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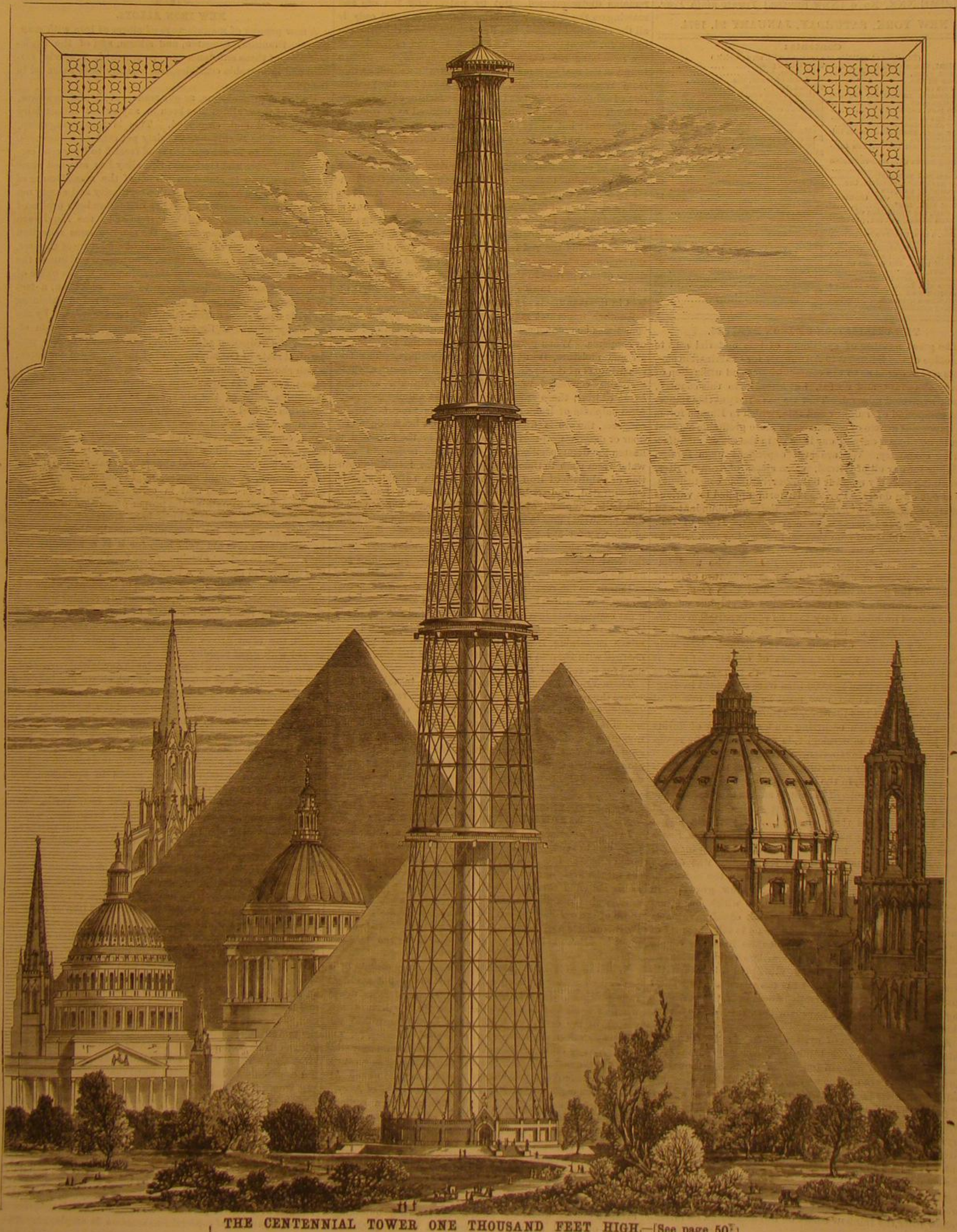

THE CENTENNIAL TOWER ONE THOUSAND FEET HIGH.—[See page 50.]

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Contents:

(Illustrated articles are marked with an asterisk.)

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 crystallization, 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 crystallized. 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 requirements, 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.

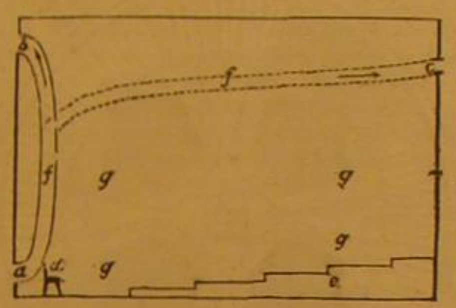
Graham and Liebig have pointed out that the mean amount of oxygen in the atmosphere is 20·9 volumes per cent, leaving a balance of 79·1 nitrogen, carbonic acid, and other constituents. The normal quantity of carbonic acid gas is, however, very small, and is estimated by De Saussure at 4 parts in 10,000. 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:

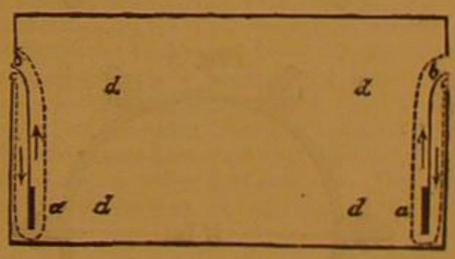
(1) Rooms 18 by 16 feet: 42 scholars; temperature, 62° Fah.; carbonic acid in 10,000 parts, 26·1, or 6·6 times the normal amount. The air was described by the inmates as generally oppressive. (2) Large class room, 20x18 feet: Odor very foul; 47 scholars; 4 times the normal amount. (3) Class room on top 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 *e*. 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.

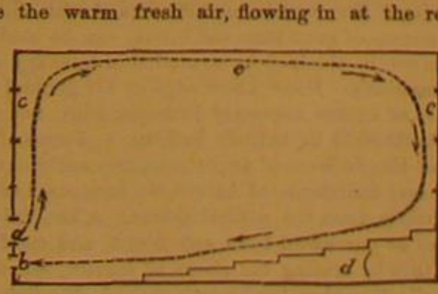
Example 6 consists in analyses made in a room heated by steam; teacher and children all complaining. The temperature was 60°, and 8·3 times the normal proportion of carbonic acid was indicated. Passing over succeeding tests, none of which show a larger percentage of carbonic acid than last mentioned, 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, 42 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.

Fig. 3

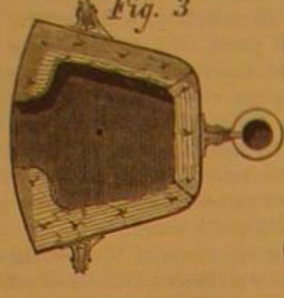


Fig. 4

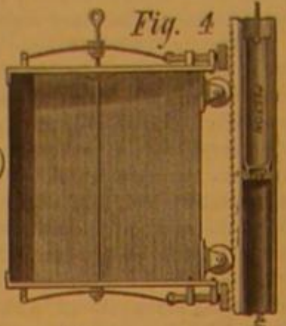
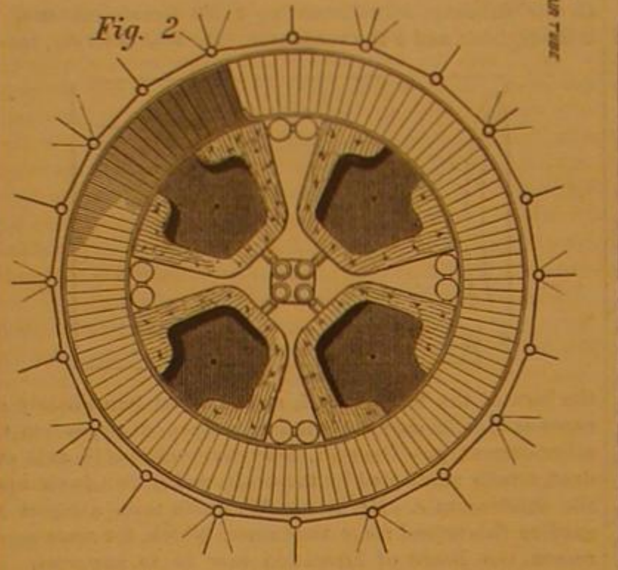


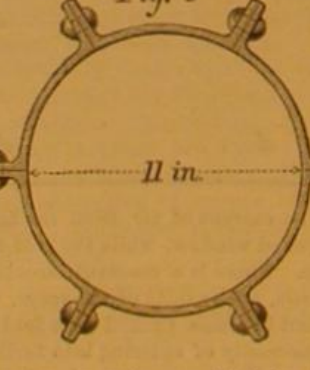
Fig. 2



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

Fig. 6

Fig. 5



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.

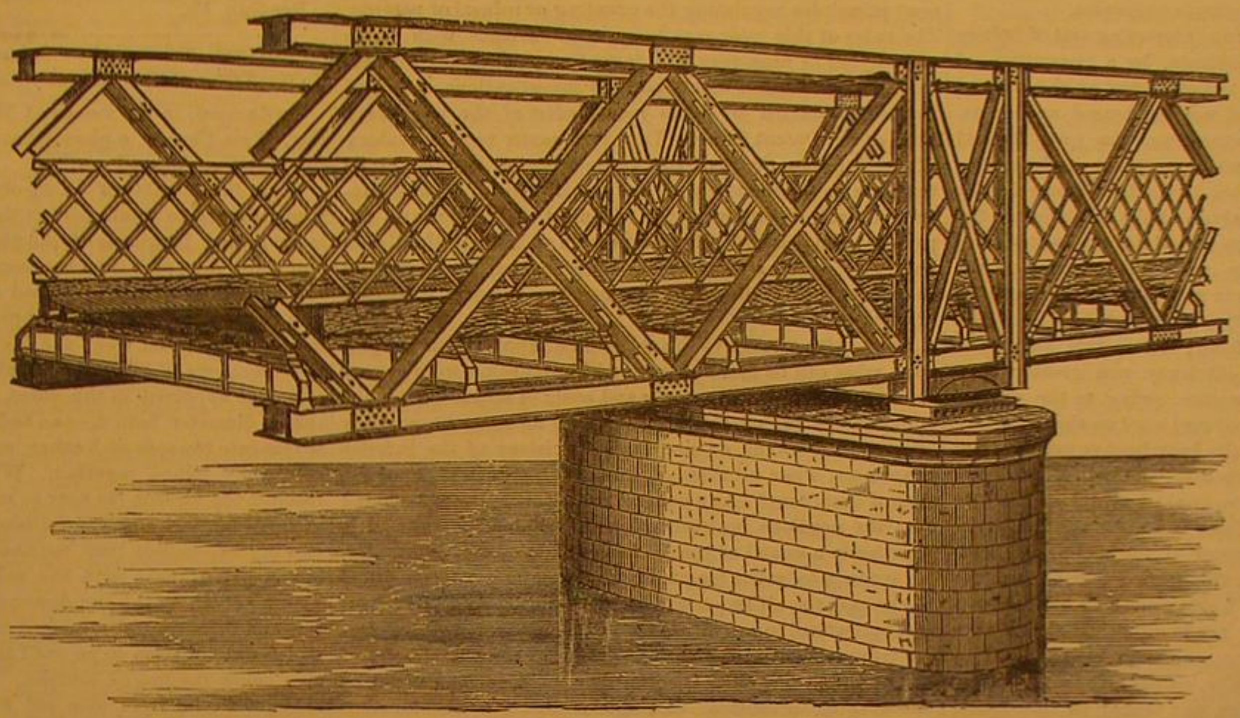
RECENT IRON BRIDGE CONSTRUCTION.

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.

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.



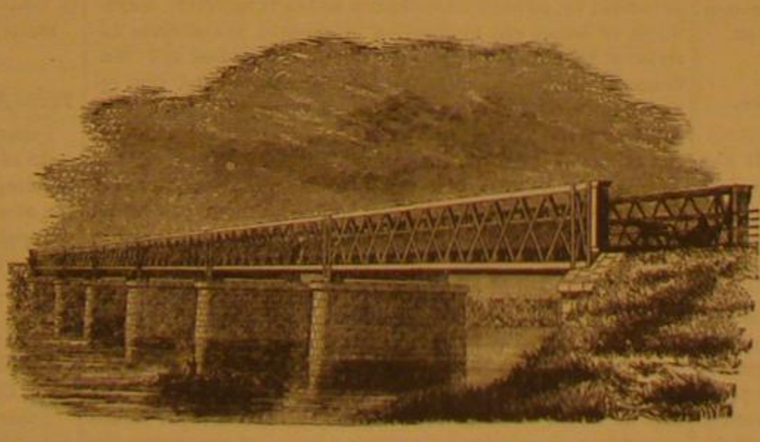
SECTION AND GIRDER OF IRON BRIDGE, CZERNOWITZ, AUSTRIA.

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.

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.



IRON BRIDGE AT CZERNOWITZ, AUSTRIA.

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 $23·25 \div 60 = 0·3375$ pounds, so that $0·3375 \times 1166·1 = 393·56$ 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 $393·56 \times 772 = 303{,}828·32$ foot pounds, or $303{,}828·32 \div 33{,}000 = 9·21$ 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 $(1 \times 100) \div 9·21 = 10·86$ 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 n 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 × 10 × 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, $\frac{1}{2}$ 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 83 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.

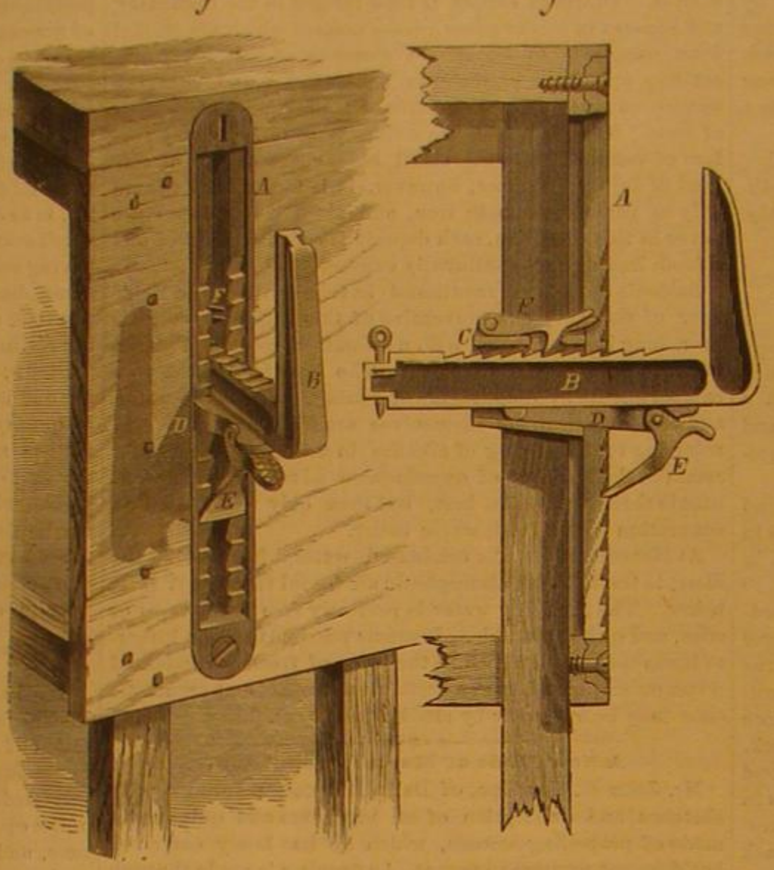
WARDWELL'S ADJUSTABLE BENCH JACK.

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.

Fig.1 *Fig.2*



WARDWELL'S ADJUSTABLE BENCH JACK.

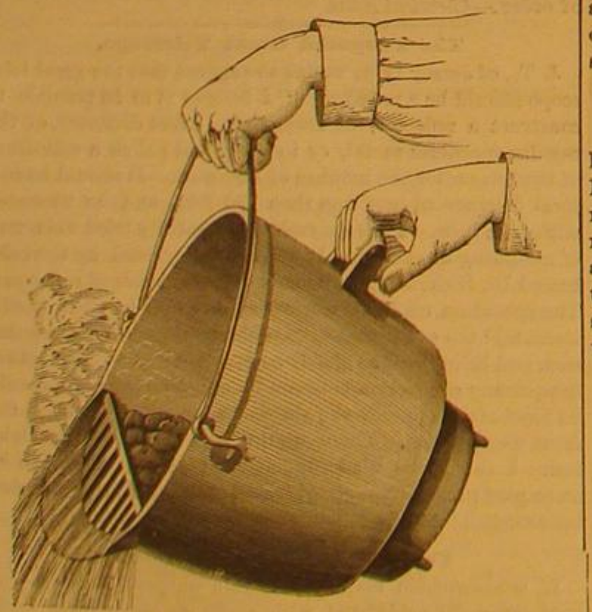
When desired, two or more of the jacks may be attached to the bench at different distances from the vise, so as to accommodate long or short work. But a single set of the smaller working portions need, in this case, be employed, as they can be readily removed and shifted from one bar to the other, and 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.

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



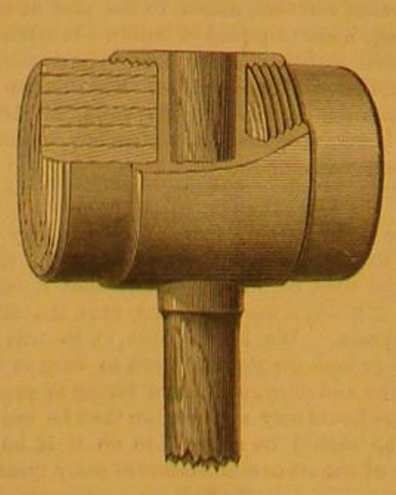
each other at their inner ends. These bars are made in triangular form, and, while offering the least possible obstruction to the escaping liquid, serve to hold the cooked substance within the pot. A handle is provided on the rear side for convenience in tipping. In other respects, the vessel is of the ordinary description in common use.

Yankee Notions.

Incited thereto by certain domestic annoyances, classed here under the generic title of "servant-galism," 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.

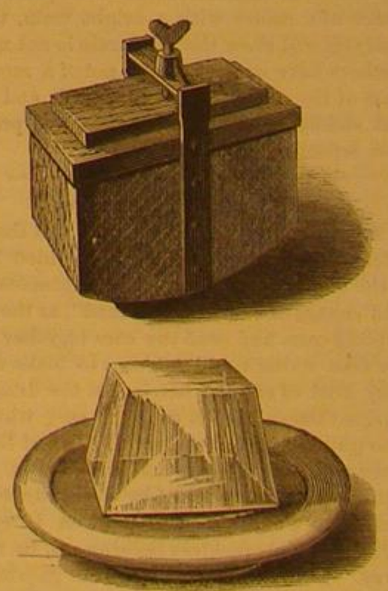
A rule, or custom, obtains on board Norwegian ships, known as skamfjelding, which is simply this: Every morning at daylight, as soon as the decks are washed down, the officer in charge details each individual of his watch to some particular part of the ship, skampfjelding: Johannis goes over the mainmast 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 $1\frac{1}{4}$ 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 chemiical. 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 ta ken 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, Lobos island, Viejas Island, Lobillo Island, Huanillo Island, Huanillo Point, White Point, Pabollon de Pica, and Chipana 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 *vid* 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 headed 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 shelf, 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, Kitzingen, 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 disselution 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 lps 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 Urinal.

John C. Garnsey, 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.

Mordeca H. Heyman, 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 calculated to give the best results in respect of power.

Business and Personal.

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 50 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 ¾ 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 *rhodorisa*, 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 ½ more grate surface than for wood; and if the grate bars are cast in half cylinders of 6 inches diameter, full of ½ or ⅜ 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 8½ 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 Rankine's "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 ⅜ 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 3 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 30 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 $1{\cdot}09 \times 2 \times 0{\cdot}15697 = 0{\cdot}185$ 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 airtight 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 1½ 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 28 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. V.—T. B. W.—T. W.—W. M. D.—J. C. C.—T.—N. L.—H. H. 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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Bedstead, sofa, E. Lord	145,741
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Shoe fastening, S. Babbitt	145,776
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Sieve, G. Wright	145,924
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Skylight, G. Hayes, (r)	5,693
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Spading machine, J. G. Jones	145,737
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Toy gun, Mills & Wolfe	145,745
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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:

27,609.—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.

26,582.—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.—R. 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.—Loretz *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
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

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. 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.

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, 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 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.

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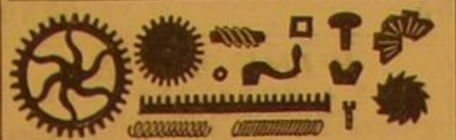

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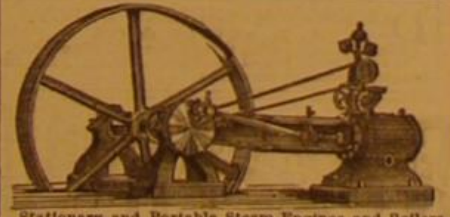

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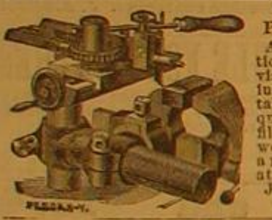

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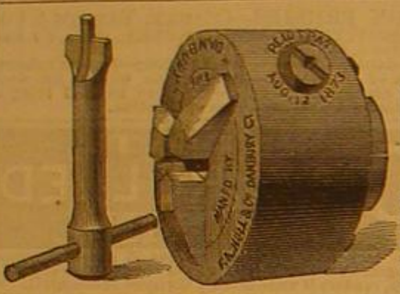

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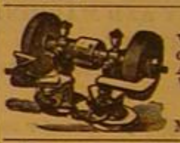

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