per acre for potatoes; and how is it to be used, in the hill or broadcast? A. Either way, and the amount depends on the condition of your soil. Try a small quantity and increase as needed.

A. P. asks: 1. In the case of a book, what is protected by a copyright, the title or the whole mass of literary matter? 2. Must a book be completed as to printing, binding, etc., before being entered for copyright? 3. What are the conditions on which copyright protection is accorded to foreigners resident in the United States? A. 1. Copyright protects the printed matter as a whole. 2. No; only the title must be specified. 3. Authors of books, resident in the United States, can obtain copyright protection on the same conditions as citizens.

A. R. M. says that O. S., who enquired how to heat a house satisfactorily, should follow out carefully the plans and modification recommended by Ruttar in his work on ventilation. Proper heating is inseparably connected with proper ventilation. The "one large register over the furnace, which is in the cellar," should open into the hall; from the latter, transoms should be constructed so as to introduce the supply of heated air into the tops of adjacent rooms, while at the same time exhaustion should be provided below, either by means of open fire places (low down) into chimneys, or into a foul air duct running under the floors and leading to a common chimney. By this method an ample supply of pure, fresh and warm air may be obtained and a uniform temperature maintained. This plan has of late been very generally adopted in the West in new public and private buildings, and with most satisfactory results, both in an economical and sanative point of view.

W. J. asks: What are the methods of joining the rails at their ends on the best American and English railways? A. By rail joints and fish plates. Many kinds have been illustrated in our columns.

J. R. S. asks: What is the best way to smooth out engravings that have become wrinkled by being rolled and sent through the mail? A. Roll them the other way and then submit them to pressure.

W. W. says: I see you recommend your querists to use plaster of Paris for attaching the glasses of kerosene lamps to metal bases. For some years past I have used melted alum for this purpose. I put a piece of alum on to a fire shovel, lay the shovel on the fire till the alum is melted, and then apply with a thin piece of wood. It hardens in a few minutes and is far better than plaster of Paris, as kerosene will not loosen it.

G. writes to say that he has built several steam boats, and now owns one, which he considers to be nearer perfection than any he has yet seen. A description of it may answer the needs of some of our correspondents. She is built with double hull, or rather two half hulls, placed 8 feet apart and decked entirely over the space between the hulls, as well as over the hulls, on which are seats and a railing around the entire boat except the stern. The paddle wheel is between the hulls, towards the stern. The boat is very light and strong. The hulls are well fastened together, two inch beams running across both hulls, which are 35 feet long and of 3 feet beam. She is driven by a belt from a caloric engine, costing twenty cents per day to run it, and a boy 12 years old can fire up and run her. She carries, comfortably, 30 passengers; her speed is from 5 to 6 miles per hour. From this you will see that she possesses two desirable qualities in a pleasure yacht, economy and perfect safety.

M. D. asks: 1. If a cylinder 6 inches in diameter and 3 feet long (with an inch pipe attached to the bottom of the cylinder, passing thence down 20 feet below into water) be filled with steam and suddenly condensed, how full will the cylinder be of water? 2. How many cubic inches of water at 60° are required to condense a cubic foot of steam at 1 lb. pressure? 3. If a man covers an invention with a caveat and then manufactures and sells, and finds that he has a good thing, and a second party also sees that it is a good thing and manufactures and sells it, and then the first party gets it patented: Can the first party come down on the second party as soon as the patent is issued? 4. Can the first party claim that the second party infringed upon his rights, prior to the date of the patent? 5. Are small cast steel castings as strong and durable as wrought iron for trimming wood work? A. 1. We think it would be completely filled. 2. At least seven. 3. We think so. 4. No. 5. In general, no.

J. W. says: I am running two old boilers, and the steam from them enters into a boiler steam dome by means of 2 pipes. 1. I generally run them at 50 lbs. pressure by the gage on steam pipe to boiler, and my employer tells me there is only 25 lbs. on each boiler, because pipes from boiler to steam dome are double the area of steam pipe. Is he right? If a gage were placed on each boiler, would it not indicate 50 lbs.? 2. How would you fix 2 boilers so that the gage would indicate double the pressure on each boiler? 3. When my engine makes 100 revolutions per minute, with 2 feet stroke and 50 lbs. pressure, with no cut-off, how much water does she use, the cylinder being 10 inches diameter? A. 1. He is wrong. 2. You could make the gage indicate double the pressure by having a weak spring or by graduating it wrongly. 3. If the cylinder is 10 inches in diameter, and 2 feet stroke, its capacity in cubic feet, disregarding clearance, is about 1·09 cubic feet. A cubic foot of steam, at the given pressure, weighs about 0·15697 lbs. Hence, in each stroke, the engine uses about 1·09 × 2 × 0·15697 = 0·185 lbs. of water. This calculation does not take into account the steam required to fill the clearance spaces, and the losses from leakage, radiation and condensation.

M. says: In an inclined tunnel a full truck of wash dirt ascends while an empty truck descends. Sometimes the chain, which is attached to the whim and draws up the full truck, breaks, and consequently the truck dashes back and strikes against a stick of timber or some other obstacle underground. How can the loaded truck be prevented from running down the incline when the chain breaks? A. By having a stop arranged which will come into play when the chain breaks.

C. A. W. asks: How can I melt vulcanized rubber without injuring its qualities? A. This will have to be a matter of experiment. The vulcanized rubber can be exposed to heat in a suitable vessel without access of air. A safety tube should be attached to allow of the escape of any gas or vapor generated during the operation.

M. J. S. asks: 1. What is the proportion of mercury necessary to make a perfect zinc for a Bunsen battery? 2. What are the ingredients of hair dye? Is it injurious to the head? 3. There is a powder, sold under the name of kerosene oil rectifier, which is said to prevent the lamp from exploding or the chimney from breaking. Is it good for anything? A. 1. To amalgamate a zinc plate for a battery, wet with dilute sulphuric acid and then rub mercury over the surface till a bright coating is produced. 2. The numerous preparations sold as hair dye have generally a basis of lead or silver. Bismuth, pyrogallic acid and certain astringent vegetable juices are also sometimes used. When properly applied, we have never heard that they are particularly injurious to the hair. 3. Do not trust any powder sold for the purpose of rendering impure kerosene inexplosive. Buy only the best oil from the best makers. Good kerosene is not explosive and will not readily take fire. The only way to prevent lamp chimneys from breaking from heat is to see that they are properly annealed. This can be done by placing the chimney in cold water, which is to be gradually brought to the boiling point and then slowly allowed to cool, when the chimney is removed.

C. C. A. asks: 1. Are nickel five cent pieces specie? 2. Does the government issue the old fashioned five cent silver coin? 3. Of what power is the engine at the Chicago water works? A. 1. All solid coin that has passed through the mint is specie. 2. Not at present. 3. Probably over a thousand horse power.

L. F. J. asks: Are eye stones alive or not? My opponent claims that they are, because some will move while others will not, and I claim that they cannot be alive, for the reason that the treatment they undergo, being taken from the open air and corked in air-tight vessels, is in opposition to every law of animate creation. The particular ones under discussion have been kept corked up in glass bottles for over thirty years. A. Eye stones are simply bits of smooth pebbles, and when placed in the eye, are made to move about by the involuntary motions of the eyeball. Any specks in the eye stick to the stone when they come in contact with it. There is no more life in the eye stone than in any other piece of rock.

C. W. H. asks: Suppose a section of exhaust pipe be made of alternate joints of charcoal iron and common iron will the charcoal last longer than the common iron? If so, why? A. Probably the charcoal iron, being more homogeneous will last the longer.

X asks: How can I make a spectroscope? I have a double convex lens, a flint glass prism, and an achromatic telescope with a glass 1¾ inches in diameter. Will the lens and telescope answer? If so, how shall I arrange them with regard to the slit, etc.? A. You can make a spectroscope with one telescope, but it will not be a very efficient instrument. We advise you to look up the subject in some standard work, such as Ganot's "Physics."

D. N. B. asks: Is there a small water wheel built to use as little as 8 gallons water per minute? A. You can easily make one of tin.

O. C. H. asks: How can I gild letters on marble? A. Apply first a coating of size, and then several successive coats of size thickened with finely powdered whiting, until a good face is produced. Be sure to let each coat become dry, and rub it smooth with fine glass paper before applying the next. Then go over it thinly and evenly with gold size and apply the gold leaf, burnishing with an agate. Several coats of leaf will be necessary to give a good effect.

W. W. asks: When were the first iron vessels built? A. The first iron vessels were three steamers, built for the trade between Liverpool and Glasgow, by Mr. William Fairbairn, in 1830-31.

J. A. V. says, in reply to several correspondents who have asked about echoes in buildings: It has been mentioned in the SCIENTIFIC AMERICAN that echoes in rooms were prevented in England by stretching wires across the room, 6 inches apart. Our judiciary tried it in the county court room, but failed, as the distance between wires was at least 4 feet. It is very probable that, at 6 inches and in a horizontal zone, as you suggest, the vibration of the wire will stop the reverberation from the ceiling; but it will not prevent the horizontal reflection against side walls and the surfaces opposite and to the rear of the pulpit. The remedy in this case is to raise the seats gradually as in the parquets of theaters, and have the rear seat at least as high as the mouth of the speaker. A simple remedy, for a plain meeting room, is to canvas the walls and ceilings on half inch strips of wood, and paper them in imitation of fresco. The window glass opposite the speaker should be covered with shades or blinds.

H. G. C. says that C. M. A. will find that one great cause of the unsteady flame in his German study lamp will be that burned particles of wick adhere to the edge of the metallic rim which surrounds the flame and the one which is inside the wick. These particles flame up and go out with great rapidity and often make the light useless. The rims must be cleaned frequently. Another reason is that sometimes the waste oil fills up the cup at the bottom, cutting off the supply of air. Good chimney, clean lamp, and evenly trimmed wick will give good light if the lamp is all right.

J. H. P. says that J. F. W., who asked how to straighten vulcanite squares, should warm them carefully and place them between two perfectly smooth surfaces, applying considerable pressure, and leave them till cold. If the surfaces be true, the squares will be true also.

C. H. H. says that J. K. W., who has difficulty in using sawdust as fuel, should build his furnaces after the following plan: Space for cold air to enter each furnace, 20 x 36 inches. Space between boilers and bridge wall, 10 inches. Size of smoke stack for each boiler, 23 inches x 36 feet. Do not fill up the chamber behind the bridge wall.

J. B. says, in reply to C. R., who asked as to a race between the Niagara and the Agamemnon: Such a race took place the morning after the first Atlantic cable parted. The accident occurred about 3 A. M., a little after sunrise. "We all started back to England; at 12 M. we could just see the Agamemnon's topsail yards above the horizon astern."

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

C. C. A.—1. The mineral enclosed is iron pyrites or sulphide of iron; of no value unless found in large quantities. Pyrites is so called from a Greek word meaning fire, because it will strike fire with steel.

C. R.—This mineral is a mixture of two ores of copper. The green colored portion is the carbonate of copper, and the dark bronze parts the sulphuret of copper. We cannot give its relative value without particulars as to location and accessibility.

O. D. asks: What is the double royal cubit of the Temple of Karnak?—T. G. asks: Can you inform me how the chocolate colored stain is produced on Swiss wood ornaments?—E. L. A. asks: How can I reduce bone to a plastic state, and what will bleach it so that it will look like ivory?—A. R. asks: Is there anything that will make cotton goods take dye as readily as silk and wool do?—J. A. F. asks: How can I whiten piano keys?

COMMUNICATIONS RECEIVED.

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

On a Sore Throat Remedy. By S. C. E.

On Mysterious Rappings. By A. F. C.

On Ignition by Compressed Air. By C. C. A.

On Red Ants. By A. S.

On Ventilating the Senate House. By W. McK.

On Animal Electricity and Magnetism. By J. H.

On Friction Gears. By B. N. O.

Also enquiries from the following:

A. C.—T. G. Y.—T. B. W.—T. W.—W. M. D.—J. C. C.—T.—N. L.—H. R. T.—J. M.—O. R.—G. W. K.—W. H.—J. H. C.—J. M. F.—C. S. N.—C. H.—G. W. M.

Correspondents in different parts of the country ask Who makes metal mail boxes, to put on gate posts, etc.? Where can pin-making machines be obtained? Who makes the cheapest and most durable local telegraph battery? Where can I obtain a small printing press for amateur use? Who makes machinery for blocking tin and galvanized iron, for cornices and other ornamental work? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal" which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

December 23, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Respirator, B. W. James 145,874
Rigging, fair leader for ship's, J. J. Walton 145,919
Rigging stopper, T. G. Bell 145,833
Roadways, etc., removing snow, M. C. Rogers, (r) 5,697
Roadways, etc., removing snow, C. G. Waterbury 145,822
Rod, connecting, T. T. Prosser 145,752
Rod, connecting, W. L. Switzer 145,917
Safe, fireproof, Sontag & Lotz 145,716
Sash cord guide, W. M. Griscom 145,863
Saw set, R. F. Cook 145,724
Screw threads, forming, Neuber & Perry 145,893
Scrubbing machine, W. J. Gard 145,796
Sewing machine, C. H. Palmer 145,814
Sewing machine, T. A. Weber 145,823
Sewing machine quilter, F. G. Buschmeier 145,841
Sewing stand, Fling & Land 145,858
Shearing sheep, device for, A. J. Fullam, (r) 5,701
Shoe fastening, S. Babbitt 145,776
Shutter fastening, H. H. Miner 145,888
Sieve, G. Wright 145,924
Skate, J. Forbes, (r) 5,705
Skate, roller, W. P. Gregg, (r) 5,707
Skylight, G. Hayes, (r) 5,693
Sofa, chair, etc., A. S. Newhouse 145,811
Spading machine, J. G. Jones 145,737
Spinning ring, W. Jenckes (r) 5,702
Spring brace for vehicles, C. V. M. Suydam 145,916
Square, try, L. Bailey 145,715
Stalks, apparatus for binding, S. Kuh 145,739
Stirrup, A. J. Herring 145,869
Stove, heating, I. G. Macfarlane 145,744
Tack puller, C. W. Blakeslee 145,837
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Toy gun, Mills & Wolfe 145,745
Toy money box, J. Hall 145,734
Toy pistol or gun, G. S. Hastings 145,798
Trap, fly, G. W. Eichholtz 145,791
Umbrella, G. G. Griswold 145,737
Umbrella, L. Sawyer 145,904
Valve, G. R. Crane 145,789
Valve, safety, Jordan & Paul 145,876
Vehicle wheel, D. Brown 145,783
Ventilating car windows, C. B. Knevals 145,805
Ventilator, car, M. T. Hitchcock 145,871
Ventilator, railroad car, J. D. Simmons 145,760
Wagons, unloading corn from, T. Barron 145,779
Washer, ore, S. Wheeler 145,771
Washing machine, M. L. Hawks 145,779
Washing machine, S. Short 145,911
Water meter, diaphragm, D. B. Spooner 145,762
Water wheel, J. Kunkle 145,740
Weather guard, J. Pease 145,750
Weather strip, O. Vorce 145,839
Whalebone splitting machine, D. Warner 145,770
Whiffletree, H. Agar 145,826
Whip sockets, clamping, E. Chamberlin (r) 5,698
Whip sockets, clamping, E. Chamberlin (r) 5,699
Whip sockets, clamping, E. Chamberlin (r) 5,700
Windlass, W. H. Harfield 145,866
Windmill, Crossman & Spicer (r) 5,692
Windmill, Keeler & Harris 145,877
Windmill regulator, D. C. Stover 145,765
Window blind slat operator, E. C. Byam 145,842
Window guard, J. W. White 145,773
Wind wheel, Brand *et al.* 145,782
Wire, nippers for twisting, J. W. Fry 145,794
Wood to imitate slate, J. O. Froshaug 145,859

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:

27,603.—WRINGING MACHINE.—S. A. Bailey. March 11.
27,620.—SEWING MACHINE STITCH.—J. Davis. March 11.
27,631.—TOBACCO SCREW.—N. Hoag *et al.* March 11.
27,624.—PLOW.—G. W. Hunt. March 11.
27,735.—GRINDING MILL.—E. Munson. March 18.

EXTENSIONS GRANTED.

26,564.—CARRIAGE TOP PROP.—G. Cook *et al.*
26,582.—HARVESTER.—J. Gore.
26,584.—PLANING CURVED SURFACES.—J. B. Grosvenor.
26,599.—HORSE HAY RAKE.—S. Lessig.
26,614.—POROUS WARE.—B. S. Pierce *et al.*
26,627.—LATHE FOR CUTTING VENEERS.—B. F. Sturtevant.

DISCLAIMERS.

26,564.—HARVESTER.—J. Gore.
26,627.—LATHE FOR CUTTING VENEERS.—B. F. Sturtevant

DESIGNS PATENTED.

7,068.—KNOB ROSE AND ESCUTCHEON.—W. Gorman, New Britain, Conn.
7,069 & 7,070.—CANISTERS.—S. A. Ilsley, Brooklyn, N. Y.
7,071.—HARNESS TRIMMINGS.—H. Hoyer, New York city.
7,072 to 7,074.—PRINTING TYPES.—W. H. Page, Norwich, Conn.
7,075.—DRAWER PULL.—A. Shepard, Southington, Conn.
7,076.—LOCK CASE.—L. Widmayer, New Britain, Conn.

TRADE MARKS REGISTERED.

1,578 to 1,580.—HATS.—O. Benedict & Co., Bethel, Conn.
1,581.—FERTILIZER.—Loreta *et al.*, Baltimore, Md.
1,582 & 1,583.—EXPLOSIVE COMPOUNDS.—Giant Powder Co. *et al.*, San Francisco, Cal.
1,584.—MOTTO PAPERS.—T. Van Skelline, Brooklyn, N.Y.
1,585.—ANILINE DYES.—Wells & Co., Burlington, Vt.
1,586.—SOAP.—J. Eavenson & Sons, Philadelphia, Pa.
1,587.—LINIMENT.—W. Kidder, Goffstown, N.H.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
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On appeal to Commissioner of Patents	$20
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VALUE OF PATENTS,
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Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent, even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

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HOW TO OBTAIN PATENTS

This 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, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

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

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money after 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.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000, and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Caveats.

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

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of fomer, 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, New York.

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Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

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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, opinions, and advice, *no charge is made*. Write plain; do not use pencil or pale ink; be brief.

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PATENTS are now granted to inventors in Canada, without distinction as to the nationality of the applicant. The proceedings to obtain patents in Canada are nearly the same as in the United States. The applicant is required to furnish a model, with specification and drawings in duplicate. It is also necessary for him to sign and make affidavit to the originality of the invention.

The total expense, in ordinary cases, to apply for a Canadian patent, is $75, U. S. currency. This includes the government fees for the first five years, and also our (Munn & Co.'s) charges for preparing drawings, specifications and papers, and attending to the entire business. The holder of the patent is entitled to two extensions of the patent, each for five years, making fifteen years in all.

If the inventor assigns the patent, the assignee enjoys all the rights of the inventor.

A small working model must be furnished, made to any convenient scale. The dimensions of the model should not exceed twelve inches.

If the invention consists of a composition of matter, samples of the composition, and also of the several ingredients, must be furnished.

Persons who desire to apply for patents in Canada are requested to send to us (MUNN & Co.), by express, a model with a description, in their own language, showing the merits and operation of the invention, remitting also the fees as above for such term for the patent as they may elect. We will then immediately prepare the drawings and specification, and send the latter to the applicant for his examination, signature, and affidavit. It requires from four to twelve weeks' time, after completion of the papers, to obtain the decision of the Canadian Patent Office. Remit the fees by check, draft, or Postal order. Do not send the money in the box with model. Give us your name in full, middle name included.

Inventions that have already been patented in the United States for not more than one year may also be patented in Canada.

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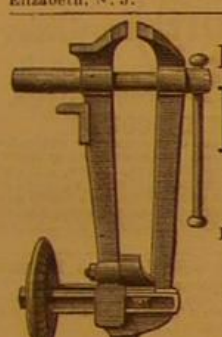

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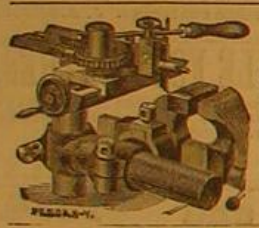

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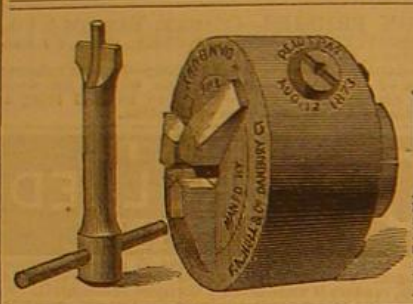

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