SCIENTIFIC AMERICAN

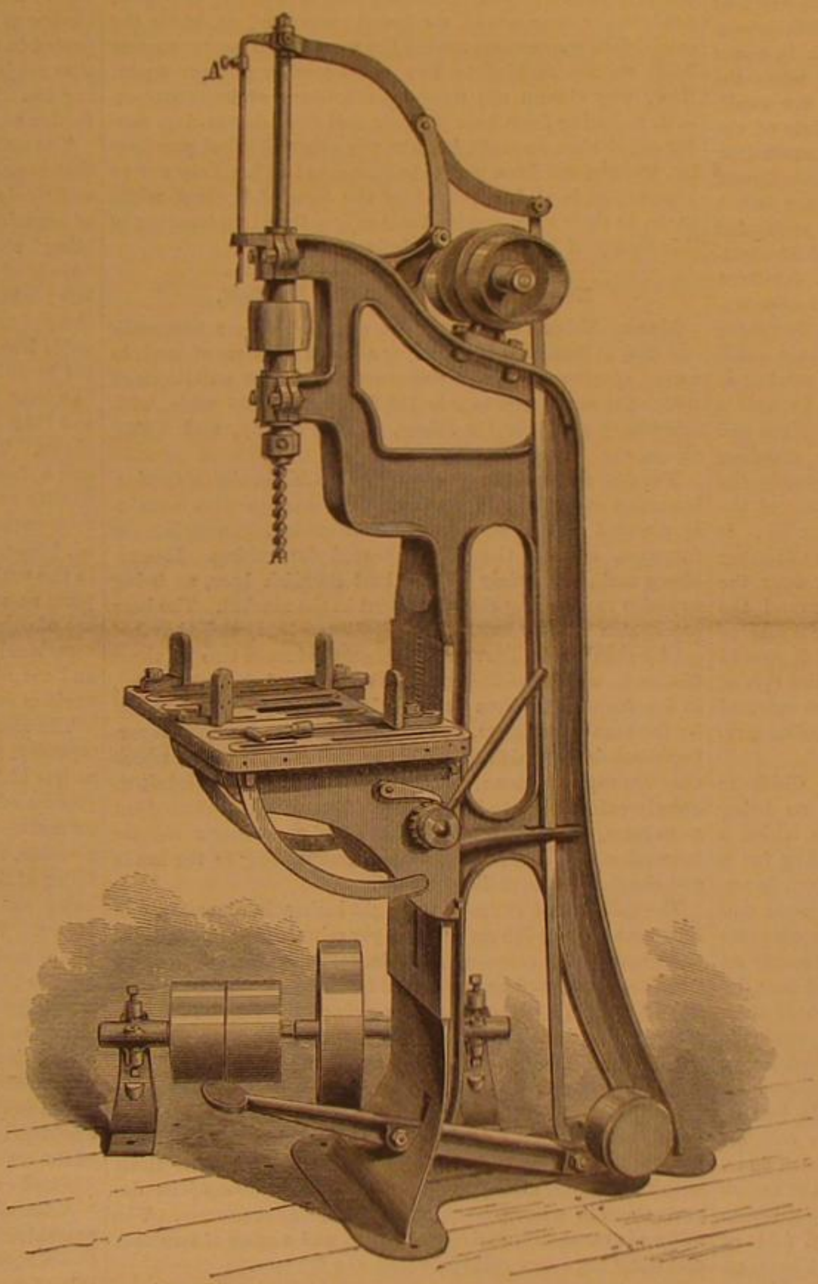
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXVII.--No. 21. [NEW SERIES.] NEW YORK, NOVEMBER 23, 1872. [$3 per Annum, IN ADVANCE.

UPRIGHT BORING MACHINE.

We illustrate herewith an upright boring machine of a new and improved construction, designed and constructed by one of the largest and best tool manufacturers of the West. The engraving presents the different parts with such clearness that it is hardly necessary to enter into any detailed description of the mechanism, and therefore we confine ourselves to calling the attention of the reader to the special points of advantage claimed. The steel mandrel of 1½ inches in diameter, which can be made to bore to a depth of 14 inches, is connected with the treadle, and the bit is thus brought down the desired distance. The bit is readily changed and adjusted; its return or upward motion is caused by the weight, placed in a convenient position at the bottom of the machine. The table is gibbed to the frame, can be placed to bore at any angle, and may be raised or lowered through a distance of twenty-two inches by means of a suitably arranged rack and pinion. At A is shown a small movable sleeve attached by a thumbscrew to the vertical rod; this, fastened at any point on the latter, serves as a gage to regulate the depth of the orifice to be bored. The belt communicating power passes over one of the idlers shown, then around the vertical pulley and back over the other idler.

For further particulars address the manufacturers, Messrs. McBeth, Bentel & Margedant, Hamilton, Ohio.



UPRIGHT BORING MACHINE.

Cheap Saline Disinfectants.

Professor Sidney W. Rich, on the experience derived from a large amount of experimental labor devoted to a study of the relative power of various salts when applied to animal and vegetable solids and fluids, and also to sewage, states that the greatest efficacy and general applicability will be found in a solution containing hydrochlorate of alumina with a small quantity of chloride of iron. The hydrochlorate of alumina will serve to do the general work of a disinfectant and antiseptic, while the iron salt will absorb the sulphuretted compounds which arise from the decomposition of some kinds of organic matter.

The chloride of calcium is the cheapest, inasmuch as it is a waste product in all alkali works. In this particular, hydrochlorate of alumina will, however, be able to compare favorably in the future, as the result of late improvements in the manufacture of alum will be to cause the manufacture of large quantities as a waste product.

In recommending chloride of calcium as a disinfectant, Mr. Stanford recommends that the solution should contain 25 per cent of the solid salt, acidified with 12 per cent of hydrochloric acid. Certainly, such a solution would have a considerable disinfecting power, but most chemists would attribute this to the hydrochloric acid. Moreover, a solution containing 12 per cent of hydrochloric acid would be a very disagreeable fluid for ordinary purposes.

German Machinery at Vienna.

There will be 58 firms exhibiting prime movers, steam generators, boilers, steam engines, turbines, etc.; of transmission machines, etc., 24; machinery for metallurgy and metal work, 68; wood-working machinery, 17; machines for spinning, weaving, knitting, and embroidering, etc., 78; for the manufacture of paper and printing machines, 60; machines and apparatus for sugar-making, 26; distillery and brewery machines, etc., 60; machines for mining, etc., in particular, 24; exhibitors of sewing machines, etc., 55; of agricultural machines, 125; machines for army purposes, pumps, etc., will be exhibited by 50 firms; other kinds of machinery and apparatus, which cannot be specially classified, will be represented by 45 firms. The exhibition of fire engines, etc., embraces 42 exhibitors, and street locomotives, 39 firms. Lastly, there will be 42 firms exhibiting railway material, such as locomotives, wagons, trucks, etc. The total number of German exhibitors in group 13 (Machinery Exhibits) is 763.

Indian Tea vs. Chinese Tea.

A Glasgow correspondent furnishes the following on this subject, testifying to the purity of Indian tea:

"During a sojourn of several years among the tea districts of India, I visited scores of the tea plantations, and saw the tea leaf undergoing the various processes of manufacture, from the green state as it comes from the shrubs to the final drying and packing, and I have never seen a leaf other than that of the tea shrub being converted into tea." The correspondent of the London *Grocer* further says: "I have forwarded from 70,000 to 80,000 chests of tea for shipment to this country, and can safely affirm that not one of them contained an ounce of anything other than the pure tea made from the leaf of the tea shrub. Last year 16,000,000 lbs. of tea were sent from India to this country, and it is expected that the crop this season will be nearly 20,000,000 lbs. In the London market, to which all tea for this country both from China or India is now sent for sale, the price of Indian tea is 50 per cent higher than China tea. The Indian tea possesses nearly double the strength of the Chinese article, and it is principally used by tea merchants and grocers for mixing with China tea to give strength and flavor to the latter. Most of the China tea sold in the London market sells at 1s. or 1s. 6d. per lb., exclusive of the duty of 6d. per lb.; while scarcely a chest of Indian congou sells so low as 1s. 6d., and Souchong and Pekoe realize 2s. to 3s. 6d. per lb. without duty. China tea is retailed at 1 1-2d. to 2 1-2d. per ounce; Indian tea at 3d. to 4d. Green teas are almost exclusively the production of China. I have never seen green tea made at any of the tea plantations in India which I have visited. I believe, however, that a limited quantity of green tea is manufactured at some of the tea plantations on the Himalayas, but it is mostly sold to traders from Turkestan and Thibet, and only the surplus is sent to this country. It pays the tea planter to make his tea leaf into black tea rather than green. Tea drinkers in this country who prefer green tea must therefore be content with the product of Chinese ingenuity, and be satisfied to drink the compound of tea, turmeric, Prussian blue, China clay, etc., prepared for the British "barbarians." It is different, however, with respect to black tea, as we are no longer altogether dependent upon China for a supply, and pure Indian tea can now be obtained from most of the principal tea merchants and grocers. The consumer has only to ask for and obtain unmixed Indian tea in order to be able to enjoy the luxury of a cup of genuine tea."

A POOR man wants something, a covetous man wants all things

Pneumatic Method of Preventing Explosions in Coal Mines.

Diminished atmospheric pressure is frequently followed by the escape of fire damp into the workings of a colliery. To obviate the risk incurred by such barometrical changes, I propose, says Professor J. A. R. Newlands, in the *Chemical News*, that artificial means should be adopted, so as to maintain the atmospheric pressure within a given mine always at one and the same level, and also, if desired, to work under a somewhat increased atmospheric pressure. Taking the case of a mine having a downcast and an upcast shaft, the mouth of each of these should be covered over by an air-tight chamber, capable of withstanding a moderate pressure either from within or without. This air-tight chamber might be conveniently constructed of sheet iron, provided with thick glass windows; it should also be made sufficiently large to admit of all the usual operations at the pit's mouth being conducted within it. The shaft of the engine used for raising coal would pass through the sides of this air-tight chamber, so as to move the necessary hoisting apparatus within. Connected with this air-tight chamber an air-tight room should be constructed, provided with two sliding doors, the inner door separating it from the air-tight chamber, and the outer door preventing contact with the external atmosphere. It will be seen at a glance that, when the outer door of the room is shut and the inner open, the room becomes part and parcel of the air-tight chamber, so that any truck laden with coal might be run from the air-tight chamber into the room, and then (by closing the inner door of the room and opening the outer) on to the ground surrounding the pit's mouth, without sensibly altering the pressure within the pit itself.

To produce the requisite current of air for ventilating the pit, the air-tight chamber over the downcast shaft should be connected with powerful air pumps, worked by steam, so that a continuous current of fresh air might be forced through all the workings of the pit before finally escaping through a pressure valve from the air-tight chamber over the upcast shaft. Any required degree of ventilation, or of increased atmospheric pressure, could thus be produced within the pit. As no fire would be wanted in the upcast shaft, it would be available for hoisting coal, etc. The air supplied to the mine might, if required, be easily cooled, by compressing it in cylinders surrounded with cold water before allowing it to pass into the pit, and thus the temperature of the pit might be reduced to any extent. The air issuing from the pit should be chemically tested at stated hours, and whenever the fire damp appeared to be increasing the men and horses should be brought up, and the air pumps should be employed in drawing air out of the mine, so as to diminish the pressure within, and thus cause any imprisoned marsh gas to be brought out of its hiding place. After keeping the mine under diminished pressure for some hours, a rapid current of air should be driven through the workings, and when—by testing the air passing through the escape valve—it was found to be nearly pure, operations could be safely recommenced.

Prizes for Improved Cabs.

The English Society for the Encouragement of Arts, Manufactures and Commerce offer the following prizes: One prize of £60 ($290 gold) for the best improved cab of any description. Two prizes of £20 ($97) each for the next two best. Two prizes of £10 each for the next two best. The competing cabs must be exhibited at the International Exhibition, to be held in South Kensington, London, in 1873, and, on their delivery at the Exhibition Building, they must be certified to the satisfaction of the Judge as having been in regular use in the streets of some city or town either in the United Kingdom or abroad for three months previously. They must be delivered on or before the first Saturday in April 1873.

The Society points out the following defects in the cabs of London, which should be especially remembered: Want of room, both as regards four wheelers as well as the Hansoms. The seats in the four wheelers are too high, not commodiously made, and the space underneath is lost. Difficulty of getting in and out of the Hansom, by reason of the hight of the step as well as the interference of the large wheels. The arrangements for opening and closing the window and the confined space and want of ventilation when the window is closed. Lastly, imperfect locking of the wheels in four wheelers.

ON INSTINCT.

[Paper read before the British Association, by D. A. Spalding.]

With regard to instinct, we have yet to ascertain the facts. Do the animals exhibit untaught skill and innate knowledge? May not the supposed examples of instinct be after all but the results of rapid learning and imitation? The controversy on this subject has been chiefly concerning the perceptions of distance and direction by the eye and the ear. Against the instinctive character of these perceptions it is argued that, as distance means movement, locomotion, the very essence of the idea is such as cannot be taken in by the eye or ear; that what the varying sensations of sight and hearing correspond to, must be got at by moving over the ground by experience. The results, however, of experiments on chickens were wholly in favor of the instinctive nature of these perceptions. Chickens, kept in a state of blindness by various devices from one to three days, when placed in the light under a set of carefully prepared conditions, gave conclusive evidence against the theory that the perceptions of distance and direction by the eye are the result of associations formed in the experience of each individual life. Often, at the end of two minutes, they followed with their eyes the movements of crawling insects, turning their heads with all the precision of an old fowl. In from two to fifteen minutes they pecked at some object, showing not merely an instinctive perception of distance, but an original ability to measure distance with something like infallible accuracy. If beyond the reach of their necks, they walked or ran up to the object of their pursuit, and may be said to have invariably struck it, never missing by more than a hair's breadth; this, too, when the specks at which they struck were no bigger than the smallest visible dot of an *i*. To seize between the points of the mandible at the very instant of striking seemed a more difficult operation. Though at times they seized and swallowed an insect at the first attempt, more frequently they struck five or six times, lifting once or twice before they succeeded in swallowing their first food. To take, by way of illustration, the observations on a single case a little in detail: A chicken, at the end of six minutes after having its eyes unveiled, followed with its head the movements of a fly twelve inches distant; at ten minutes the fly, coming within reach of its neck, was seized and swallowed at the first stroke; at the end of twenty minutes it had not attempted to walk a step. It was then placed on rough ground within sight and call of a hen, with chickens of its own age. After standing chirping for about a minute, it went straight towards the hen, displaying as keen a perception of the qualities of the outer world as it was ever likely to possess in after life. It never required to knock its head against a stone to discover that there was "no road that way." It leaped over the smaller obstacles that lay in its path, and ran round the larger, reaching the mother in as nearly a straight line as the nature of the ground would permit. Thus it would seem that, prior to experience, the eye—at least the eye of the chicken—perceives the primary qualities of the external world, all arguments of the purely analytical school of psychology to the contrary, notwithstanding.

Not less decisive were experiments on hearing. Chickens hatched and kept in the dark for a day or two, on being placed in the light nine or ten feet from a box in which a brooding hen was concealed, after standing chirping for a moment or two, uniformly set off straight to the box, in answer to the call of the hen which they had never seen and never before heard. This they did struggling through grass and over rough ground, when not able to stand steadily on their legs. Again, chickens, that from the first had been denied the use of their eyes by having hoods drawn over their heads while yet in the shell, were, while thus blind, made the subject of experiment. These, when left to themselves, seldom made a forward step, their movements being round and round and backward; but when placed within five or six feet of the hen mother, they, in answer to her call, became much more lively, began to make little forward journeys, and soon followed her by sound alone, though of course blindly. Another experiment consisted in rendering chickens deaf for a time by sealing their ears with several folds of gum paper before they escaped from the shell. These, on having their ears opened when two or three days old and being placed within call of the mother concealed in a box or on the other side of a door, after turning round a few times ran straight to the spot whence came the first sound they had ever heard. Clearly, of these chickens it cannot be said that sounds were to them at first but meaningless sensations.

A very useful instinct may be observed in the early attention that chickens pay to their toilet. As soon as they can hold up their heads, when only from four to five hours old, they attempt dressing their wings, and that, too, when they have been denied the use of their eyes. Another incontestable case of instinct may be seen in the art of scraping in search of food. Without any opportunities of imitation, chickens begin to scrape when from two to six days old. Most frequently the circumstances are suggestive; at other times, however, the first attempt, which generally consists of a sort of nervous dance, was made on a smooth table. The unacquired dexterity shown in the capture of insects is very remarkable. A duckling one day old, on being placed in the open air for the first time, almost immediately snapped at, and caught, a fly on the wing. Still more interesting is the instructive art of catching flies peculiar to the turkey. I observed a young turkey, not a day and a half old which I had adopted while yet in the shell, pointing its beak slowly and deliberately at flies and other small insects without actually pecking at them. In doing this, its head could be seen to shake like a hand that is attempted to be held steady by a visible effort. This I recorded when I did not understand its meaning. For it was not until afterwards that I observed that a turkey, when it sees a fly settled on any object, steals on the unwary insect with slow and measured step, and, when sufficiently near, advances its head very slowly and steadily until within reach of its prey, which is then seized by a sudden dart. In still further confirmation of the opinion, that such wonderful examples of dexterity and cunning are instinctive and not acquired, may be adduced the significant fact that the individuals of each species have little capacity to learn anything not found in the habits of their progenitors. A chicken was made, from the first and for several months, the sole companion of a young turkey. Yet it never showed the slightest tendency to adopt the admirable art of catching flies that it saw practiced before its eyes every hour of the day.

The only theory, in explanation of the phenomena of instinct, that has an air of science about it is the doctrine of Inherited Association. Instinct in the present generation of animals is the product of the accumulated experiences of past generations. Great difficulty, however, is felt by many in conceiving how anything so impalpable as fear at the sight of a bee should be transmitted from parent to offspring. It should be remembered, however, that the permanence of such associations in the history of an individual life depends on the corresponding impress given to the nervous organization. We cannot, strictly speaking, experience any individual act of consciousness twice over; but as, by pulling the bell cord to-day we can, in the language of ordinary discourse, produce the same sound we heard yesterday, so, while the established connections among the nerves and nerve centers hold, we are enabled to live our experiences over again. Now, why should not those modifications of brain matter, that, enduring from hour to hour and from day to day, render acquisition possible, be, like any other physical peculiarity, transmitted from parent to offspring? That they are so transmitted is all but proved by the facts of instinct, while these, in their turn, receive their only rational explanation in this theory of Inherited Association.

HORSENAIL MAKING IN LONDON.

Messrs. Moser's new works are established on a commodious site, at Battersea, comprising about 3 1-2 acres of land, in a neat, spacious, and well constructed series of buildings, of which the main structure is 145 feet long by 86 wide, with subsidiary erections for offices, stores, smithy, and fitting shops, etc.

The first stage of the process, says the *Mechanics' Magazine* is carried on at the rolling mills. Here our attention is mainly directed to one of Siemens' admirable regenerating gas furnaces, wherein the iron is heated for rolling. Messrs. Moser make use solely of the best Swedish bars, as being superior to anything else at present in the market. The bars are square and of suitably small dimensions, and they are cut by shears into convenient lengths of from two to three feet each, which are then placed, by half a dozen at a time, in the furnace. When properly heated they are drawn out by the man with tongs, and dropped into a slanting, tapering shoot down which they slide to the rolls, through which they are rapidly drawn, and delivered on a metal table below, greatly extended as to length, and extraordinarily diversified as to form, one side being straight and the other a regular succession of bulbs and hollows, corresponding to the heads and shanks of the nails *in futuro*.

The rolls are of chilled iron, eight inches in diameter, and they make about 520 revolutions per minute; the one is plain and grooved and recessed, so as to hold the other as between two shoulders; and the other has facets or circular segments of varying radii, eccentric to the axis of the roll. The general effect is most singular, the passage of the bars through the rolls being accompanied with a very peculiar crackling, crepitating sound which is unique.

As the rolled bars issue, they assume various distorted forms, as if writhing in agony at the rough treatment they have been subjected to; but the attendant boys seize them with tongs, and, straightening them by a dexterous jerk, deposit them in a heap, preparatory to the next process. The rolling is carried on entirely at night, and a gang of two men and three boys can roll 15 cwt. at one furnace.

From the rolls to the squaring or "thickening" machines, the rolled bars pass, for the purpose of flattening down the bulb so as to produce thickening laterally, which cannot be effected at the one operation. Of these machines there are three, tended by girls; and they are simply plain rolls which square the bulbs for the next operation.

Close adjoining are six cutting machines, also operated by girls, whereat the rods are cut up into blanks, by cutters operating with square cuts across the center of each bulb or head piece, and diagonal cuts across the middle of each shank part, for the points. As a necessary consequence of the mechanical adjustment in rolling and cutting, these blanks are perfect counterparts. Each girl can cut with one machine, on the average, 32,000 nails per day, being paid at the rate of 1d. per thousand; the greatest number made in an ordinary day's work is about 37,000.

The next operation is to form the heads upon the blanks, which is done by suitable punches and heading dies, operated in a "heading" machine, of which there are seven. In this machine a polygonal drum, with faces perfectly true and containing a suitable hole in the exact center, is caused to revolve with an intermittent or step by step motion, by means of a ratchet wheel and pallet, presenting each face in succession under the punch and heading dies, for the nail to be operated on to form the head. The girl feeds the nail blanks into the apertures one by one in their ascent as the drum revolves, and the headed nails drop out on the other side in the descent. There are some very ingenious and complex mechanical details about this machine, notably the action of the side dies, closing on the drum and nail blank when at rest, and a tapping action on the face of the drum to prevent the blank lodging with the pressure exercised, and to loosen it so that it may not fail to drop out. The speed of these machines is somewhat less than the last described, averaging about 24,000 per day, for which the pay is increased to 1 1-4d. per thousand.

After the heading process, which hardens and stiffens the metal, the nails are taken to a furnace, or annealing muffle, also on Siemens' principle, where they undergo the process of annealing in closely covered cast iron pots containing 5 cwt. each, for about 24 hours; this has the effect of softening the iron.

The nails are then taken to the final "shaping" machine, through which they pass at about the same rate as in heading. Of these machines there are 12. This is almost the most remarkable machine of the series, and by it the shape of the finished horsenail is impressed by a top die and two side dies, of suitable form, descending and closing on each blank in succession, as it is carried round by the intermittent revolutions of a deeply slotted drum. As in the heading machine, so here, the girl attendant drops the blanks in place in the slot as it ascends, and they drop out by gravity on the other side. The plain straight back of the nail is hereby formed into a curve against the surface of the drum; the top die forms the head, neck, shank and point, with suitable taper; and the side dies form the tapering parallel sides, having at the same time a duplicate or recurring action imparted to them, in order to remedy any defect of distortion that might result from the downward pressure of the shaping die. This is a most ingenious mechanical device, as effective as it is neat and clever.

The nails being thus accurately and perfectly formed, all that remains is to give them that finish in external appearance and "color" that is required to satisfy the eye and judgment of connoisseurs in such matters. This is done firstly by "rumbling" about a tun of nails at a time for three hours in the bowels of a hollow wrought iron drum caused slowly to rotate; whereby, through attrition, the edges and surfaces are cleaned and finished off, with the aid of the resulting impalpable iron dust. Thereafter the "coloring" process is effected by subjecting the nails in the Siemens' annealing muffle to a heat, medium between red and white, for 3 1-2 hours, and then spreading them abroad to cool on a flooring of iron plates. This imparts to them a peculiar greyish blue color, and a sheeny glitter as of silver when bent, by which their quality and temper may be adjudged. The finished nails are then packed in bags, ready for delivery. No sorting is needed, because the various operations are adapted and adjusted to the various different sizes made, by change rolls and other parts as required; and thus all the nails made at one time are of one size and counterparts. Imperfect nails may occur occasionally, but this is quite exceptional, and they may be and are readily detected and rejected at one or other of the various stages.

The resulting products are remarkable for such evenness, equality, and regularity, of make, shape, size, and quality, as has hitherto been, and would ever be, unattainable by the process of manufacture by hand, as at present practiced; and no matter how much it might be improved, even were that possible, it would still be rendered obsolete and become a thing of the past, because it is excelled, to say nothing of being undersold, by the new patent machinery of Messrs. Moser. We hail every new extension of the application and use of machinery, in "fresh fields and pastures new," as so many additional triumphs of mind over matter; and as such we congratulate Mr. Huggett and Messrs. Moser on the patience and perseverance with which they have overcome all difficulties, and on the successful establishment of their horsenail making machinery on an extensive and commercial scale. Five tuns per week is the present rate of production, and we confidently expect to see it speedily decupled. As statistics of the trade it may be noted that the total demand for home use and export is about 150 tuns weekly.

A feature, collaterally interesting about the work, is the extensive employment of skilled female labor at remunerative wages. Those who deplored the reductions and dismissals of female hands that have taken place at the Government establishments, Woolwich Arsenal, etc., may be glad to learn that a considerable number have been absorbed by the requirements of Messrs. Moser's factory.

Reducing Bones.

In the discussion of wheat culture, at a late agricultural convention in Newport, N. H., Mr. Pattee, of Warner, gave a formula for reducing bones, as follows: Place them in a large kettle, filled with ashes and about one peck of lime to a barrel of bones. Cover with water and boil. In tweenty four hours all the bones, with the exception, perhaps, of the hard shin bones, will become so much softened as to be easily pulverized by hand. They will not be in particles of bone, but in a pasty condition, and in excellent form to mix with muck, loam or ashes. By boiling the shin bones ten or twelve hours longer, they will also become soft. This is an easy and cheap method of reducing bones. If the farmer will set aside a cask for the reception of bones in some convenient place, and throw all that are found on the farm into it, especially if one or two dead horses come into his possession, he will be likely to find a large collection at the end of the year, which would prove a valuable adjunct to the manure heap.

THE Boston *Journal of Commerce* is the name of a new and large weekly paper, devoted to commercial and manufacturing interests. $3 a year. It is modeled after the Boston *Commercial Bulletin*

Chemical News Translations from *Comptes Rendus, Journal de Pharmacie, Neues, Jahrbuch* and *Revue Scientifique*.]

Anti-ferment Substances.

A. Petit records experiments made with the view to ascertain the effect of certain substances on a fermenting liquid made up of 50 grms. of sugar to the liter, and 0·5 grm. of dry yeast to 10 c. c. of fluid. It appears that when silicate of soda and borax are added to such a solution, these salts exert no marked anti-fermentative action. 1 per cent of a solution of sulphate of iron does not affect the fermentation; but it is arrested by a 1 per cent solution of sulphate of copper. Phosphorus, oil of turpentine, mustard powder, creosote, sulphuric and tartaric acids, all in quantities of 1 per cent, fail to affect fermentation; while 1 100th of arsenious acid renders the action more slow, 1 300th of oxalic acid renders it still slower. Acetic acid does not appear to be an anti-ferment, and a liquid containing 25 per cent of alcohol, 5 per cent of glycerin, and one per cent of succinic acid, enters readily into fermentation; on the other hand, corrosive sublimate and red oxide of mercury are strong anti-ferments, even in very small quantities. Sulphites do not impede fermentation, and are converted into sulphates.

Spontaneous Decomposition of an Alloy of Lead.

It appears that, among the collection of coins and medals belonging to the University of Munich, there are preserved some copies of medals and coins made of a soft alloy—bismuth and lead—which was found to consist (when unaltered) of various proportions of the metals alluded to, namely: 1. Lead, 66; bismuth, 34. 2. Lead, 86; bismuth, 14. 3. Lead, 88; bismuth, 12. It is apparent that these alloys were not all made at the same time; in some instances the medals cast in these alloys had not only become somewhat oxidized but had even fallen to powder, which effervesced on being treated with acetic acid, and the solution was found to contain chiefly lead, but bismuth was also present. The author observes that it is rather curious that alloys kept in well closed show cases should have become thus altered and deteriorated; the cause is ascribed to the tendency of bismuth to crystalize, whereby a molecular change is first effected, and thus oxidation is rendered more easy.—*Dr. Vogel.*

Animal Charcoal and Phosphate of Lime.

The author first observed that there is, as far at least as decoloration is concerned, no necessity whatever to wash animal charcoal with dilute hydrochloric acid for the purpose of increasing thereby its decolorizing property; he next observes that the hydrated phosphate of lime, the gelatinous precipitate caused by ammonia in an acid solution of bone ash, has a powerful affinity for coloring matters, organic as well as inorganic, and that that substance by itself exerts a decolorizing effect upon raw sugar. The conclusions drawn from these observations are that, far from being injurious, the phosphate of lime present in bone black is really a useful ingredient, both on account of increasing the efficacy of the charcoal by rendering it more porous, and by acting as a decolorizer itself; bone black should be washed with pure water before being used, and should be stored in cellars so as not to be exposed to direct sunlight.—*M. Collas.*

Metals Contained in Soot from Coals.

The author states that, while testing some soot collected in a stovepipe, he perceived the smell of arsenic: this gave rise to further experiments, the result of which showed that the soot contained iron, manganese, copper, arsenic, potassa, soda, and lime, in considerable quantities. The coal which yielded this soot is that found at Zwickau, Saxony.—*H. Reinsch.*

Chloride of Silver.

When recently precipitated, this substance is soluble in water, 1 liter dissolving 13 milligrammes at the ordinary temperature, and 25 milligrammes at boiling temperature. These solutions are precipitated by hydrochloric acid, as well as by nitrate of silver; 1 molecule of the chloride of silver requires, for complete precipitation, 3 molecules of either the acid or the salt. Bromide of silver is completely insoluble in cold water, and only slightly soluble (2 milligrammes to the liter) in boiling water. When chloride of silver is dissolved in acetate of mercury, it requires for precipitation a quantity of hydrochloric acid or of nitrate of silver in the proportion of 3:1.—*M. Stas.*

Analysis of Phosphates.

The native phosphate is first acted upon by bisulphate of ammonia at a high temperature, and is next treated with cold water; carbonate of ammonia is then added to the decanted solution, whereby lime and alumina are precipitated quite free from phosphoric acid, which is left in the solution and estimated as metaphosphoric acid.—*M. Prat.*

Ozone.

Experiments made by the author prove that, while albumen is not acted upon by ozone—retaining even the property of coagulating by heat—blood albumen, which in consequence of its coloring matter cannot be used in calico printing, becomes quite decolorized by the action of ozone, leaving white and perfectly coagulable albumen. It further appears that ozone is a very powerful disinfectant, since the author found that a room, in which sulphydrate of ammonium was purposely spilt, was readily disinfected by ozone.—*Lilis Bodart.*

Fulminating Compound.

As a substitute for the fulminate of mercury in percussion caps, the author has used a mixture consisting of picrate of lead, chlorate of potassa, and a very small quantity of amorphous phosphorus.—*M. Prat.*

Hydrofluoric Acid.

By causing phosphoric anhydride to act upon anhydrous hydrofluoric acid, the author obtained water and a non-condensable gaseous hydrofluoric acid, thus rendering it probable that the substance hitherto viewed as hydrofluoric acid contains oxygen; the non-condensable hydrofluoric acid just alluded to yields, by saturation with oxide of silver, a fluoride of silver resembling the chloride and quite different from the ordinary fluoride of silver. From these researches it would follow that the bodies known as fluorides, fluor spar for instance, is, instead of fluoride of calcium, an oxyfluoride and that the atomic weight of fluorine is wrong.—*M. Prat.*

A Correction.

In our remarks relating to a communication from "A Disciple of Watt," in our issue of November 16, page 308, an error in punctuation makes us state that we have seen steam rise, with an open safety valve, to a pressure "37 pounds above the inspector's test." The words "above the inspector's test" should have been in parenthesis.

Correspondence.

Fusion of Lightning Rods and the Sound of Thunder.

To the Editor of the Scientific American:

A few years ago during a thunderstorm, I saw a flash of lightning move nearly horizontally into a piece of woods not far from me, and a tremendous peal of thunder, that nearly stunned me, followed. After the storm was over, I went to see what had been struck, and found that a large post oak nearly two feet in diameter had been struck and shivered into rails and splinters, which were scattered in every direction. So complete was the destruction that I could find no piece too large to be conveniently moved, and the stump appeared just above the surface of the ground. There was no appearance of the disruptive force acting in the direction of the flash, but it was as if the tree had been filled with powder and had exploded, scattering the fragments in all directions. The tree was in full leaf and of course full of sap. At another time a dry fence post near me was struck and split into kindling. As the cause of this phenomenon so often observed is under discussion now, I hand in my contribution to its solution; but before doing this, I will present another fact or two that has a bearing upon the question.

I have just had handed to me for examination two lightning rod points that are said to have been struck. They have both been upon the same rod, are hollow cones of brass and were about six inches long originally. Each one bears evidence of having its extreme point, to the distance of about half an inch, fused. The rod was of $\frac{3}{4}$ inch iron and the points were driven down upon it. One of the points was melted at the junction of the iron and fell off; the other was burst on one side, the hole being about three quarters of an inch square; and the torn out pieces were nearly symmetrical, opening outward like two doors, the edges having been fused to some extent. I can only account for this by supposing that the conducting ability of the brass point was not equal to that of the iron rod, on account of its thinness, and that, having a large quantity of electricity to conduct to the iron, it became heated by retardation, in the same way as a platinum wire is made to glow by sending a large quantity of electricity through it. If the quantity of electricity be sufficient, the best conductors will be melted. This may be the case in these substances, and will thus account for the fusion. But the exploded one needs further consideration.

As these points were driven down tightly upon the rod, it may be presumed that in a little while, through the oxidation of the iron, an airtight joint was made, the brass cone then containing a volume of confined air. As the confined air was heated, its pressure upon the wall of the cone increased. Now the fusing point of brass is in the neighborhood of 1100°C., and as gas doubles its pressure for every 273° of heat, it is evident that the pressure within the cone will be $\frac{1100}{273}=4$ atmospheres, or 60 lbs. to the square inch. The metal, being softened by the heat at the same time, would be likely to burst at its weakest place. If my reasoning is correct, it will suggest the propriety of having the conducting ability of the point equal to that of the rod, and also leaving a small hole in it to prevent a greater pressure on its inner surface. There is in the Smithsonian Institute a copper ball, that was once mounted upon the Capitol building and was struck by lightning while there. It has a hole in it that was possibly torn in the same way.

It seems probable that, when an object like a green tree is struck by lightning, the retardation is so great (on account of the poor conductivity of the wood and the water within it) that a great quantity of heat may result, and so the water may be suddenly converted into steam of great tension and explode the tree. If it be a dead and dry tree or pole, the long cells may be filled with air which may be expanded in the same way and produce a like result.

A few words now upon the velocity of the sound of thunder. It is not an uncommon remark during a thunderstorm, if the thunder follows very quick upon the flash: "That struck close by." It may afterward prove to have struck a mile or two away or perhaps not at all. I am aware of the reputed difference in velocity of very heavy sounds, but am quite sure that it does not apply always or often to thunder. I have many times counted the seconds between the appearance of a flash overheard and the accompanying thunder; and if the sound moved much faster than ordinary sounds, the cloud must have been much higher than such clouds are ever found to be. But we do not need to assume it. Lightning is quite as frequently seen moving horizontally as in any other direction, going from one cloud to another; and in most thunderstorms, these clouds are not more than one half a mile above the earth, and very often are not one fourth of a mile above it. In going from one cloud to another, lightning often goes some miles through the air, and lightning that strikes seldom comes down perpendicularly and may start from a distant place. Suppose, for instance, a thunder cloud at the hight of one fourth of a mile above an observer, and a flash of lightning from this cloud should strike a tree two miles distant. The observer would hear the report in a little more than one second after seeing the flash, and if it was particularly heavy, might think it struck close to him. An observer near the tree would hear it at the same time, and all observers on the same line would hear it, practically, at the same time. But it evidently would not be right to conclude that the sound travelled two miles in little more than one second. It is evident that, to settle this, one must know where the lightning starts from as well as where it strikes.

A. E. DOLBEAR.

Bethany, W. Va.

Milk Sickness.

To the Editor of the Scientific American:

In your paper of October 12, an article appears with the caption "Milk Sickness, its Causes and Cure," by Orren S. Mote. Medical men, who have had any experience in treating that fearful disease, will laugh at his theory of the cause. The assertion that the poisoning is from the *rhus toxicodendron* is neither new nor true. Dr. Crooks, of this State, advanced that idea twenty years ago, but actual investigation proved it untenable. Mr. O. S. Mote says that wherever milk sickness exists, the *toxicodendron* may always be found. This is perhaps a fact, but it is equally true that, in the many places where that vegetable is abundant, there is no milk sickness. I have resided in Illinois, where, at certain seasons, the disease was prevalent. And in order to test the Crooks theory, we put a calf in a stable and fed it large quantities of the poison oak, which it ate with perfect impunity. And further: In that State, there are large pastures where milk sickness, or rather its cause, is known to exist on a small piece of ground; and where that is fenced out, cattle range the pasture with perfect freedom; but if one is placed within the ground fenced out, it will be attacked and die. To us who have had some experience in that direction, Mr. O. S. Mote's theory is not only old, but ludicrous.

Lebanon, Ind. A. G. PORTER.

[Mr. Porter's experiment with the calf goes to prove that the leaves of the *rhus toxicodendron* may be eaten with impunity, but the fact of the poisonous exhalation from that plant cannot be denied. The "United States Dispensatory" says: "The juice applied to the skin frequently produces inflammation and vesication; and the same poisonous property is possessed by a volatile principle which escapes from the plant itself, and produces, in certain persons when they come into its vicinity, an exceedingly troublesome erysipelatoid affection, particularly of the face. Itching, redness, a sense of burning, tumefaction, vesication, and ultimate desquamation are some of the attendants of this poisonous action. The swelling of the face is sometimes so great as almost entirely to obliterate the features," etc.—EDS.]

The Sun and the Origin of Storms.

To the Editor of the Scientific American:

In your paper dated November 2, on page 280, Mr. John Hepburn says: "I have seen that all gusts coming up in the morning come from the eastward," and "that the rays of the sun drive the storm," etc. This theory is not sustained by facts, as I am fully prepared to show by numerous examples which are in direct conflict with it. To save time, I will state but one case of the large number I have at hand.

On July 14, 1870, a gust came across this town at right angles to the sun's rays, bringing with it rain and hail, moving with such force as to prostrate many large trees, and bruise others so as to kill many large branches. The hail in some places rolled together more than six inches thick; the crops were destroyed, windows broken and much damage was done. This is enough to show that the theory is not true in all cases; and if necessary, I can confirm the above by like facts both of an earlier and later date.

JACOB DAVIS.

Florida, Mass.

REMARKS:—Florida, Mass., the point of observation from which our correspondent writes, is situated, we believe, on a plateau on or near the top of the Hoosic mountains; and we believe that the celebrated Hoosic tunnel through the mountains passes under some portion of the township.

Cider versus Juice.

To the Editor of the Scientific American:

Your correspondent, E. H., of Jacksonville, Pa., thinks it impracticable to make good cider by grinding the apples and expressing the juice at the same operation. My experience tells me that he is mistaken. I have a mill of the kind alluded to that does thorough work. The cider is not colored like that made by ordinary mills, but is nearly as clear as water, and, to my taste, a really superior article. What has given rise to the idea entertained by your correspondent is the fact that apples contain something (I do not know the name of it) that cannot be separated from the pomace by any ordinary pressure, when a considerable amount is in pressure at the same time, unless a chemical change is produced by leaving the bruised apples and cider together for a length of time. But in the mill I use, the smallness of the amount under actual pressure at the same time enables the mill to do thorough work.

AN OLD FARMER.

West Union, W. Va.

ABSORPTION OF AMMONIA BY NICKEL.—Boettger finds that nickel absorbs ammonia like palladium. A piece of nickel used as a negative electrode in acidulated water absorbed 165 times its volume of hydrogen. On being detached from the battery and plunged into water, it gave up the whole of its hydrogen in the course of a few days. Palladium absorbs four times as much, and gives it up more rapidly.

Fearful Boiler Explosion.

To the Editor of the Scientific American:

I am requested to call your attention to a fearful steam boiler explosion which happened, at the Mahoning iron works here, about a month ago; and I trust that your circulation of the facts among your numerous readers will effect some good. Probably so violent an explosion as this never occurred before; nine cylindrical boilers, each 36 inches in diameter and 50 feet in length, were literally torn to pieces, some of the fragments being hurled to a distance of two miles from the spot. Three persons were killed, one at the scene of the disaster, and two at a distance of a mile, the latter being struck by a piece of a boiler consisting of the head and about 8 feet of the length. The missile was not only thrown a mile, but penetrated one side of a house, killing two of the inmates. Had the explosion taken place two hours later, when the people were at work, the loss of life would have been far more terrible. A practical investigation of the causes of this calamity will show that it is due to the most culpable negligence of the engineers and their employers.

First. The construction of the boilers was faulty, and the iron of poor quality, breaking short off when bent to a right angle. I send you a piece of the iron that you may judge for yourself. I contend that cylindrical boilers 50 feet long, made of such iron, are unable to carry a pressure of 100 lbs. to the inch; for the longer the tube, the less is its power of resistance. Fig. 1 is a side view of any of the boilers, showing a portion of the surrounding brick work, the grate bars, G, and the mud drum, I. The boilers are suspended by the ends and middles, by hangers, F, F, to beams overhead.

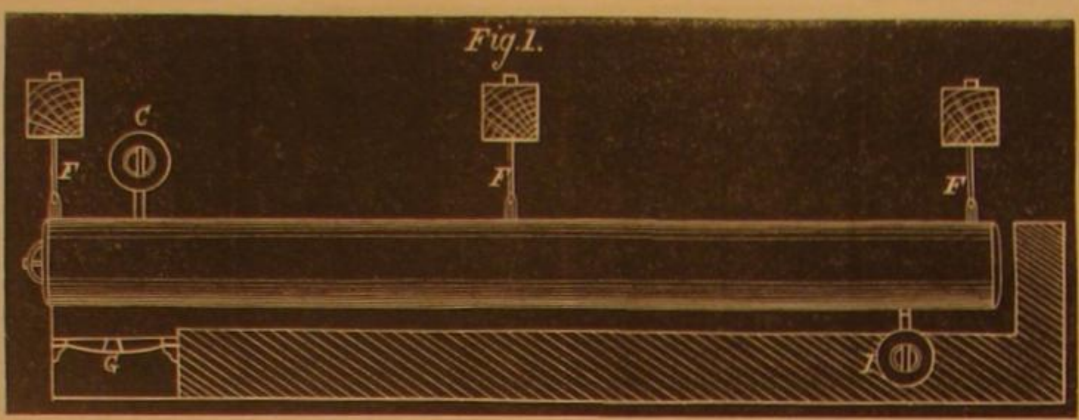
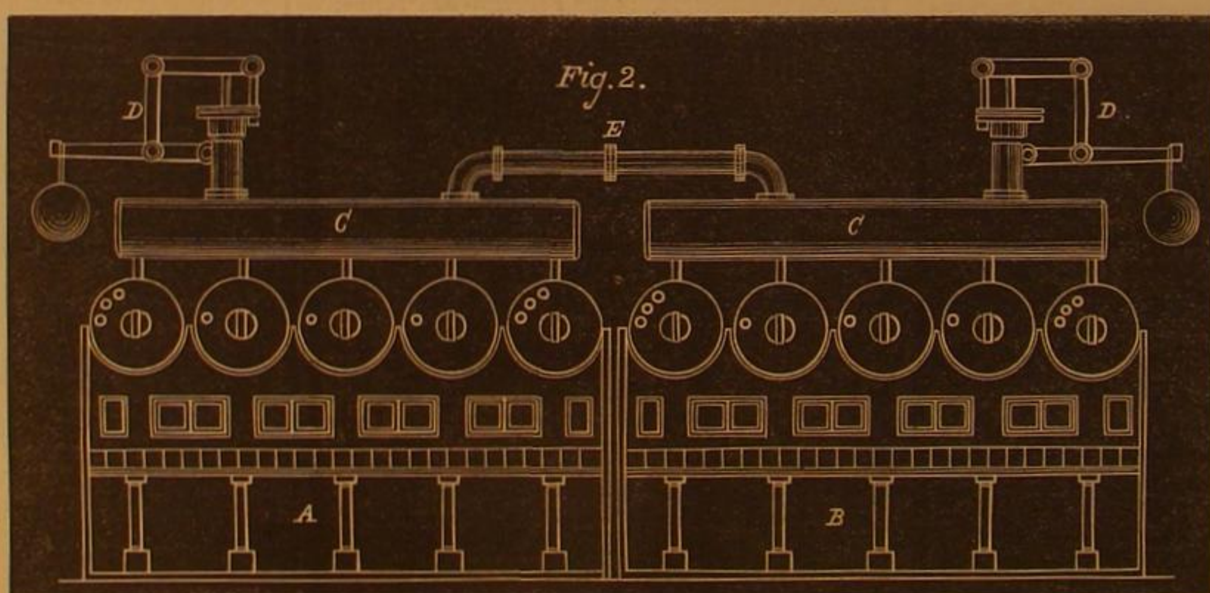


Fig. 2 is an end view and vertical section of the boilers, 10 in number, arranged in two batteries of 5 each, A and B. Each battery is surmounted by a steam drum, C. A cast iron pipe, E, joins the two drums. D D are the safety valves, one on each steam drum; each valve, being 8 inches in diameter, required a large lever and a heavy weight to carry the pressure (100 lbs.) at which the boilers were worked; therefore double fulcrum levers were used, as shown in the engraving. This arrangement would, I think, work with more friction than a single lever, and thus impede the free action of the valves. The dotted line in Fig. 1 shows the hight of the fire, the lowest gage cock being 3 inches above the line.

The cause of the explosion was inquired into by a jury consisting of five or six gentlemen, who claim to be acquainted with steam and its powers. The engineers testified as follows: The boilers were in good condition, and never gave them any trouble whatever; the fireman always attended to the water and steam; the pump was a perfect one and capable of keeping the boilers well supplied with water; the fireman must have neglected his duty and let the water get too low, and then the sudden inflow of feed water must have caused the instantaneous generation of steam sufficient to burst the boilers; they gave the fireman strict orders to rake the fires out if the water got low, or anything else happened to the boilers. The engineer, who was on watch at the time of the occurrence, said that he was at the boilers one hour before, and asked the fireman if all was right; the fireman said "yes," and the engineer returned to his engine, which was not running, without trying the gage cocks, or inspecting anything else; and he also said that if the water had been tried every half or three quarters of an hour, no accident would have occurred.



The jury decided that the water was too low in battery B, this conclusion being derived from the appearance of the boilers, and the fact that the feed water was turned on. This verdict endorses the view given above, and releases the engineers, putting the blame on the innocent fireman, who was killed. This poor ignorant fellow, instead of the incompetent engineers, has to bear the blame. It is perfectly incredible that, in this enlightened nineteenth century, such engineers can be allowed to go free from the censure of a jury, and all the fault be attributed to the unskilled laborer, whose duty it was to fill up the furnaces, who cannot be supposed to know anything of the instantaneous generation of steam, the repulsion of the atoms of water, or the state of ebullition in a boiler. If the engineer be not responsible for the boilers, who is? When I officiate as engineer, I never feel satisfied unless the gage cocks are tested as often as every ten minutes, and oftener still if the boilers are being worked to their full capacity, as these were. Trying the gage cocks once in half or three quarters of an hour is useless.

Intelligent people will agree with me that, in order to raise the intellectual standard of the men employed in steam engineering, boiler owners must be more liberal in wages, and thus induce a better class of men, both as to habits and education, to enter the honorable and highly responsible profession, in which a full consciousness of the importance of the duties to be performed is most needed. It is the failure to recognize this truth that causes most of the boiler accidents; and so thousands of dollars worth of property and hundreds of lives are sacrificed to "economy," an idea the abuse of which is the most expensive thing in the world. It would be better to pay double, and even treble, wages to a qualified man than to employ one whose education cost nothing, and whose only training as an engineer has been acquired by shoveling coal into a furnace. But the question of saving can hardly be argued in this instance, as the employers are a rich iron company, employing 500 men. There was employment enough for two assistants besides the two engineers employed. There were three engines in use, one of 300 horse power, and two of 80 horse power each, with independent steam pumps, and one or two smaller engines; and there was a third battery of boilers. The works were run day and night, and these two men had to oversee the whole. Can any one wonder that these catastrophes occur, or that machinery and boilers soon become deteriorated, under these very economical arrangements?

The loss caused by this disaster, including the stoppage of business, is estimated at over $100,000. This sum would have paid a first engineer at $1,500 a year, a second engineer at $1,200, and two assistant engineers at $900 a year each, for over twenty-two years.

Some of your readers may think it is hard to lay all the blame on the owners; but as long as money rules the world, who else is to blame? Their low wages deteriorate the engineering profession, and exclude from it capable men.

Let me now give my opinion as to the cause of the explosion. From the appearance of the plates of the boilers in battery B, I should say that the water was somewhat low, as the scale adhered only to the bottom, about two thirds below the water line, and it was firmly fixed all over the boilers of battery A. By this, it will be seen that battery B must have been only one third full of water, which would be 14 inches from the bottom. The lower gage cock, as already stated, was only three inches above the fire line, dotted in Fig. 1. I was informed that the engines, etc., had all been stopped two hours before the disaster; and up to the time of stopping, the fires had been very hot, but had gradually gone down. The watchman stated that the gage showed between 60 and 70 lbs. pressure. I believe that the fireman was asleep, and so did not keep a watch on the hight of the water in the boilers, a duty which is one of the most important, and should be performed by the engineer and not be left to the humble ignorant laborer. The exposure of the boiler to heat would cause the scale to peel off; and then, when the fireman woke and found the water run down, no doubt he turned on his feed cock, and caused an instantaneous generation of steam, and an explosion. The scale was about three sixteenths of an inch thick. I do not think the explosion was caused by the water coming in contact with the iron, as some say it was. If the boilers were one third full of water, the sudden starting of the feed pump would not cause a sudden generation of steam, as the jury and the two engineers believed, for the only heating surface in the cylindrical boiler is the outside shell, and water could not then be converted into steam faster than the safety valves would pass it off, provided the area of the valves was in due proportion to the heating surface, and the levers and weights were so arranged that the valves would act freely.

Similar explosions have no doubt occurred, but they have been seldom as disastrous as this one. I might term them "partial explosions," as they are not caused by over pressure in the boiler, but by over expansion of the metal by cold water coming in contact with the heated plates. This would fracture the plates, or the parts most exposed to the unequal strain.

When explosions tear and rend iron plates and hurl pieces, like projectiles from the mouth of a cannon, two or three miles away, there must be some agent at work more powerful than any yet described, except instantly generated steam or repulsion of the water, which latter is due to the over heating of the water, which occurs when all the steam and water pipes are closed and there is no circulation in the boiler. Water which has been long boiled loses gradually the air it previously contained, and this raises its boiling point little by little. Engineers should be acquainted with an experiment of M. Denny, who found that he could raise water to a temperature of 275° Fah. before it began to evaporate. This was due to the closer adhesion of its particles, the air having been expelled. If a drop of water fall on the surface of a hot stove, it does not touch the plate, but is suspended above it by a thin film of vapor which surrounds the drop. This condition is known as the spheroidal state, and it may be produced in boilers when the fires have burned low; and then all is ready for an explosion. Let any force produce contact between the water and the iron, and an enormous liberation of steam must instantly follow; and this force may be supplied by pumping water into the boiler, or even by the sudden jar of opening the throttle valve to start the engine. I have known explosions to occur at each of these times.

Whatever may cause the contact of the water and iron, the result is an explosive force that nothing can withstand; this could not escape if the safety valve had five times the area usually considered sufficient. Such a force, no doubt, originated the awful catastrophe which tore these nine boilers to fragments, one only of the ten being left undestroyed.

ENGINEER.

Youngstown, Ohio.

REMARKS BY THE EDITOR.—Without an opportunity of carefully investigating the case and personally inspecting the exploded boilers, it would be impossible to give an opinion as to the correctness of the views of our correspondent. The piece of iron sent us is not equal in quality to the very best in the market, if we may judge by simple inspection of this small fragment; but it is what would be considered by manufacturers a very fair grade of iron. It must be an excellent iron that will bend over a sharp corner through an angle of 90° without breaking, when of this thickness (quarter inch). If it will bend cold over a corner rounded to a half inch radius, through an angle of 70°, it will come within regulation tests for first quality plate. The tremendous violence of the explosion would be generally considered to indicate great strength in the boiler.

The boilers described, when carrying 100 pounds of steam, subjected the metal to a stress of 7,200 pounds per square inch of section in the whole sheet; deducting for weakening by rivets, this is equivalent to a stress of 12,000 pounds per square inch of metal in the laps, a figure which, although too high for good practice with iron of average quality, is yet not as high as the law permits.

The safety valves are fully as large as is usual with such boilers, but the unfortunate arrangement of levers, described, would seriously interfere with their lifting promptly and sufficiently when steam was rising rapidly.

Our correspondent is fully justified in protesting against the penny wise, pound foolish policy which so frequently leads to the employment of unskillful, unintelligent, and unreliable engineers and firemen, at low rates of pay, instead of men of known good standing at a fair compensation. Good sense and ordinary business prudence unite in dictating the employment of good men at good prices in positions of such importance and responsibility. We have not sufficient evidence before us to justify the expression of an opinion regarding the character of the appointments made in the instance under consideration. We should certainly hesitate to employ any engineer who would allow even cylinder boilers to be worked for a half or three quarters of an hour at a time without trying the gage cocks, or who would visit the fire room and return to his engine without noting the hight of water in his boilers.

AT the Krupp Works, at Essen, a large casting, namely, a steel block weighing 50 tuns, has been made for navy purposes.

On the Manufacture of Phosphoric Acid and of certain Phosphates.

Blanchard describes this process as applied to the fossil phosphate of lime found in the department of Lot, containing from 52 to 80 per cent of tribasic phosphate of lime.

The average composition is: phosphate of lime, 72; carbonate of lime, 7 to 8; phosphate of peroxide of iron, 2; fluoride of calcium, 4 to 5; silicate of lime and alumina, 10. Traces of iodine are also present, especially in the gray varieties. The phosphate is treated with an equal weight of sulphuric acid at 50° to 55° Baumé in large vats, and stirred for a quarter of an hour. It is then allowed to rest for half an hour, when it presents a spongy mass ready for the manure maker or the farmer. At the first, dark brown fumes containing fluorine are given off, and afterwards splendid violet fumes of iodine, neither of which appear to injure the health of the workmen.

The superphosphates produced are of two classes; the lower quality containing 10 to 14, and the higher 17 to 18 per cent of soluble phosphate.

For the preparation of free phosphoric acid, equal weights of acid and phosphate are mixed as above, but after a short time, 1,200 kilogrammes of water are added to 1,000 kilogrammes of phosphate taken, and the agitation is continued. After an hour, the product is submitted to hydraulic pressure in coarse cloths surrounded by casings of wood perforated with holes. The solution of acid phosphate of lime at 18° Baumé, which is thus obtained, can be used either for the preparation of alkaline phosphates or of the free acid. The last equivalent of lime is removed by the addition of a further equivalent of sulphuric acid, when sulphate of lime subsides, and the phosphoric acid is drawn off at 61° Baumé.

The Macropode.

This little fish forms the subject of a paper communicated to the French Academy of Sciences by M. N. Joly. Eight years ago, M. Agassiz said that he had found among the fish tribe metamorphoses as considerable as those which had been remarked in reptiles; and this is a case in point. The egg of the macropode, not bigger than a poppy seed, when hatched is perfectly transparent and lighter than water. It is hatched in about sixty-five hours, just as is the case with the egg of the tench. But on account of this rapid birth, the creature is necessarily in an imperfect state. It makes its appearance in the shape of a tadpole, the head and trunk of which are attached to a large belly, the tail being free and surrounded with a natatory membrane which is exceedingly transparent. Although the animal seems to have no striped muscular fibers, it is very nimble under the microscope and is not more than a millimeter and a half in length. Its head has two large eyes still deprived of their pigment; there is no mouth, and no digestive apparatus either. But the heart is already active, and some circulation is perceptible in the upper part of the tail. There are no gills, so that respiration must be effected through the skin. There are no secretory organs and no fins. The same as in all fish, the nervous system is formed at an early period, and is composed of two parallel chords which branch out into the head. Of the skeleton, nothing appears as yet but the dorsal cord. Numerous pigmentary spots appear all over the body. A short time after, the mouth, intestines, liver and air bladder are formed, together with the gills. New vessels gradually make their appearance, while the earlier ones are obliterated. The caudal natatory membrane is gradually formed into two pectoral fins, and brilliant scales cover the body, and from that moment the creature assumes the shape of a regular fish. Here, therefore, we have changes similar to those which are observed in Planer's lamprey, in insects and in crustacea. This is an important fact, since naturalists had hitherto denied the existence of such changes in fish.

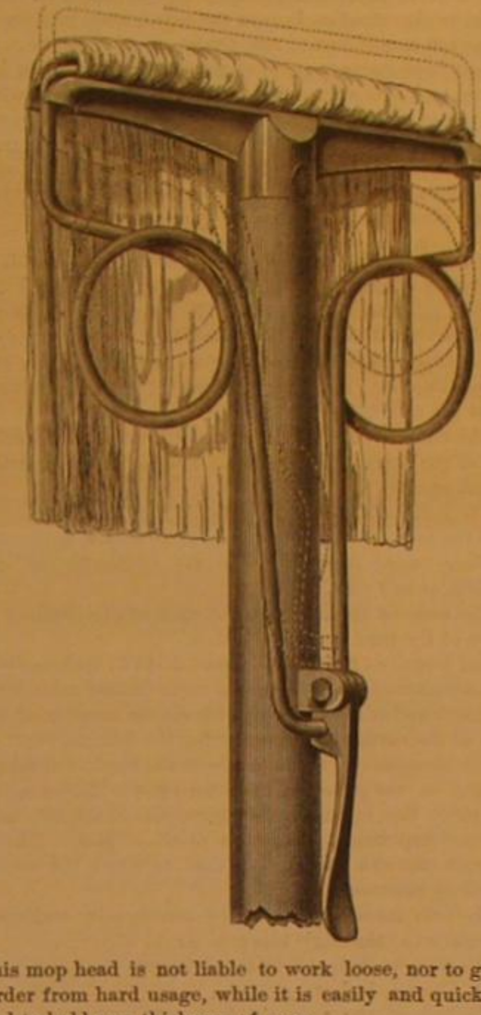
Beware of Green Wall Papers.

A physician in Western Massachusetts recently had a lady patient who, for several weeks, had been suffering from nausea, general prostration, and other symptoms of slow poisoning. Failing to discover the cause of the symptoms, says the Hartford *Courant*, as a last resort the doctor requested her to move from her chamber, the walls of which were covered with paper of a very light shade of green, so light, indeed, that in the evening it could scarcely be distinguished from white. After leaving the room the symptoms immediately disappeared, and the patient rapidly recovered. A sample of the paper was forwarded for analysis to the State chemist at Hartford (Mr. Joseph Hall, of the High School), and was found to contain a large quantity of arsenic. Mr. Hall obtained the poison in the various forms of metallic arsenic, yellow tersulphite, silver arsenite and arsenious acid or common white arsenic. He estimates that every square foot of this innocent-looking paper contained an amount of the poison equivalent to five grains of arsenious acid, or double the fatal dose for an adult person. This, in the moist warm weather of last July and August, was amply sufficient to keep the air of a room constantly impregnated with the poison, and any person occupying such a room would be as certainly poisoned as though the arsenic had been taken into the stomach.

LONDON has a new industry, namely the manufacture of cripples. The police have discovered a firm of human fiends that take children of tender age and twist their limbs so that they may be bandy-legged or otherwise deformed, according to the wish of the parents. The object of this is to make the unfortunate infants objects of charity. A regular tariff of prices is demanded, a thorough and complete maiming costing four pounds. The members of the concern and about a dozen employees have been imprisoned.

IMPROVED MOP HEAD.

The invention herewith illustrated furnishes an improved method of attaching a mop to its handle. To operate the device, the small lever on the staff is turned over, the bail is lifted from the notch on the same, and pushed down as far as necessary to receive the mop. The relative position of the parts will then be as shown by the dotted lines in the engraving. The mop being inserted in place, the bail is pulled up into the notch on the lever and the latter is turned back to its original position.

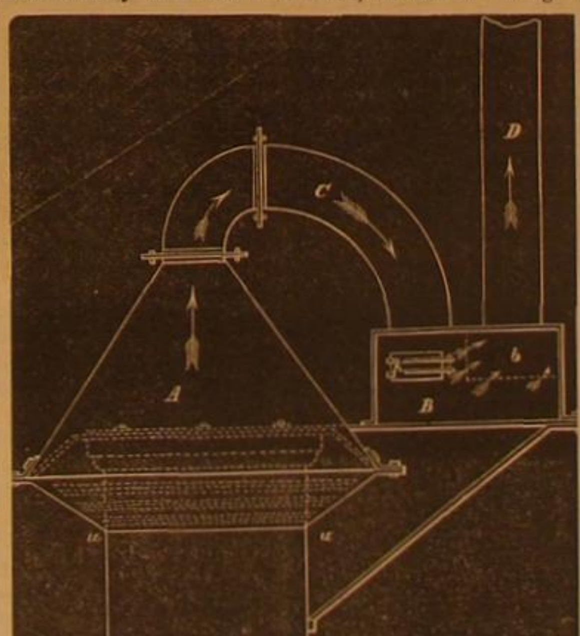


This mop head is not liable to work loose, nor to get out of order from hard usage, while it is easily and quickly adjusted to hold any thickness of mop.

Patented December 13, 1870. For rights and further information, address the inventor, Mr. L. Williams, Arlington, Vt.

APPARATUS FOR EXTINGUISHING SPARKS.

G. J. Syrkin, of Irkutsk, Eastern Siberia, describes, in No. 18 of the *Practische Maschinen Constructeur*, an apparatus which was constructed for the purpose of extinguishing the sparks issuing from the stacks of the gold-refining establishments of that city. The incandescent particles of carbon have sometimes very nearly set the whole town, which is almost entirely constructed of wood, in flames. Being of



course applicable to stacks of all kinds, we believe the following illustration and description will be found interesting:

The apparatus consists of four principal parts. A is the head, fastened with iron clamps over the opening of the chimney; B is a water reservoir, with a compartment, *b*, occupying exactly a fourth of the length of the reservoir, and containing numerous perforations on its sides. *k* is a small airtight side door. C is a pipe, extending from the head of the receptacle to B, both of which consist of strong sheet iron. The lower rim of the head does not directly rest on the chimney top, but extends for 14 inches further downwards, being supported by the slanting sides, *u u*. These four sides are perforated, so that a part of the hot gases may escape through them. The size of the head corresponds to the diameter of the chimney, and the bent pipe may vary in size according to the distance of the receptacle, B, from the stack, while the straight pipe may be of any length. The reservoir should be large enough to hold more water than will evaporate during the melting operation, and till the furnaces are cooled down sufficiently; it is filled to one quarter of its hight.

Incandescent particles of carbon will fall in the water, while the gaseous products of combustion pass off through the perforations of the compartment, *b*, and pipe D. As the density of the watery vapors is less than that of the products of combustion, the pressure they exert can in no wise influence the draft. Any gold that may be carried off through the chimney will be deposited in the water and thus saved.

In the establishment where the above described apparatus is in use, the following quantities of gold, from the various districts of Eastern Siberia, have been refined.

	Pouds.
Olekme (Irkutsk)	761¼
Bargusin (Transbaikalien)	69¼
Werchneoudinsk (do.)	15
Nertschinsk (do.)	154¾
Amur	172
Total	1172¼

One poud equals 36·11 lbs. avoirdupois.

One of the Errors of the Age.

One of the growing evils of this country is the overweening desire on the part of young men to engage for life in pursuits that have not "the smell of shop" about them (says the *Journal of the Farm*), or to be more explicit, to engage in those classes of business which do not involve the necessity for practical mechanical skill, or even a theoretical knowledge of them. Thus we find thousands of farmers' sons rushing to the city, and eagerly seeking employment in stores as clerks or salesmen. A portion of them, with better judgment, apply themselves to the study of the professions, and hence it is that large cities abound with hundreds of lawyers, physicians and clergymen, who eke out a miserable subsistence, and who, had Nature's rights been respected, should be following the plow, or doing duty in the workshop. Much of this unwholesome disposition is due to what are known as business colleges, the proprietors of which, by inflated advertisements, induce young men to believe that all that is necessary to success in life is a knowledge of bookkeeping, and that this knowledge can be obtained through their institution in the course of a month or two of ordinary study. Excited by these plausible stories, and believing—as many of them do—that a clerkship is not only a more lucrative, but more respectable avocation than that of a farmer, young men flock to the city, enter upon a course of two or three months, study in one of these mercantile colleges, graduate(?), and are awarded a diploma, setting forth the fact that they are thoroughly fitted to take charge of the books of any business house. It is only when these graduates are called upon to apply in practice what they found so easy in theory that they awaken to the fact that they have made a serious blunder, and, worse yet, that their visions of big salaries have dwindled down to figures that barely provide them with the commonest necessities of life. Occasionally one succeeds in doing better, but the instances are rare. Failure is the rule; success the exception.

It is not surprising, therefore, to find business men fighting shy of these mercantile college graduates, or to encounter at almost every step young men in fruitless search of clerkships, while our workshops and farms are sadly needing their services.

A Meteor in Arkansas.

About twelve miles south of Huntsville, Madison county, on the 8th instant, occurred the most wonderful and startling phenomenon that has ever been witnessed by the citizens of that neighborhood. Near the farm of Captain Smith, sheriff of the county, some of the citizens were startled by a frightful noise like the rushing of a mighty cannon ball through the air. On looking up, they discovered something that looked like a solid column of fire passing with tremendous velocity through the air, with a whirring, hissing sound, something like that of a shell, but many fold louder. It appeared to be from eight to ten feet in length and from four to five feet in diameter, but it was passing with such swiftness that it may have been many times larger than it appeared. When first discovered, it seemed to be several hundred feet above the earth, and was inclining in its course toward the ground, profusely emitting great sparks of fire. About a minute or two after it passed out of sight, an awful explosion was heard, that shook the earth for miles around, and was heard at a distance of fifteen miles. The truth of this statement is vouched for by several prominent citizens of the neighborhood.—*Fayetteville* (*Ark.*) *News*.

CUTTING UP WHALES BY STEAM.—The whaling bark Java, of New Bedford, is provided with an upright five horse power engine, to be used in cutting in whales and discharging cargo, hoisting topsails, if required, etc. This must prove a great saving of time and labor, as it usually requires 15 or 16 men to cut in a whale, while, with the help of the engine, six men can easily attend to it. The engine is stationed in the forecastle, occupying a space ten feet by four feet. It will be the first ever carried to sea in a whaler for these purposes. The idea originated with the first officer of the Java, Mr. E. T. Fish, of Falmouth, Mass.

COOKING UNDER PRESSURE.—Experiments by Professor Junichen prove that the time for cooking various articles of daily consumption is very much shorter when effected under strong pressure, while a great saving in fuel is also obtained.

The Horse Disease.

Professor James Law of Cornell University recently delivered a lecture, before the International Academy of Science, on "The Horse Disease."

The disease is by no means a new one. Between 415 and 412 B. C. a similar disease raged in Greece, Italy, and Sicily. It has also occurred in A. D. 330, 876, 1173, 1259, 1299 (then especially severe), 6 times in the fourteenth century, 39 times in the fifteenth, twice in the sixteenth,, 5 times in the seventeenth, 15 times in the eighteenth, and 17 times in the nineteenth, thus far, probably not more frequently in later times, but apparently so from the lack of full records earlier. Sometimes it has especially attacked horses, dogs, cats, and oxen, and man. It is essentially an influenza. After infection, from one to three days intervene before its appearance. Its symptoms are sudden. They differ according to the parts attacked and the severity of the attacks. Sometimes the disease confines itself to the throat, sometimes to the parts of the neck further back, sometimes to the lungs, sometimes to the digestive organs, and sometimes to the tendons and muscles, when it is rheumatic in its form. A common symptom of all these forms is great weakness and prostration, indisposition to move, half closed eyes, relaxed limbs, staggering, etc.

The present manifestation is largely that of the throat, and is attended by coughing. The lecturer thought that it could not be the result of conditions of the atmosphere, for these could not continue unchanged for the length of time that the disease runs; nor to gases, or ingredients of the air, for these must become diluted and pass away; nor could temperature be its cause, for it had occurred under a great variety of thermal conditions. These and other agencies might, however, influence its course after its inception. It was true that for the past few months butchers had had unusual trouble in preserving meat, and there must have been a great growth of fungi from ill-preserved meat, but whether this was a coincidence it was impossible to determine. The lecturer, however, inclined to the belief that the disease was the result of poisonous organic matter in the atmosphere, not probably vital, but rather morbid matter.

As to its prevention, one method is complete: the shutting up of the animal in a stable, and the use of disinfectants; but this involved trouble and expense, and, as the disease is now light in form, he thought the animals should be exposed. The stables should be closed and general preventives employed, such as the burning of a little sulphur on a shovel in the stables two or three times a day. Again, rest and proper remedies where the animals are attacked are essential. The lecturer described at some length the different phases of the disease and the methods of treatment. The horse is a finely organized animal; the surface exposed to the air in his lungs is about 1,000 square feet; and, since he is so often overworked and badly housed, it is not strange that such diseases affect him with peculiar severity.

The Wizard and the Tobacconist.

The other day, a pleasant-looking gentleman, of foreign appearance and accent of speech, entered a tobacconist's shop in one of the market towns of South Durham, says the London *Grocer*, and requested that he might be supplied with a good cigar. The article having been furnished him, he proceeded to apply it to his nose with the air of a connoisseur, and then to protest that its flavor was most peculiar, not to say offensive. The worthy tradesman declared that the cigar was an excellent one; his visitor as stoutly maintained that it was not, and that he was so convinced of the fact that he was at once determined to try what the cigar was really made of. Taking a penknife from his pocket, he began to cut the "weed" in two, and he had no sooner commenced to do so than a quantity of feathers dropped from the cigar. The more he cut the faster the feathers flew, until the whole cigar had been whittled away, and the shop looked more like an upholsterer's than a tobacconist's. Having given this ocular and practical proof that he had not remarked the peculiar flavor of the cigar without reason, the foreign gentleman took his departure, leaving the shop-keeper utterly bewildered and the possessor of a quantity of feathers enough to stuff an ordinary cushion. The customer was Signor Bosco, the conjuror.

Locomotive Shops of the Boston and Albany Railway.

The locomotives built at these shops under the superintendence of the master mechanic, Mr. Wilson Eddy, are an interesting study, as they present many departures from the ordinary type of engine. They are not pleasing at first sight, owing to absence of steam domes, which are condemned for causing constant leakages, and producing weakness in the shell. The whistles and safety valves are set in brass tubes shaped like a steamer's escape pipe. Instead of the steam dome, the steam pipe is carried the whole length of the shell, and perforated on its upper side with small holes to admit steam. This pipe is of copper, and perfectly answers the purpose. The fire box is four inches wider than the ordinary way of framing. This is accomplished by flattening the frames as they pass the fire box into four flat bars, two on a side. The upper ones are 7 inches deep by 7-8 of an inch thick, and the lower ones 6 inches deep, with same thickness. These plates are bolted to the fire box, and come as close to the driving wheels as ordinary frames do, leaving all the space inside as so much gain for the box. The springs are hung in what may be called box yokes directly under the firebox. The ash pan is narrow, but that is of small importance compared with the advantages gained. The narrow pan, however, can hardly be charged to the general construction, as it is more from the arrangement of the feed pipes than from the position of the springs. The pumps are beneath the foot board, and are driven by eccentrics on the rear driving axle. The cab is 7 feet 2 3-4 inches wide; the foot board 4 feet 4 inches wide, and the seats 17 1-2 inches. The standard passenger engine on this road has 5 feet 6 inch drivers, with 17 inch cylinders, and 26 inch stroke. At the time we were in the shop, a freight engine was nearly finished with 4 feet 6 inch drivers, four in number, and 17 by 26 inch cylinders. Objections have been made to this style of engine, but a very satisfactory answer seems to be that a year's repairs can be made in six days or thereabouts; that is to say, when an engine has run twelve months, it is in the repair shop but six days to be put in a condition to run twelve months longer. It is said that these engines are very powerful, being often much superior to larger ones with a greater number of wheels. They steam freely, and seem to be generally liked on the road. The shops turn out about twelve of them a year.

All the locomotives and tender axles are made here, also a few freight axles. In 1871, the shop turned out fifty tuns of coupling pins, which is about the yearly average.

The Cosmic Science of the Great Pyramid.

The Great Pyramid of Ghizeh has been established to be the oldest monument in Egypt. Mr. Piazzi Smyth, in view of this fact, has devoted a long period of time to studying, not its hieroglyphics, but the peculiar relations of its structure, position, etc., and has, by a long series of reasoning, arrived at the following conclusions:

1. The Great Pyramid is accurately located as regards the points of the compass (*orientation*), and its base is practically a perfect square.

2. The vertical hight of the pyramid, 5,835 inches, is to the sum of the four sides of its base, 36,702·36 inches, as the radius of a circle (approximately) is to the circumference, or as 1: 6·2832, or as 1: 2π.

3. The area of the meridional section of the pyramid is to the area of the base as 1: π.

4. The length of a side of the base, 9,165·47 inches, divided by the contents of the pyramidal cubit (25,025 cubic inches) gives the number 366·24, which equals the number of revolutions of the earth on its axis during the sidereal year.

5. The distance of the sun from the earth, indicated by the hight of the pyramid, is given by the following relation: $10^9 \times$ the hight of the pyramid = 92,093,000 miles, and the corresponding parallax is of 8″ = 87648. This distance from the sun is precisely that to which the latest investigations approach.

6. The four faces of the pyramid are equally inclined on the central axis, the angle being 51°51′ 14·3″.

7. The inch as deduced from the great pyramid equals 1+0·001 English inches.

8. The inch of the pyramid is the 500,000,000th part of the polar axis of the earth.

9. The cubit of the pyramid equals 25 of these inches; it represents, then, the 20,000,000th part of the polar axis, or the 10,000,000 part of the semi-axis.

10. The modern value of the space passed over by the earth in 24 hours in its orbit around the sun equals 10^{11} inches of the pyramid, or 100,000,000,000 pyramidal inches.

11. The weight of the pyramid is the fraction $(\frac{1}{10})^{15}$, or $\frac{1}{1,000,000,000,000,000}$ of the weight of the earth.

12. The pyramid indicates that the average temperature of the total surface of the earth is 20° centigrade, or $\frac{1}{5}$ the interval between the temperature of melting ice and of boiling water.

13. The sum of the two diagonals of the pyramid, valued in English inches, is 25,859, a number sensibly equal to the years that separate the successive returns of the meredian of some fixed star; for example, α of the constellation Dragon, or the number of years that the sun occupies in traversing the circle of the ecliptic.

14. The pyramid indicates that the density of the earth is 5·70, water being taken as unity. This density has been found by experimental methods, subject to great uncertainty, to be 5·67, 6·568, and 5·316, of which the average differs little from the figures given by the pyramid.

Friedrich Welwitsch, M. D., F. L. S., etc.

Dr. Welwitsch, the well-known African botanist, died in England, Oct. 20, aged 65 years. He was born in the Austrian Duchy of Carinthia, and in early life showed his great love for the study of Nature. He dated his first lessons in botany from an apothecary, who, seeing him pass his door with a bunch of flowers, engaged him in conversation, told him the names of the plants and instructed him in preserving them. This gave an incentive to his exertions, and every week found him in the good apothecary's company. In 1853 he started to Africa in order to explore for the Portuguese Government their possessions on the west coast. There he remained until 1861, collecting and examining the *flora* and *fauna* of Angola, Benguela, etc., and on the magnificent results his fame will rest. His collections of critically studied plants are unique, and are undoubtedly the finest ever brought from West Tropical Africa; and the "Flora of Tropical Africa" (two volumes of which have already been published) will owe much to his labors. In other departments of natural history, his collections are no less valuable. In entomology they are unrivalled, and in zoology he enriched our knowledge.

RUSSIA will soon beat the world in her staff of feminine doctors. The *British Medical Journal* says that 300 young Russian women have claimed admission as students in medicine and surgery at the newly opened Medical School of St. Petersburgh. The number of admissions being fixed, however, at 70, there will be a great many disappointed.

Electro-Recording Barometer.

H. C. Russell, of Sydney Observatory, New South Wales, describes in *Nature* his recent improvement. The barometer tube is an ordinary glass one, 0·58 in diameter, and is fixed firmly to the case. Its cistern is a small glass one, one inch in diameter, and cemented to a brass arm hinged to the left side of the case, which allows it perfectly free motion up and down, but not sideways. From this cistern projects a very light arm, also hinged, and bent at the end so as to extend over the inclined plane. One wire of the battery is attached to the cistern arm, and the other, after passing round the magnet, to the inclined plane. As soon, then, as these two parts touch, the electro-magnet brings down the brass frame, and with it the pen, on to the paper which at once begins to mark, and continues to do so until the motion of the clock draws the inclined plane from the cistern arm, and so breaks the contact; the pen remains off the paper until, by the motion of the clock, the inclined plane is brought to touch the projecting cistern arm, when the pen at once begins to write.

As the barometer, when the pressure increases, must draw the mercury for its increased hight from the floating cistern, the cistern becomes lighter, and rises with it, and the smallest motion may be made sensible by altering the inclination of the moving inclined plane. The accuracy of the motion of this plane is secured by making it work on two fine steel points—the same motion, in fact, as that given to the cutter of a dividing engine. The cistern floats in a reservoir of mercury. The pen is a siphon pen, supplied with thin ordinary writing ink.

A Scientific Anecdote.

A professor's wife, who occupied herself sometimes with assisting her husband in making casts of interesting objects of geology and natural history, says the *Manufacturer and Builder*, also for her own pleasure made sometimes flowers and fruits, of wax and other materials, and notwithstanding she had become quite a successful expert in this line, she found that almost always her efforts were criticized by her friends. Once at a tea party she passed a large apple around, and stated her confidence that this time she had been quite successful in her imitation of Nature's product; but her friends were as usual not of her opinion; one criticized the shape, saying that it would be more natural if it was not so globular; another criticized the colors, and said that it was better than other imitations, but she had not quite hit that natural indescribable peculiarity which distinguishes the natural apples from mere imitations; almost every one had some fault to find. After the apple had passed round and came in her hands again, she ate it, without saying anything. Her friends had been criticizing a real apple, but never afterward criticized her imitations of fruit.

Artificial Indigo.

By a scientific investigation, which for difficulty and complexity is almost unequalled, says Professor E. Davies, the coloring matter of indigo, indigotine, has been added to the list of natural products now made artificially. Nitro-acetophenon, obtained by the action of nitric acid on acetophenon, itself a product from the dry distillation of benzoates and acetates mixed, only differs from indigotine by H_2O and O. By heating with soda lime and zinc, small quantities of indigotine are produced. The process is in no sense commercial; but neither was that by which alizarine was first produced. The way being pointed out, probably improvements will be introduced, and indigo become a product of our own country. Benzoic acid is now made in quantity from naphthaline, a product of coal tar, so the new coloring matter is related to that exhaustless store of valuable chemical treasures.

Oil Wells in Italy.

There has just been discovered, says the *Chronique de l'Instrie*, at San Giovanni Incarico, Province of Caserta, Italy, petroleum well which promises to yield an extremely rich w. Abbé Stoppani, a celebrated geologist, has visited the ality, and is of the opinion that the deposit of petroleum ust be remarkably large. M. Gonni, an engineer of conmderable previous experience in the oil regions of the United tates, has already begun extensive excavations.

Narrow Gage in Russia.

The Fairlie narrow gage system in Russia has met with complete success. The Emperor has forwarded to the inventor a bronze medal, in reognition of the value of his engines, which have been placed on the Livny Railroad.

BLEACHING JUTE.—For 50lbs. of the material make up a solution of 5lbs. of soda at 60° C., and draw it five times through; then lift and rinse in clean water. To make up the chlorine bath, 2 1-2 lbs. chloride of lime are mixed with an equivalent quantity of the sulphate of magnesia and dissolved in cold water. The jute is steeped in this bath for three hours and is then taken out, rinsed, and slightly blued with soluble indigo.

A FOUNTAIN OF SOUP.—Liebig's extract of meat, which makes an excellent soup, is hereafter to be supplied to the poor classes of Paris at a merely nominal cost, from regular fountains. A M. Levy announces that he will inaugurate a fountain of soup in his establishment, and, for the first two days, will distribute the same gratis to the public.

AT the Brooklyn Exposition, there is an engine belt, on approaching the knuckle to which, a strong stream of electricity apparently passes from the hand to the belt.

Richard Trevithick.

The name of Richard Trevithick, or Captain Dick, as he was called by the miners of Cornwall, is, says the *English Mechanic*, one that is inseparably connected with the history of the steam engine, and can never be forgotten while the steam engine is employed, or railways form our principal means of locomotion. He was born on the 13th of April, 1771, in the parish of Illogan, Cornwall, and attended a school in the little town of Camborne, where his attainments were limited to the "three R's," but where, if we may believe the anecdote, the originality of his mind asserted itself in his method of doing sums, for his master is reported to have once said to him: "Your sum may be right, but it is not done by the rule," to which young Trevithick, who is characterized as a disobedient, slow, obstinate, spoiled boy, replied by "I'll do six sums to your one." In 1792 he was appointed to examine and report on the relative duties or work done with a certain quantity of coal in the patent engine of Watt and in the double cylinder engine of Hornblower. From this time began the antagonism between Trevithick and Watt, and the impartial reader is compelled to acknowledge that the artifices by which the former sought to evade the patent rights of Watt do not say much for his credit as a man, or for his abilities as an engineer. Mr. Francis Trevithick, the author, suggests that it was, probably, his frequent meeting with engineers in the interminable law suits consequent on these attempts at evasion, together with the shrewd questioning of the lawyers, that led Trevithick to ponder on the possibility of working a steam engine without air pump or vacuum. This was in 1796, and two years later high pressure engines were in full work in Cornwall and active rivals of the low pressure vacuum engine. The manager of Cook's Kitchen says that one of these engines, erected in 1800 or 1801, still works well with 25lbs. steam, and promises to do so for many years. The steam is admitted by a four way cock worked by tappets. This engine was still at work in 1870, lifting three tuns and a half.

In 1801 he made and used on the roads a steam carriage. In connection with this carriage, Trevithick used both a double action bellows and the blast pipe; but according to our author the bellows did not answer, and was never afterwards used. The invention of the blast pipe is a disputed point; for although it cannot be denied that Trevithick was the first to turn the exhaust steam into the chimney, it is asserted, by those who dispute his claim to be the inventor, that he was entirely ignorant of its effect in creating a draft. Trevithick, however, writes to Mr. Gilbert that the steam "makes the draft much stronger by going up the chimney," and an engine constructed in 1804 had a cock for regulating the blast. The story of Trevithick and the origin of the locomotive is an old one now, and few can bring much evidence to rebut his claim to have made the first. Trevithick also discovered that adhesion or friction existed between the wheel and the road, sufficient to convince him that if the wheels were turned by force the carriage would advance; for he invited Mr. Davies Gilbert to come and witness the fact, which that gentleman mentions in one of his letters.

About the time when Trevithick's locomotive drew a carriage on a circular railroad, on the site of the present London and North Western Railway station, he was engaged on the first Thames tunnel, which was abandoned by the directors; although, if Trevithick had been permitted to do things in his own way, the Thames would probably have been tunneled many years before Brunel accomplished the feat.

In 1817 Trevithick, who had previously sent out engines and machinery, went to Peru to superintend the working of some mines; but in 1827 he returned to England a poor man, and his restless brain began devising new schemes and fresh improvements. Trevithick died on the 22nd of April, 1833, penniless and without a relative attending his last moments, for he was at Dartford, far away from home. Some of those who had been losers by his schemes performed the last offices of humanity, and no stone marked his last resting place. In the words of his son: "He is known by his works. His high pressure steam engine was the pioneer of locomotion and its wide spreading civilization." Many of his designs remain to this day as instructive guides, and several of the machines he constructed are still doing duty at the present time. In a letter to Mr. Davies Gilbert a few months before his death, he writes: "I have been branded with folly and madness for attempting what the world calls impossibilities, and even from the great engineer, the late Mr. James Watt, who said to an eminent scientific character still living, that I deserved hanging for bringing into use the high pressure engine. This, so far, has been my reward from the public; but should this be all, I shall be satisfied with the great secret pleasure and laudable pride that I feel in my own breast from having been the instrument of bringing forward and maturing new principles and new arrangements of boundless value to my country. However much I may be straitened in pecuniary circumstances, the great honor of being a useful subject can never be taken from me, which to me far exceeds riches."

So passed away the great Cornish genius, rough as his native county, but whose fame is as durable as that imperishable stone. His genius was of an intensely practical nature; but while he displayed an ignorance of many things which led him into blunders, his failures were few, his successes many. We who can look back and see the cause of his failures may learn a valuable lesson of how essential a knowledge of first principles is to the most consummate genius; we can see that, if Trevithick had possessed what we call an elementary knowledge of natural philosophy, his achievements would undoubtedly have been greater than they were. We have no space to record even a moiety of the crude inventions he brought forward; but his water pressure engines and his plans for propelling vessels by steam, apart from the great invention of the high pressure and the locomotive engine, are alone sufficient to stamp him as a man of no common order. In person Trevithick was of more than average stature (6ft. 2in.) and was probably the strongest man in Cornwall. He could easily lift a thousand lbs. The College of Surgeons had never seen so fine a development of muscle, and several anecdotes of his great strength are told. Captain Andrew Vivian had also seen him write his name on a beam 6ft. from the floor with a 56lb. weight suspended from his thumb.

Novel Plan for Exploration.

An astonishing proposal has been made by one Captain Bazerque to the International Commission of Weights and Measures, now in session in Paris. He proposes to organize a "universal caravan" to undertake a grand voyage of scientific exploration over the entire globe. The Arctic regions, Equatorial Africa and other inaccessible localities are to be penetrated, and full information obtained regarding every point of interest thereby afforded. Captain Bazerque says: My organization is composed of: First (and here we think we may trace the influence of the gallant captain's spouse), there shall be bi-monthly telegraphic communication (how, not stated) between each of the members of the caravan and his family. Second, priests, Catholic and Anglican, shall be treasurers of the expedition. Third, the camping material shall be of the utmost lightness and portability in order that it may be transported on the backs of Indians, so that the expedition may sojourn in the midst of hitherto unexplored countries as long as the study of the *fauna*, *flora*, geology, etc., presents points of interest. Fourth, a company of sappers will precede the devoted band of scientists to clear the road. Thirty-five sailors may be disembarked to fulfil this function and also to act as couriers and *valets de camp*. We do not see how this is to be done. It is expected that the various governments of the world will render every assistance, and it is considered fully assured that the rulers of the Southern American States, Australia, Java, and the Philippines—we are totally at a loss to discover why this selection—will provide native troops to ensure safety. Every known and, we infer from the language of this inventor, several entirely unknown sciences are to be investigated. The expedition is to be supported by a grand subscription from eminent persons in Europe and America. How many explorers are to participate in the delights of the undertaking is not yet determined; but, for the benefit of our younger readers who may cherish a hope of enrolling their names, we can state that no one is to be admitted unless he is over 45 years of age. After the labors of the voyagers are completed, a book will be published, containing everything that can possibly be said, thought, written or engraved about everything else, in five languages, an announcement which we hail with much joy, as we shall thus be delivered from the immense number of volumes of scientific explorations which are yearly issued and which it is our duty to review. The grand work will exhaust every subject, and consequently leave future generations nothing to write about. Lastly, the remarkable Captain Bazerque wishes everybody to give him problems which he proposes to make the philosophers of the expedition work out, and he closes his announcement in *Les Mondes* with the notice that he will exhibit a long and brilliant series of pictures, in the electric ight, of the localities he proposes to visit.

Chinese Cheap Labor.

The Memphis *Appeal* gives the following example of Chinese industry and success:

"Two years ago a number of Chinese arrived at our wharf and were objects of great curiosity. Some of these men settled near here, and among them a small colony found homes and cotton picking in the neighborhood of Marion, Ark., some nine or ten miles from this city. Among them was Ah Maun, who proved to be a Chinese of education, gathered up some knowledge of English rapidly, became popular, and was called by the country people John Ormond. He set to work at once. The first day his cotton picking amounted to twenty-two pounds. The negroes laughed at the small specimen with a pigtail under his hat. In one year not a negro on the plantation could bring as much cotton to the gin house as Ah Maun. Ah Maun took his triumph quietly, and kept his popularity. Last spring he and six of his fellow countrymen rented a piece of ground near Marion. Twenty acres they put in corn and forty in cotton. Seven times was the ground plowed over, until it was in complete order for a crop. Every bit of grass was obliterated, every weed exterminated, every fence corner made clean. The five men had appointed Ah Maun "boss," and Ah Maun allowed no slovenly ways. Early morn and dewy eve saw the six Chinese at their tasks. Patient, plodding, unwearied industry that never lost heart, never intermitted, brought a crop of corn and another of cotton that are the admiration of Crittenden county. It is visited and gazed at as a wonder of skill, industry and success. Another wonder was that Ah Maun and his men not only knew no such word as fail, but they knew no such English as "sick;" well they were and well they remained through heat and cold, and swamp fogs and chilly mornings. When picking time came, Ah Maun hired four more of his compatriots, and all the year the ten are busy as ants. On Thursday they sent two bales of cotton to the city. It was received by Keel & Co., and Mr. Keel says two better bales of well grown, cleanly picked cotton he had not seen this year. Ah Maun's energy and skill and those of his hardworking companions are admired, and we hear that if the group choose to break up next spring, taking new farms and joining with them new hands, they will be liberally aided, and such money and supplies as may be necessary will not be withheld. Ah Maun is triumphant; the white folks regard him as a prodigy."

Searching for Diamonds.

Professor Orton in his new book, *Underground Treasures*, says: Few things are so unpromising and unattractive as gems in their native state. Hence their slow discovery. There is little doubt that diamonds exist in many places as yet unknown, or where their presence is unsuspected. It is very difficult for the unpracticed eye to distinguish them from crystals of quartz or topaz. The color constitutes the main difficulty in detecting their presence. They are of various shades of yellowish brown, green, blue and rose red, and thus closely resemble the common gravel by which they are surrounded. Often they are not unlike a lump of gum arabic, neither brilliant nor transparent. The finest, however, are colorless, and appear like rock crystals.

In Brazil, where great numbers of diamonds, chiefly of small size, have been discovered, the method of searching for them is to wash the sand of certain rivers in a manner precisely similar to that employed in the gold fields, namely, by prospecting pans. A shovelful of earth is thrown into the pan, which is then immersed in water, and gently moved about. As the washing goes on, the pebbles, dirt and sand are removed, and the pan then contains about a pint of thin mud. Great caution is now observed, and ultimately there remains only a small quantity of sand. The diamonds and particles of gold, if present, sink to the bottom, being heavier, and are selected and removed by the practiced fingers of the operator. But how shall the gems be detected by one who in a jeweler's shop could not separate them from quartz or French paste? The difficulty can only be overcome by testing such stones as may be suspected to be precious. Let these be tried by the very sure operation of attempting to cut with their sharp corners glass, crystal or quartz. When too minute to be held between the finger and thumb, the specimens may be pressed into the end of a stick of hard wood and run along the surface of window glass. A diamond will make its mark, and cause, too, a ready fracture in the line over which it has traveled. It will also easily scratch rock crystal, as no other crystal will.

But a more certain and peculiar characteristic of the diamond lies in the form of its crystals. The ruby and topaz will scratch quartz, but no mineral which will scratch quartz has the *curved edges* of the diamond. In small crystals this peculiarity can be seen only by means of a magnifying glass; but it is invariably present. Interrupted, convex or rounded angles, are sure indication of genuineness. Quartz crystal is surrounded by six faces; the diamond by four. The diamond breaks with difficulty; and hence a test sometimes used is to place the specimen between two hard bodies, as a couple of coins, and force them together with the hands. Such a pressure will crush a particle of quartz, but the diamond will only indent the metal.

The value of the diamond is estimated by the carat, which is equal to about four grains, and the value increases rapidly with its weight. If a small, rough diamond weigh four grains, its value is about $10; if eight grains, $40; if sixteen grains, $640. A cut diamond of one carat is worth from $50 to $100.

The imperfections of the diamond, and, in fact, of all cut gems, are made visible by putting them into oil of cassia, when the slightest flaw will be seen.

A diamond weighing ten carats is "princely"; but not one in ten thousand weighs so much.

If a rough diamond resemble a drop of clear spring water, in the middle of which you perceive a strong light; or if it has a rough coat, so that you can hardly see through it, but white, and as if made rough by art, yet clear of flaws or veins; or if the coat be smooth and bright, with a tincture of green in it,—it is a good stone. If it has a milky cast, or a yellowish green coat, beware of it. Rough diamonds with a greenish crust are the most limpid when cut.

Diamonds are found in loose pebbly earth, along with gold, a little way below the surface, towards the lower outlet of broad valleys, rather than upon the ridges of the adjoining hills.

Waterspouts on Lake Erie.

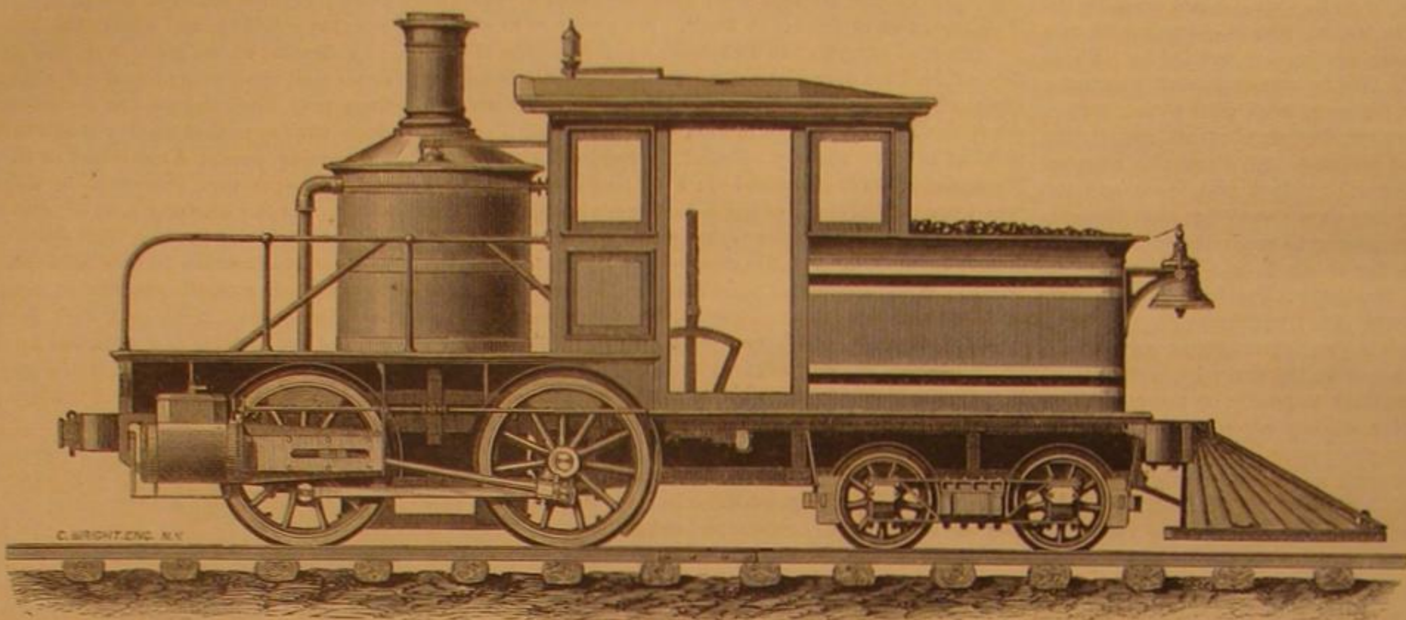
Waterspouts recently seen on Lake Erie are thus described by a newspaper correspondent: About 9.30, A.M., when about ninety miles from Erie, and nearly abreast of Cleveland, on our course to Detroit, we saw an immense waterspout, which at first looked like the heavy black smoke of a steamer. It gradually took the shape of a column and arose to the clouds, seemingly drawing up and discharging an immense quantity of water. Soon after this spout arose others, which came in sight in the same direction, and six were visible at the same time, all apparently within two or three miles of each other. They changed locality a good deal and one of them appeared to pass another. While these spouts were in operation, they appeared like long black clouds or columns, discharging immense quantities of smoke, which appeared to be caused by the falling water. Vivid lightning could be seen beyond these spouts, and by the aid of a glass it could be plainly seen that the lake in the vicinity was terribly agitated. The steamer was about six miles distant from these spouts, perhaps a little more. They lasted over half an hour.

DECOLORISING ACTION OF ANIMAL CHARCOAL.—Dr. H. Schwarz records the results of a series of experiments made with the view of ascertaining whether, by igniting bone ash with organic substances, such as glue, size, sugar, etc., a good decolorising charcoal is formed, and also whether the spent animal black can be revivified to its former strength by a similar process. It appears from the author's extensive researches that animal black may be entirely revivified in closed vessels by ignition with organic matter, which need not be nitrogenous.

IMPROVED TANK LOCOMOTIVE.

Owing to the light construction of the narrow gage railways which are being built throughout the country, it is necessary that rolling stock be employed thereon which shall be in accordance with the general strength and capacity of the roads. Inventions therefore which will economize dead weight and at the same time afford a maximum quantity of power are required, and in view of this need the attention of mechanical engineers has, of late, been directed, in no inconsiderable degree, to the introduction of devices for meeting the same.

The locomotive represented in our engraving is the invention of Mr. M. N. Forney, a well known mechanical engineer of this city, and is intended for service on roads which do a light traffic and run frequent trains. We may add that the inventor believes it suitable for use in citiesfor the traction of street cars, in place of the dummy engine; but in this opinion we can hardly concur, although the machine is obviously fitted for light, or as we above remarked, narrow gage use. The boiler, it will be seen is vertical and, with the machinery, imposes the greatest weight on the driving wheels, so that their constant adhesion is ensured. This arrangement is much superior to the method of placing the coal and water in a similar position, because, the supply of both being constantly changing, the consequent adhesive load varies all the way from an overplus to an insufficiency. In this machine a loading truck on the forward portion affords space for a large quantity of both water and fuel. In view of the employment of the locomotive on street railroads, the inventor suggests that a condensing apparatus may be easily added so that the operation of the engine would be noiseless.



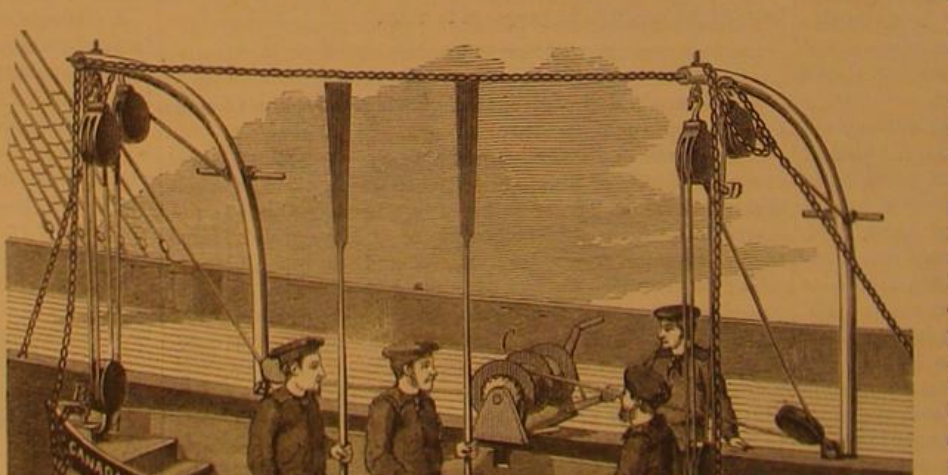
IMPROVED TANK LOCOMOTIVE.

The design seems to us economical in construction and doubtless will prove efficient in practical use. It may be built of almost any capacity from a few tons up to a weight of thirty or forty tons. The smaller sizes can, we are informed, be made to traverse curves of from thirty to forty feet radius.

AUTOMATIC BOAT DETACHING APPARATUS.

It is an odd coincidence that, within a few days after the publication of our editorial directing the attention of inventors to the urgent need of an automatic and safe means of detaching boats, we find ourselves called upon to describe and illustrate a device which seems to completely solve the long-vexed problem. The reader who has never been to sea, and is consequently unfamiliar with nautical appliances, will at first doubtless fail to appreciate the great importance of the invention. It is not an apparatus to be employed in the ordinary hoisting and lowering of the boat, for this is done by the heavy falls provided for the purpose; but in time of emergencies,when not a second can be wasted, its value is pre-eminent. A man overboard, with the ship under full steam or sail, necessitates the promptest action; the life buoy dropped, a boat must be lowered instantly, with its crew in their places, oars in hand and ready for immediate service. If a heavy and dangerous sea be running, and the vessel is under much headway, to accomplish the lowering of the boat by the falls is practically impossible, apart from the time that would be occupied in so doing; the frail structure would be swamped, and the crew lost almost to a certainty, while even if the waves be only moderately high, and the ship hove to or at anchor, it is a perilous and difficult proceeding to unhook the lower blocks while the bow and stern of the boat alternate in pointing nearly to the zenith.

An automatic mode of detachment is therefore required which will safely drop the boat bodily, allowing it to fall through a short distance just before it reaches the water. Based on this principle, numerous inventions—many highly ingenious—have been introduced. Space forbids our entering into the description of these devices; suffice it that it is a defect, common to all, that the apparatus must be operated by a hand in the boat. Either a pin must be pulled out, a lever moved or a screw turned at just the proper moment. It is no uncommon event for the person charged with this duty to become nervous or excited when all is hurry and confusion around him; he is being lowered rapidly to the water, and it is difficult for him to judge his distance above the varying surface; he may let go a minute too soon and fall down into the trough of a wave, or he may hold on so long that,before the boat can be cleared, it is dashed and stove against the side of the ship. In our own experience, we have seen one of the best known inventions, now largely used in the navy, fail again and again to detach both ends of the boat at the same moment, and we know it to be a common accident for an entire crew to be thrown headlong out through some fouling of the gear, or for a premature detachment to cause the boat to swing vertically by its bow or stern from a davit head.



QUARITIUS' AUTOMATIC BOAT DETACHING APPARATUS.

Our illustration represents an apparatus which is the simplest and apparently the safest we have ever seen. To the lower blocks of the regular falls (the large tackles which are shown supporting the boat), instead of the ordinary hooks, are attached bent or rather curved bars of metal, as shown at A A, in the lower and horizontal parts of which slots are cut. These bars slip into metal boxes, firmly secured at either extremity of the boat,and are held therein by pins, B B. From the engraving it will be seen that the boat-falls are not rove in the usual manner, that is, the standing parts are not made fast to the lower blocks, but to cleats on the davits. The running ends are carried to a horizontal drum, C, and are wound around the same in opposite directions. The drum is actuated by a crank, and is provided with a pawl and ratchet wheel, so that it may be retained in any desired position. By turning the crank in the proper direction, the rope will be wound about the drum cylinder, and the boat thus hoisted from the water.

Attached to the pins, B B, will be noticed chains, which, in the engraving, hang loosely over the gunwale of the boat, and, extending upwards, are secured to pins on the davits. These chains are a little shorter than the distance, from the boat when hoisted, to its position when floating on the surface of the water. Consequently, when the boat is lowered by the falls, the chains will allow the descent but to a certain point, when they will become taut. The boat continuing to descend, the whole strain is brought to bear on the pins B B, which, being but loosely inserted, are instantly withdrawn, the bars on the lower blocks slip out of the boxes, and the boat drops detached and clear. The lowering is rapidly effected by allowing the rope to unwind from the drum, the revolving motion of the latter being governed by the friction brake, shown in the hand of the figure on the deck of the vessel in the illustration.

Of course, the length of the detaching chains must be such as to pull out the pins when the boat reaches a certain determined distance from the water. This length is marked by shackles attached to the proper links on the chains, so that the mistake of hooking the latter too short or too long need never be made. In dropping the boat while the vessel is in motion, when it is advisable to allow the stern to fall a little in advance of the bow, a second shackle, D, may be added to the after chain, rendering the same somewhat the shorter of the two.

The extreme simplicity of this device will, we think, impress every one as favorably as it has ourselves. There is no complicated series of hooks and levers to become jammed; the action is purely automatic and absolutely positive. Nothing is left to the judgment of any of the crew or the lowering hand; and, indeed, it is difficult to foresee a case in which the apparatus would fail to be efficient. The invention has received the official approval, and has elicited high praise from fleet and commanding officers in the navy, from captains of the transatlantic steamers and packets, and last, but not least, from the British Government. Patented through the Scientific American Patent Agency, March 12, 1872. For further particulars, address the inventor, Mr. Christian Quaritius, Canarsie, Kings County, New York.

Patents have also been secured in Great Britain and France through the same source.

Recovered Treasures.

It will be remembered that the large steamship America, plying between Panama and San Francisco, was burned a few years ago, on the Pacific coast. Since that time various efforts have been made to recover the treasure which was on board. According to the San Francisco *Bulletin*, some of these recent efforts have been attended with success, and the precious metal has been delivered at the Assay Office in that city.

Twenty-three boxes of melted coin, weighing from 200 to 400 pounds each, were scattered about the floor of the room, and besides there were piles of bars and irregular masses of valuable metal lying around loose. Two pieces of the melted mass, with a length each of about three feet, and a width of eighteen inches, weighing one hundred pounds, looked like a section of frozen clay bristling with oysters. These oysters were twenty dollar pieces, Mexican dollars and half dollars of American coinage, with dimes and half dimes for young oysters, and iron spikes, bits of brass and steel to represent the shell fish that are wont to burrow in the bed of the ocean, the whole forming a valuable specimen of crustacea. In some instances the coins are only welded together in rolls, and at other times they form one lava-like gob. The melted matter and the coins are of a deep green color.

The large bars of bullion were less affected by the fire than the coin, and do not appear to have lost much in weight. The metal is to be recoined. Two twenty dollar pieces in the lot were kindly donated to the representatives of the press, who were among the reliable persons present, and had not the coins been welded to a bar, they would have been taken away. Three hundred thousand dollars worth of treasure, half melted ,colored by fire and the action of the water, is a curiosity that few people have ever had an opportunity to see.

A UNIVERSITY OF ARTS AND TRADES.—A prominent citizen of Toledo, Ohio, has matured a plan and donated to the city a building site for the establishment of a "University of Arts and Trades," for the promotion of knowledge in these and the related sciences by means of lectures and oral instruction; of models and representative works of art; of museums of the mechanic arts, and of what soever else may serve to furnish artists and artisans with the best facilities for high culture in their respective occupations, in addition to those which are furnished by the public schools. This is a most excellent movement.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

TERMS.

One copy, one year		$3 00
One copy, six months		1 50
CLUB RATES	Ten copies, one year, each $2 50	25 00
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TO BE HAD AT ALL THE NEWS DEPOTS.

VOL. XXVII., No. 21. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, NOVEMBER 23, 1872.

Contents.

(Illustrated articles are marked with an asterisk.)

NEW DISCOVERIES CONCERNING TERRESTRIAL HEAT.

The older treatises and text books on physical geography state that the temperature of the earth's crust, at the limit where the yearly oscillations of summer heat and winter cold are no more perceptible, is everywhere equal to the mean temperature of the locality. This statement is only approximate to the truth, and sufficed as long as the investigations were made in the rough manner which distinguished many of the experiments and observations of the beginning of this century. The example, however, of several conscientious observers of that time who applied the most scrutinous criticism in regard to the results obtained, has later influenced the great majority of the investigators of the present day. No longer content with approximations, they wish to come to positive numerical data; and among other corrections which were the result of the modern refined methods of experimenting, are those in regard to the relation of the temperature of the earth's crust to the mean temperature of the spot.

Considering the matter *a priori*, from a theoretical point of view, it is evident that if the interior of the earth has a temperature of its own far above that of the surrounding space, which is a fact beyond dispute, this heat must influence its surface, and raise its temperature beyond that produced by the solar radiation alone; in fact, the heat of the earth's surface must be equal to the sum of the terrestrial and solar thermic intensities; and if this be so, the temperature of all portions below its surface, beyond solar influence, must be somewhat higher than the mean temperature of the localities.

This is now found to be actually the case where the observations have been made with proper scrutiny and care. Alexander von Humboldt was, in 1817, the first who gave a clear and comprehensive view of the distribution of solar heat on the surface of the earth, by his ingenious method of drawing lines of equal mean temperature over the terrestrial maps; these are called isothermic lines, and they were founded on long continued observations in sixty different localities. It is to the great credit of that glorious investigator that, after all the later labors and corrections attempted during the last half century, no essential change has been made in these curves as first laid down by him. The latest isothermic maps, published by Dove in 1865, were founded on the observations made on 900 different localities.

Quite recently such lines have been drawn representing the distribution of terrestrial heat under the earth's surface, beyond the solar influence; these are called isogeothermic lines, and, of course, cannot be drawn across oceans, but only on the land. When drawing both the isothermic and isogeothermic lines on the same map, considerable deviations are perceived, contrary to the thus far established ideas of their coincidence. So it is found that, near the tropics, or where the yearly mean temperature is from 60° to 70°, or in other words, between the isothermic lines of 60° and 70°, the isogeothermic lines coincide nearly with the isothermic lines, having only slight local deviations; that between *the tropics* where the mean temperature is from 75° to 80°, the temperature of the corresponding isogeothermic lines is slightly lower; but that beyond the Tropic of Cancer in the northern hemisphere, the isogeothermic lines of the same temperature lay considerably north of the isothermic lines, or in other words that the temperature of the isogeotherm is considerably above that of the isotherm for the same spot. So in the United States, the yearly isothermic line of 50° runs through Philadelphia due west, and, after crossing the Rocky Mountains, continues in a northwestern course through Salem, Oregon, to our Pacific coast, while the isogeothermic line of the same temperature runs through Boston and Chicago, where the isotherm is only about 45°. In Europe and Northern Asia, the difference is still more striking; however, around the Mediterranean sea, there is only a slight difference, while in Ireland a perfect coincidence of the isothermic and isogeothermic lines takes place, undoubtedly due to the Gulf stream, raising the temperature of the air to that of the terrestrial heat. In Germany, on the contrary, and especially in Russia, the differences are very great, being as much as 9° or 10°; that is, while the yearly mean temperature of the air is, for instance, in Moscow, 38°, the temperature of the earth is 46°, while in Tobolsk, Siberia, where the mean temperature of the air is 29°, the temperature of the soil, at a depth whereto the winter frosts and summer heat do not penetrate, is 41°.

It is scarcely necessary to mention that these data constitute a most important contribution to the right understanding of many otherwise obscure facts. Our elevated mountain tops have a low temperature, not because they reflect solar rays to all sides, but because they have lost terrestrial heat by radiation long ago; and their interior temperature has descended so low that the solar rays cannot impart heat sufficient to reach the melting point of the snow. So Schlagintweit found that the mean temperature at a hight of 10,400 feet on the side of one of the peaks of the Great Glockner in the Alps was 20° Fahr.; but the temperature of the ground below the influence of solar heat was 32°. Lower down along those same mountains, where the temperature of the ground is 20° higher, the mean temperature of the air is also 20° higher, and is, in this way, raised above the freezing point by the addition of terrestrial heat. This is in fact the case everywhere on our earth's surface; and, if this internal heat were withdrawn, the whole terrestrial surface would be changed to the same condition as the lunar surface, on which the intense cold is simply a result of the absence of internal heat, lost by radiation ages ago in the same way as our mountain tops have lost it, even between the tropics, and are covered with perpetual snow. Our highly elevated plateaux have not suffered such a loss, being less exposed to loss by radiation than the more isolated mountain peaks and ranges, while the moon, by being 50 times smaller than the earth and not protected by a non-conducting atmosphere, has lost the greater portion of its own internal heat long ago.

DRAWINGS FOR THE PATENT OFFICE.

The rules of the Patent Office are now very strict in regard to the character of drawings furnished for patents. They are required to be done on "Bristol board," in India ink, size of sheet 10×15 inches, one inch margin, as few lines as possible. All lines must be clean, sharp and solid, not too fine nor crowded. Every line and letter must be absolutely black. Shading to be very sparingly used, and line shading alone permitted, brush shading and colors being wholly excluded. The light is always supposed to come from the upper left hand corner. There are a variety of other regulations about the lettering and placing on of titles, all of which are strictly enforced. The reason why the Patent Office is so very particular, as to the mode in which drawings are presented, is to secure facility and legibility in their publication. The drawings are now reproduced and printed by the photo-lithograph process. This involves, in the first place, the production of a perfect photographic glass negative from the drawing, and the clearer, blacker the lines of the drawing, of course the better will be the negative and the resulting prints. From the negative a print in chromatized gelatin, on paper, is made, which print is transferred to stone, then inked and printed in the press like all lithographs.

At present the Patent Office produces three negatives, of different sizes, from each drawing, and three different editions of the prints are issued, one of very small size for the *Official Gazette*, one of medium size for bound volumes of patents, and one of large size for attachment to the patents when issued.

LACK OF INTEREST IN ENGLAND FOR THE VIENNA EXPOSITION.

It seems that Americans are by no means the only people who are lacking in interest as participators in the Vienna Exposition. The *London Standard*, of a recent date, contains quite a lengthy communication from a correspondent, in which we find the following:

"Not one inventor or owner of special goods has ever patented his goods in Austria. When his patents are infringed by their being copied, the Austrian Courts invariably decide so as to cancel the patent, and always favor piracy. * * * The experience of the Paris Exposition to inventors was one of universal disaster, on account of the very unjust French laws on patents and trade marks, with which it is impossible for exhibitors to comply. In the windows of thousands of shops in Paris and Vienna you see both English and American inventions that were copied at the Exposition in Paris, and the inventors and manufacturers have been astonished to find their inventions patented by Frenchmen and other continental people before the inventors took their patents. The inventors rested under their exposition protection certificates, and just at the close of the Paris Exposition they took their patents. Many of them, soon after the Exposition was closed, found their goods being manufactured by the French, and when the real inventor came to demand his rights, the Frenchman showed his patent to be several months the oldest."

The letter then goes on to say that the Austrians are pursuing a similar course, and the law of the country, as now enacted, "is only an entanglement and deception, for under it no foreigner has ever succeeded, no matter how valuable his invention or how simple his case. * * Under the Austria patent law there is no provision by which a case can be completed, and the infringer can keep the case open during the entire life of the patent."

The writer states that but a short time since an attempt was made in Vienna to palm off inferior cutlery upon him as the manufacture of the Sheffield "Rodgers," which, on close examination, he found to be marked "Rodger" with the "s" left out. Owners of military goods are specially cautioned not to exhibit, as neither Austrian, German nor Russian laws afford the least protection, while it is a fact that the Austrian Minister of War has declined to exhibit Austrian war material.

A strong protest against the course of officials of the English Government, in advising inventors and manufacturers to contribute to the Vienna Exhibition, concludes the letter.

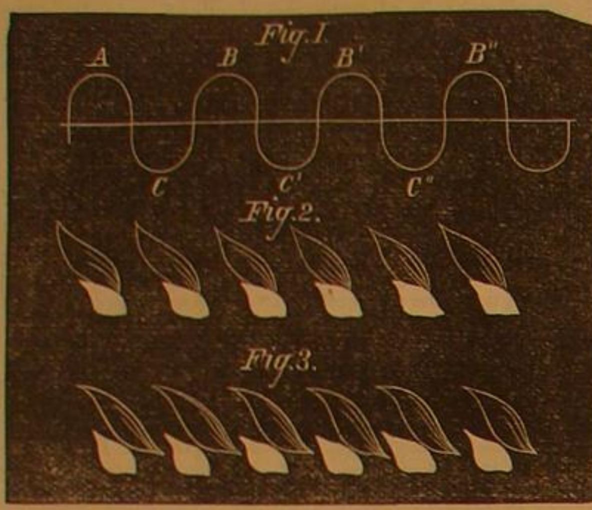
Our readers will recognize the above as confirming the views heretofore expressed by us on the subject. England, we learn, has appropriated but 6,000 pounds sterling to meet the expenses of adequate representation, but some of the papers are calling for a larger sum. It is not likely that a further amount will be forthcoming when the true state of the case is fully brought to the notice of the English people and Government. We trust that our next Congress will follow a similar course, and withhold all appropriations *for* the Exposition until the oppressive laws of Austria are modified or repealed.

THE DETERMINATION OF HIGH TEMPERATURES BY SOUND.

At a recent meeting of the Lyceum of Natural History in this city, Professor Mayer, of the Stevens Institute of Technology, delivered an interesting discourse upon the determination of high temperatures in furnaces by sounds; describing some original researches of his own, and illustrating his remarks by several effective experiments. In order to understand Professor Mayer's conclusions it is necessary to briefly review the laws of vibrations in elastic media. If a tuning fork be set in motion, its vibrations are transmitted to the air, and the latter vibrates in unison, making the same number of movements per second, whether 500 or 50,000. To comprehend the reason, said the speaker, imagine a sphere of delicate membrane containing air of the same elasticity as that which surrounds it. Suppose this sphere to contract and expand, say one hundred times per second; for each expansion there will be a corresponding condensation of the shell of air next to the surface of the globe; the air being elastic, this condensation is transmitted to the shell of air which envelopes the first shell, thence to another beyond, and so on. Conversely, if the sphere contract, a rarefaction of its immediate envelope of air takes place, which rarefaction is also transmitted outwards, each succeeding shell diminishing in density in turn. These motions, of course, are mere undulations, similar to waves of water, or of light in its passage through ether, the air taking up the form of the vibrations, transmitting it to the ear, whence it passes to the brain and is perceived.

A tuning fork, when vibrated in regular motion, leaves, when its point is drawn over the surface of a piece of smoked glass, a sinuous curve. This curve is a symbol of the condition of the air, and from it, if highly magnified and suitably divided, formulæ can be deduced. Suppose this sinuous line to be as represented in Fig. 1, and bisected by the horizontal line. Then the curves A, B, B', etc., above the line, are those of condensation, while those C, C', C'' are curves of rarefaction. Now, if we could physically see the particles at the points A and B, in the air, we should see them swing as it were together, while, if we compared those at A and C, we should see them move in opposite directions to each other. We thus might detect the particular phase of vibration surrounding sounding bodies. A wave length is that length of air which embraces all phases of vibration when a sound traverses it. To prove the above experimentally, two tuning forks of precisely the same note may be used. If one fork be sounded and then stopped, the other will continue its vibrations, being set in motion by the air. If now fork 1 be placed at any point to represent A in our Fig. 1, and fork 2 at a point corresponding to B, and if we vibrate fork 1, we shall find that similar prongs in both forks vibrate together. That is, while the right hand prong of fork 1, moves to right, the same prong in fork 1 will move in the same direction. But if we place fork 2 at C in the opposite phase of the wave, then opposite prongs will vibrate, or the right hand prong of fork 2 will move in unison with that on the left of fork 1, and *vice versâ*. If we could arrange a revolving mirror to reflect beams of light thrown from small mirrors on the prongs, we should find in the first case two curves side by side, like rails on a track; but in the second instance, the curves would be directly opposite to each other.

Professor Mayer then proceeded to explain the apparatus which he had provided for actually observing the above motions in the air. It consisted of an organ pipe, in the center of which was a hole closed by a membrane. Over the latter a small box was placed, into which gas entered through a pipe and leading out of the box was another tube terminating in a small flame. The air in the organ pipe, the medium in the tube, the lecturer stated, and the membrane will vibrate together, and the flame will be caused to jump up and down at the rate of 256 vibrations per second. If while the flame is at rest, we look at its reflection in a revolving mirror, it will appear as a band of light. But if the note of the organ pipe be sounded, the air in the same will cause the membrane to vibrate, this motion will be transmitted to the flame, the image of which will now not be a band, but a series of serrations like saw teeth. The Professor then showed the experiment very clearly and satisfactorily. Now, he continued, let us bear in mind that these teeth in the mirror are the vibrations of the point A in Fig. 1. Here is a resonator, a metal globe with a large opening at one pole and a smaller one at the other. It was invented by Professor Helmholtz, of Germany, and will resound to but a single note. Suppose this resonator to be connected with a separate flame by means of a tube containing a membrane, and that this second flame be placed directly beside that first described. If the resonator be held at a distance of a wave length from the organ or the vibrations of A—if, for instance, we hold the resonator at the point B—the two flames will vibrate together, and their reflections in the mirror will be coincident; but if the resonator be placed at point C', moving it further from



A and beyond B, the serrations of its flame will lie between those of the flame from the organ. Moving the resonator still further along to B', the flames will again coincide. Consequently, if we place the resonator as near the organ as possible, and then obtain a coincidence of flames, we shall have determined a wave length which we can actually measure; taking the distance between the organ or point A to resonator or point B for one wave, B' for two waves, and so on. Again, if we carry the resonator one half the distance between A and B, or to C, we shall have the flames intersecting, and the space between organ and resonator will be one half a wave length. To show this fact experimentally, Professor Mayer attached a tube to the small opening in the resonator, and arranged it in connection with a box, in which was a membrane to make a second flame beside the organ flame. The tube measured one meter and a fraction, that being the wave length of the organ as previously determined by the lecturer. The organ being sounded, the flames appeared coincident, as in Fig. 2. The resonator tube was then lengthened half a wave's length, and the flames appeared as in Fig. 3. This was explained very clearly by the fact that, the resonator pipe being the longer of the two, vibrations passing through it would be retarded, and therefore take more time to meet the flame. Professor Mayer went into the elucidation of this phenomenon at some length, so that we are obliged through want of space to omit the process of reasoning by which the above conclusion was attained. Having discovered how to measure a wave length, it is easy to determine a wave surface. A wave surface covers those points around a surrounding body where the air has the same phase of vibration. Now, if instead of holding the resonator still, it be moved around the organ, always keeping the reflected flames in the same relative position, it is evident that all the points through which the resonator passes are positions of the wave surface, which will be found to be an ellipsoid, of which the ends (top and bottom) of the organ pipe are foci. If air is heated, the velocity of sound transmitted therein is increased, its wave length is lengthened. The velocity of sound is determined by the formula:

v (velocity of sound) $=$ 333 (meters at zero C.) $\sqrt{1+{\cdot}00367t}$, t being the temperature.

The decimal ·00367 is the coefficient of the expansion of air under a constant pressure.

The Professor then proceeded to explain the practical application of his discovery. He placed in the furnace a platinum tube, say thirteen meters in length, connected with a resonator. The tube is coiled in convenient form, and is arranged so that the heated air within it does not leave the furnace. Outside an organ pipe is placed, sounding the note UT_4 of 512 vibrations per second. Now if the temperature of the air in the furnace, and also of that around the organ be 0° C., it is plain that the flames acted upon by vibrations from organ and resonator will coincide and the wave lengths are equal. But the temperature in the furnace is becoming increased, and the wave lengths in the metal tube are lengthening, consequently the flames no longer coincide—one set is slowly moving. The furnace is heated a certain number of degrees; another coincidence takes place. Then, if the heat be still increased to 820°, the air in the tube will be expanded to four times its first volume (at 0° C.), and the wave lengths will be doubled. That is, if twenty wave lengths were first contained in the furnace-tube, now but ten will be found; or in other words, ten successive coincidences of flames will have been noted. Therefore, if we count the coincidences and measure the fractions, by the aid of a micrometer, until the flames become stationary, we have exactly the quantity of heat in the furnace which we may determine to 10 degrees Cent.

Professor Mayer concluded his lecture by giving the following formula, in which $t =$ temperature outside the furnace; $t' =$ temperature of air in furnace; $v' =$ velocity of sound corresponding to temperature t'; $l =$ number of wave lengths at temperature t; $d =$ displacement at $t'-t$, $l-d =$ wave lengths in tubes at t'. From (1) and the formula $v' = 333\sqrt{1+{\cdot}00367t'}$, the formula

$$t' = \left(\frac{v\,l}{20{\cdot}16\,(l-d)}\right)^2 - 272{\cdot}48 \qquad (2)$$

which gives the temperature. Professor Mayer proposes to develop the theory to its fullest extent, and also to experiment as to the best modes of applying it, in order to render it useful in many industrial pursuits.

CHOOSING AN OCCUPATION FOR A YOUNG MAN.

If a boy is constantly whittling sticks, fond parents say that he has "marked constructive ability;" or if he can whistle one or two notes of an air correctly, "he will be a great musician;" or if he can draw with reasonable accuracy, "that child is a born artist." If these presumed or assumed evidences of genius are acted upon, and those in authority seize arbitrarily upon the young man and force him into a trade or art, on the ground of their being better able to judge than he is for himself, the possibility, nay, the probability is that he will turn out a Harold Skimpole, of whose class the world has far too many already. He sketches a little; tinkers a little with tools; drums a little on a piano; and in time falls into line with the rank and file of the noble army of incompetents and revilers of fate. He may protest with all his strength in his earlier years that he is not fitted for the occupation chosen for him; he may demand to be transferred into some other calling that his soul hungers after; it is all in vain if some one in authority, be the same parent or guardian, says: "Your profession has been chosen for you and you must follow it; your elders have had more experience than you and can tell better, by reason of it, what you need;" and so the young man is condemned for life. He goes moping all his days and refuses to be comforted, simply because his heart is not in what he is doing. He is out of his element; he disturbs the machinery of the world; he is as bad as a broken wheel on a train; everything with which he is connected goes halting and bumping and jumping because of him. If he does not reach the highest place in his profession, his elders, with astonishing inconsistency, upbraid him and say that he has no ambition, no energy, no desire to succeed; when the simple fact is that he has no qualification to command success.

"How *can* I know about a thing I dunno nothing about?" exclaimed an exasperated and badgered witness in the box. "How can I have inspiration to preach when I am always thinking about machinery; or paint, when I am always wishing to preach, when divine truths fire my heart to go forth and turn men from the error of their ways?" A man out of his place says these things at heart if not in actual words, and his whole life is embittered by the blindness of his elders who would not see, but claimed the right, because they had the power, to squeeze a human heart into the corner they thought it should fill. For it is crushing the heart out of the man to make the boy travel in a circuit he is unfitted for. All his energies and ambition reach forward to one goal; all his nature is bent upon that one thing, and because you cannot see as he sees, oh parent or guardian! because you are not him and do not love it as he loves it, you destroy his future power. It is a serious responsibility to assume: to direct the calling in life a young man shall follow, an action to be taken only upon great deliberation. Whatever he undertakes he must stick to. In the early years of his life, when the world expects but little of him, he must study or work hard to be qualified for the later ones, when it exacts a great deal. He cannot be always young; he cannot have two youths; he must give his young life, his bright hopes, his aspirations to the work in hand. What if his heart is far from it and he is longing with all his strength for that other calling which you have put out of his reach? You might as well go out into the world when he is of age, as some foreign parents do, and select a wife for him. With equal consistency you might say: "I have had more experience in the world than you; you can live happier with this woman than one of your own choosing," yet this is an action you would shrink from committing. Is not a man's profession the same in degree as his wife? Does he not live by it as with her? Are not all his hopes centered upon it, his happiness bound up in it? Is not the contentment which springs from a congenial occupation in some respect the same as connubial affection? It certainly is; for unless a man love the work to which he applies himself his labor is of no force, of little worth. He is half hearted, simply because he lacks the inspiration which enthusiasm lends to every occupation, even the humblest. The shoemaker who likes to make shoes makes better ones than the convict enforced to do so, and the same is true of every work under the sun.

Let every young man choose his own occupation in life. In any event, let him choose it. If he has no particular bias or bent, let him find something to do, all the same. A parent or guardian may say: "My son, it appears to me that your walk in life lies this way," and point out the advantages likely to accrue or that can be absolutely given him if he adopts the suggestion, but this is all that should be done. If he revolts, or objects and says "I cannot," do not retort with "you shall, or you are no son of mine." You will live to repent it. You will wear sackcloth and ashes for it. Humble yourself a little before you overthrow him. A boy has a right to his choice. He has an inalienable natural right—yea, a constitutional one—to "life, liberty, and the pursuit of happiness." Words mean something, and the choice of an occupation embraces all of these. How can you force a boy into a workshop to learn a trade when he has no aptness whatever for it, except that he has been seen to make boats, or kites, things that a child naturally amuses himself by? You cannot; you have no right. Consider the matter somewhat. If he is a tractable, affectionate, and docile boy, so much the worse; you use his natural affection as a vehicle to work your will with him, not seeing that in after life he will become a listless, moody, inefficient laborer in the vineyard, because you have trained him to a stake, or spread him on a wall, instead of allowing him to grow free and unfettered as he should. Consider this matter in some other light than your own inclinations. He will doubtless live many years after you are gone. How shall he best perpetuate your name and family? By following his own natural inclinations, or by trying to force his nature to run on a track too wide or too narrow gage for him? Think over it!

THE LATEST DISCOVERIES IN THE POLAR REGIONS.

Although the North Pole has not yet been reached, notable progress has recently been made in the exploration of the zone of which it is the center. During the past summer, several voyages have been accomplished; and of the results thereby determined, we are now beginning to learn the first particulars.

Dr. Augustus Petermann, the eminent German geographer, has received advices, *via* Norway, that the land at the east of the islands of Spitzbergen, of which the position has frequently changed on the charts during the past two centuries, has at last been reached, and that, during the month of August last, it was thoroughly explored by Captain Nils Johnsen, of Tromsoe. Another Norwegian captain, Altmann of Hammerfest, although reaching the same locality, failed to make observations of any importance, so that it was reserved for Captain Johnsen to complete the work. He left Tromsoe for the fisheries of Nova Zembla in the yacht Lydiana with a crew of nine men. At the beginning of June, says Dr. Petermann, he shaped his course toward the western part of the vast sea which extends between the islands of Spitzbergen and Nova Zembla. During the latter part of the same month he arrived some 80 kilometers to the south east of the Ryk Is islands (a little group off the east coast of Spitzbergen) and in the midst of a great polar current that transports enormous quantities of ice toward the eastern shores of the Spitzbergen and Bären Islands. In the following July and August, the ice current turned more to the eastward, leaving the western half of the sea comparatively clear. Captain Johnsen, who meantime was making large hauls of fish on the great Spitzbergen banks, suddenly discovered on the afternoon of the 16th of August that he had been carried to over 78° north latitude, and shortly after perceived the land which it is believed appears on the charts of 1617 under the name of Wiche or Gillis Land. Finding the sea open on the east and southeast shores of this island, Johnsen anchored his vessel near the northeast point, at latitude about 79°. north, and disembarked in order to explore the surroundings, to ascend a mountain near the coast, and also to obtain a supply of the wood which he saw in enormous quantities on the beach. The main island he found to be accompanied by others smaller in extent. On no portion of the land could extended snowfields be seen. One glacier was visible on the southeast coast, while numerous streams of clear water were apparent.

The length of the island between its furthest points was determined to be 44 marine miles. The drift wood had accumulated in vast heaps, hundreds of feet from the shore and as high as twenty feet above the sea level. The principal animals inhabiting the polar regions were observed, and especially the Greenland seal, which appeared in immense numbers. The explorers evince considerable surprise at the reindeer, which they state are fatter and larger in size than any they had ever seen. On the back of one of these animals, fat was found of over three inches in thickness. Specimens of argillaceous and quartziferous rock were collected and, with some fossil vegetation, forwarded to museums in Europe for examination. On the evening of the 17th of August, Johnsen departed, following the southern and south eastern shores of the island. There was no ice except on the north coast, while in a northeasterly direction the sea was open as far as the eye could reach. Regarding the Austrian expedition of Payer and Wieprecht, we have news as late as the 16th of August. At that date the expedition was near the Isle of Barentz '70° 7' north latitude and 58° 24' longitude east of Paris. There is little of novelty communicated other than that the temperature of the sea, as taken, verifies the figures adopted by Dr. Petermann, on the charts. "Much thick ice has been encountered" says M. Payer, "but with the aid of steam we have no difficulty in penetrating it."

IMPROVEMENTS IN THE MANUFACTURE OF SILK.

In a report to the *Société d'Encouragement*, in Paris, M. Alcan lately gave an account of some recent improvements in the production and manufacture of silk. Among the various branches of this industry are the rearing of the silkworm, the collection of the cocoons, the filature or reeling of the raw silk, the spinning, the utilization of various waste products, and the dyeing and weaving of the threads in their manifold stages from the singles, trams and organzines to the finished silk tissues. Moreover, there belongs to the silk industry the obtaining of the silk substance from the body of the worms and its use for fish lines and violin strings. Recently the regaining of the silk fiber from the silken rags has been added to it; and in regard to this, we would say that it is more important than the shoddy industry, inasmuch as the silk threads regained possess a proportionally higher value than shoddy, because, when used again, they differ less from the new material which is mixed with them.

Of these various branches, we will first allude to the killing of the worms. The most preferable method would undoubtedly be that in which hot air is the means, were it not for the fact that the contrivances used for the purpose are still very defective. Hence, steam is mostly employed, and this process is easy and inexpensive. Yet there is one disadvantage connected with it, as the cocoons absorb moisture; and if not dried with the utmost care, they require afterwards to be turned over several times a day to prevent their loss by decay. In foreign silk growing countries, much care is bestowed upon this branch of the art. In China, for instance, they use *caloriféres*, specially built in Paris with great care. To facilitate transportation, the cocoons are treated in hydraulic presses, whereby spots will most assuredly show themselves if the dead worms have not been perfectly dry. In order to simplify this process, Alcan conceived the idea of employing a volatile substance (camphor) which he did in the following manner: Thirty pounds of cocoons, which were to be sent from southern France to Paris, were packed into a box with a small quantity of camphor, all the cracks having been carefully closed by pasting strips of paper over them. Although forwarded at a time most favorable to the metamorphosis, not a single butterfly was found on opening the box; all the cocoons were saved, and the worms had assumed a mummy-like appearance; they were black, hard, and caused no spots. From these facts, it may well be inferred that this process may well be used in the killing of the silkworm.

Alcan called attention to another operation, namely, the filature or reeling, an apparently simple but important part of the treatment, and one that must be very carefully carried out. To fully appreciate the importance of the improvement to be described, it may suffice to point to the fact that formerly the silk from Persia, China, and the Levant commanded a much higher price than the French production. This condition of things has been changed; for in Europe the silk is now treated differently from the process still followed in Asia. For the better understanding of this operation, let us mention the principal points required in reeling. The most common, as well as the finest, raw silk consists of at least three or four single threads, as many as there are cocoons thrown into hot water which is used for the purpose of softening the threads and to separate them from each other. These single threads have unequal cross sections, and are unequally thick throughout their length; and, moreover, they are not round, but rather flat. Great care is necessary to produce a uniform thread; it should be smooth and brilliant, and when torn should not divide itself; if it does, the union between the single threads has not been perfect. The unification is accomplished by twisting the fibers on their way from the hot water basin to the reeling machine, and it is consequently important that the length of the twisted part should remain unchanged during the reeling of one kind of silk. It is said that to this end Vaucanson has constructed a very simple but ingenious apparatus, which seems to answer all purposes. Unfortunately Alcan has neither furnished an engraving nor a clear description of the invention.

Another point that is very important is that the number and equal strength of the threads should be maintained. As the filature progresses, the diameter of the thread varies; and for this reason, new cocoons must be used from time to time in order to equalize the variation in thickness. The successful performance of this operation requires an apprenticeship of from two to three years.

The third point to be observed relates to the luster of the product. If the threads have not been properly reeled, they exhibit, when magnified, arch-like twists and appear downy. But if they have been stretched in a straight line, they reflect the light, and attain the luster peculiar to properly treated silk.

The improvement made in the art of reeling consists principally in the application of steam power. By this the velocity may be regulated at will, and if the cocoons are well freed from the gummy substance, the operation may readily be carried out. The product obtained is in every respect superior to that obtained by hand; and the process was imperfect as long as hot water, which it is not easy to retain at a uniform and sufficiently high temperature, was used. The stuff called *paquetaille*, a common product, was largely obtained as waste by the direct application of heat.

So long ago as 1810, Gensoul introduced the heating by steam, and from this time dates a new epoch in the manufacture of silk. Two or three years since, a new method for applying heat has come into use in the silk districts of France. The inventor is the manufacturer Limet, of Coisne, department Nièvre, and the principle consists in the alternate or combined action of water and steam, the operation being effected by the alternate opening and closing of stop cocks. The first stop cock furnishes steam with which the cocoons are to be softened; by opening a second cock, they are impregnated with water, which is heated by the steam. If allowed to remain in this position they would sink to the bottom of the basin, which would be a great disadvantage; a third stop cock is therefore opened, by which the water is allowed to reascend, whereupon the cocoons swell, diminish in weight and again ascend to the surface. This operation requires from two to six minutes, according to the hardness, species, or origin of the cocoon. After this preliminary treatment, the reeling is done with great ease, so that the operatives, although generally opposed to innovations, are not likely to return to the old method if they have once used this process. Not only is the silk improved in appearance and the production increased twenty per cent, but defective cocoons may also be reeled without much loss or trouble. Besides, one cocoon or one hundred may be treated with equal certainty.

The invention is characterized by the following considerations: 1. The steam acts uniformly on all cocoons. 2. By the boiling in water mixed with steam, the friction of the cocoons among themselves, which causes loss, is entirely obviated. 3. By the subsequent application of steam, the water is driven out from the cocoons, so that they are caused to float.

The advantages claimed are: 1. The more carefully prepared cocoons can be better reeled, there are fewer ruptures and less loss, and the workmen are enabled to produce one fifth more silk. 2. The silk is smoother, and without down, to which all manufacturers of glossy goods object; it is cleaner from gum and more uniform and strong. 3. The apparatus saves labor, fuel and time.

INTOLERANCE IN SCIENCE.

We have received a pamphlet entitled "On Force of Falling Bodies and Dynamics of Matter, classified with precision to the meaning of dynamical terms, by John W. Nystrom, C. E." It contains 29 pages, of which, to our disappointment, we find 20 filled with different articles published in 1865 and 1872 in the SCIENTIFIC AMERICAN, only 5 pages of explanation of the author's views on the subject, while the remaining 4 are filled, not with scientific refutations, but with personal abuse of his antagonists, who appear to be very numerous, and from among whom he especially singles out Dr. Vander Weyde, saying: "It will do no harm to tell the truth to one of them, every now and then . . . . equally applicable to all the rest of the high authorities who have invariably attacked me. . . When my ideas differ from what is written in their books, they blindly suppose that I am wrong," etc. He further threatens that he will warn the university where Dr. Vander Weyde graduated of his erroneous philosophy, and "if that university cannot sustain its doctor's statements, he ought to be called back and made to study over again, or be requested to return his doctor's diploma."

We have already in our paper of July 29 and September 9, 1865, given our opinion concerning Mr. Nystrom's views; they agree perfectly with those of the National Academy of Sciences, which met in Washington that same year, and would not accept Mr. Nystrom's papers on that subject, as his method of explanation rather confused than elucidated the matter in question; we are, therefore, not inclined to go into any argument at present, but will only remark that it strikes us as not a little curious that Mr. Nystrom finds so much fault with Dr. Vander Weyde's disagreeing with the books and accepted views, while Mr. Nystrom himself boastfully proclaims that the books and accepted views are erroneous; thus he is guilty of the same offence. Only the manner differs in which both gentlemen disagree from the books, and this appears to be very distasteful to Mr. Nystrom.

We are aware that in theological colleges the diplomas are sometimes withdrawn when the graduates preach heresies, not sanctioned by their orthodox *Mater Alma;* but we wish to remind Mr. Nystrom that science is eminently tolerant, and that a graduate, after having been taught the prevalent scientific doctrines in college (and we are convinced this was the case with Dr. Vander Weyde) is at full liberty to promulgate afterwards new scientific ideas or philosophies, without fear of being prosecuted, called back, or having his diploma annulled. On the contrary, such attempts are considered praiseworthy, as without them science would not progress; we are, therefore, far from blaming Mr. Nystrom for trying to promulgate and defend his views, only he must acknowledge that others have a right to the same privileges, which nobody wishes to deprive him of, even if they cannot agree with his peculiar notions, whether they be on velocity of thunder (see SCIENTIFIC AMERICAN of August 24, 1872) the decimal and tonal systems, or the force of falling bodies, etc.

SCIENTIFIC AND MECHANICAL POSSIBILITIES.

One hundred and fifty years ago, if any one had dared to announce the possibility of crossing the ocean in a vessel driven by steam, or of carriages being driven at the rate of thirty miles an hour by this same agent, or of daguerreotyping the human face on a metallic plate by the light of the sun, and then chemically fixing it there, or of conveying news by electric agency for hundreds of miles, and specially under the ocean, such predictions would have been considered simply ridiculous. And now when science announces that it is possible to control the elements, to cause it to rain or shine at pleasure, and that it is possible to draw from the earth's hidden treasure new resources of untold wealth, imparting the greatest happiness and benefits to the human race, it is still viewed with incredulity by the masses. But a few years since, petroleum was first utilized to our benefit. There doubtless was a time when man never dreamed of warming himself by artificial heat. For ages the savage did not know that the possibility of heat existed in the trees under whose shelter he lay. He pulled up wild roots, picked wild fruits, swallowed the raw oysters and mussels as he wandered naked along the beach. A cave by the river or seaside, or a hollow tree, served him for a shelter. Many generations passed before he learned to make a fire; by slow steps he passed from rude tents, huts and cabins, to comfortable houses and stately mansions, with heating apparatus, by which winter is shorn of its vigor.

Heat increases about one degree to every fifty feet that we penetrate the earth; shafts are now sometimes sunk to a depth of 2,000 feet. It is not within the possibility of mechanism to bore 4,000 feet more; at that depth we should find a heat of at least one hundred and fifty degrees, and in many places even greater than this. Mechanical power could be obtained from the steam and water forced up from this depth. Heated water and steam from these wells could be carried into our houses and warm our dwellings to a summer temperature. Conducted in pipes under the soil protected by glass, we could cheaply grow, in New England, all of the southern and tropical plants and vegetables. The snow could be kept melted from the streets of New York, and all of the buildings warmed from this spontaneous flow, useful also for cooking and other purposes.

The Garden of Plants in Paris is heated by water from an artesian well eighteen hundred feet deep, which has a temperature of 82° Fah., and is carried in pipes under the soil. A salad garden at Erfurt, in Saxony, is heated in the same manner, and is said to have yielded $60,000 a year to the proprietor.

J. E. E.

Deep Well.

At the village of Sperenberg, about twenty miles from Berlin, a well has been sunk to the depth of 4,194 feet. A shaft was sunk in this locality, because the known existence of gypsum there led the explorers to infer that they might possibly find a mine of rock salt. At the depth of 280 feet, they dik reach the salt, and continuing on they passed through the salt deposit, 3,907 feet, without having reached the bottom of it. The boring would have been continued to ascertain what deposit lay under the salt, but the mechanical difficulties were too great. The greater part of the boring was done by steam.

THE CONFLAGRATION IN BOSTON.

Another calamity involving the loss of millions of money and valuable property has happened in our midst. Boston, following the sad fate of Chicago, has fallen prey to the flames, and sixty-four acres of her finest buildings lie a heap of ruins. The district burned over is bounded by Summer, Washington, Milk, Congress, Water, Kilby, and half of Central streets, proceeding therefrom in nearly a straight line to Broad street and thence to the Boston, Hartford and Erie Railroad depot. In it are inclnded Otis, Arch, Hawley, Franklin, Devonshire, Matthews, Perkins, High, Purchase and Pearl streets, besides a large number of alleys and places. The fire was discovered on Saturday evening—the 9th inst; and before the engines could arrive, it had spread to the the mansard roof, setting it in a blaze, which, favored by a strong wind, in less than half an hour was communicated to the entire block. So fierce and terrible was the heat that it was impossible for the firemen to remain at their posts; and the granite front walls, of which many of the buildings were composed, cracked and exploded, falling in fragments upon the street. No structure, however massive, opposed the slightest resistance to the flames. Aid was obtained from adjacent cities; and after twenty-four hours labor and the blowing up of several blocks of splendid buildings, the fire was at last brought under control. But in the course of a few hours it broke out afresh, owing to gas explosions, the result of negligence in not shutting off the mains leading into the burned district. Thirty-six hours in all elapsed before the fire was fully reduced. The estimated loss, which will be felt over the entire country, is ninety millions of dollars. Seven hundred buildings, embracing, perhaps, the finest specimens of city architecture in the world, were destroyed.

The fate of Boston enforces more strongly the lessons taught by Chicago, which pointed out the radical defects existing in our modern method of building. The first details of the catastrophe tells us that the flames burst with their greatest fury from the mansard roofs. It is to this imported innovation in architecture that many of our most disastrous conflagrations are due. At the present day in this city, there are scores of these roofs surmounting buildings that are mere fire traps, shells of light, dry beams covered with thin tin or slate, and inviting, by their immense surfaces, immediate ignition from burning buildings in the vicinity. Many of our so-called fireproof edifices are mere skins of iron and masonry, with wooden floors and fixtures, the firing of which twists the iron and tumbles down the whole structure. Our partition walls are too generally made of scantling and lath which receive no protection from their light casing of plaster. If French roofs must be built, the law should require that the walls extend clear up to the decks so as to afford some shield to the light frame work. Wooden church steeples are wisely forbidden in the city, and the same prohibition should be extended to the mansard.

Buildings in crowded localities should be rigidly required to be fireproof, and the use of wood in their construction denied. Interior walls should be of plaster, made in sections and built up, the interstices being filled with dry plaster or other non-conducting and non-inflammable material.

The reports of the late casualty indicate a deficiency of water. With great rivers and bays at the very doors of almost all our large cities, there is no reason why we should not have a most abundant supply. In New York, towers might be built at points along the island which might be kept filled and communicating with pipes laid through all the streets. A powerful head might thus be obtained, and the water be always ready under constant pressure. Or suitable pumping engines of the Holly type might be employed, which, drawing from adjacent rivers, would materially relieve the ordinary fire apparatus.

It should be rendered obligatory to place pipes carrying water through large establishments, so that the entire interior might be drenched by the turning of a single cock. We have heretofore alluded to an excellent system based on this principle, which has been amply tested in cotton mills—the most dangerously inflammable of factories—with every success.

For buildings already erected, such as crowd the narrow thoroughfares of the lower portion of this city, it is imperatively necessary that adequate means of protection from fire be devised and applied, and inventions leading to such are sadly wanted. Wide streets and isolated warehouses have thus far proved to be the only really efficient safeguards, and in further extensions of our cities, this experience will doubtless be turned to profit.

Business and Personal.

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

Notes & Queries.

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

1.—What will give a perfectly black, smooth and even surface to sheet iron, and how it is put on?—S. B. D.

2.—What is the best formula for making a good, durable slate paint, such as is used on blackboards for illustrations in schools, etc?—W. A. B.

3.—Will some one please give me directions for producing a dark glaze on stone ware, that will not melt or blister? I would like to know what glazing is used on Rockingham ware, and where the materials can be obtained.—J. J. K.

4.—I wish to construct a worm of cast or wrought iron about 14 inches long with the core 1¼ inches in diameter, and the flange or thread 5½ inches in diameter, with about 3 inches pitch. The worm is to work in a cylinder 5¾ inches diameter, to act as a pusher, the same as a meat cutter for stuffing sausage. Will some one give me the simplest and best way to make it?—J. D. L.

5.—In August last, at one of the stations on the Union Pacific Railroad, situated nearly 7,000 feet above the sea level, the thermometer being at 80, and the atmosphere exceedingly dry (no rain having fallen for months, so that the land around grew nothing but sage brush), a piece of ice about two pounds weight, laying on the floor and between the draft of two entrances, remained undissolved from 9 A. M. to 4 P. M., when the writer last saw it. Usually, under like circumstances, the ice would have dissolved in a few minutes. Is there any theory that will account for this?—C. P.

6.—Can any one give me a log of the English government steamer Comet, which, in 1835, steamed from Falmouth to Lisbon, being driven by Mr. Thomas Howard's small boiler? This was scarcely what we should call a boiler. The part exposed to the fire being double walled and filled with mercury, upon the inner surface jets of water were injected, periodically with the strokes of the engine, so that just enough high steam was formed on the blistering, sizzling plate to form two or three cylindersful of steam. In those days high steam was a distant acquaintance. In our days for exceptional purposes we see 300 lbs. already used, and for ballooning purposes, 500 lbs. talked of. High steam allows the use of small, and strong boilers, and this brings us to the query of whether the search for the smallest, most compact, and strongest does not lead us back to the principle of Howard. The Comet was reported to burn only 200 lbs. of coal where, with machinery and boilers of that day (1835) she would have burned 800 lbs. and only part of the saving can be and was attributed to surface condensers, which novelties (of that day) she was also provided with. I hope in America, where everybody and thing, animate and inanimate, is expected to carry 1,000 pounds steam or near it, you may be able to speak from experience about Howard's principle.—J. P. C., Jr., of England.

Answers to Correspondents.

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

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

J. C. was informed by the types in our last that hydrochloric acid might be used for dissolving gold quartz. It should read hydrofluoric acid.

I. P. asks for an answer to A. B. S.'s query of April 26, asking for a method of dyeing skins on the grain. A recently published work says: "Leather is dyed or stained by the application, with an ordinary brush, of any of the strong liquid dyes, in the cold or only gently heated, to the surface of the skin previously stretched on a board. The surface when dry is commonly finished off with white of egg and the pommel or shooting stick. Bookbinders employ copperas water as a black stain or sprinkle, a solution of indigo as a blue one, and a solution of salt of tartar or common soda as a brown one."

Can some one tell me how to render the water in my well fit for use? It has become foul by the presence of a large number of dead angle worms. The well is about 16 feet deep and has about three feet of water in it, which cannot be lessened much by the pump or any other means at hand. The bottom seems to be fine gravel and quicksand into which large numbers of the worms have crawled and died, giving to the sand the same bad odor that the water has; and the water cannot be used on account of the bad odor.—E. L. Answer: The remedy is simple: Clean out your well thoroughly by means of buckets.

C. Y. K. says: Enclosed please find specimen of what I take to be a mineral, and I wish you to inform me what it is. Our police court wants a cage or two to use in our jail; can you inform me who makes the best? Answer: The mineral is iron pyrites, of no special value. As to police cages, it might be well for your people to advertise for the best.

L. S. W. asks:—Why have not steam brakes been employed to stop railway trains? Can you refer me to some work or works treating upon the subject of steam brakes upon railroads? What amount of force (power) is required to each car to effectually brake it? Answer: Steam brakes have been used on some of our railways, but on account of difficulties connected with the manipulation, such as condensation of steam, irregularity in steam pressure, freezing of pipes in winter, etc., we believe they have been abandoned. Accounts of the trials and of various steam brake devices, pressure of steam, etc., have been published in back volumes of the SCIENTIFIC AMERICAN. We call to mind no special work upon the subject.

G. W. D., of O., says:—We had occasion to repair a low steam heating arrangement for a dwelling which was furnished with an automatic water feeder; the feeder failed to work on account of the mud depositing under the copper float, which kept it from falling as the water fell in the boiler, in consequence of which the boiler became red hot. In disconnecting the regulator or feeder from the boiler, we held a light at the opening of one of the pipes, intending to look through, when an explosion occurred of great violence. A flame of fire squirted out of the pipe at least two feet long. The mud had a strong fishy smell. What kind of gas was it that ignited, and what produced it? Answer: The gas was produced by the decomposition of oil which must have been in the boiler floating on the water. When the water disappeared and the boiler reached the red heat, the oil was decomposed and converted into ordinary illuminating gas.

S. C. says:—How would it do to place the oxide of manganese in evaporating pans of a house furnace, instead of water, in order to refresh the oxygen as fast as consumed? Answer: Water is placed on stoves and house furnaces for the purpose of supplying the atmosphere of the dwelling with vapor, which is good for the health. The water does not supply oxygen to the atmosphere as you seem to suppose. The use of manganese as you propose would not add oxygen to the air, in any appreciable quantity. Salts of manganese are used in connection with steam in the production of oxygen.

R. B. G. says: Please give us a thesis on the subject of diamonds made from carbonic acid gas, as described in a Missouri paper, and purporting to have been cut from the New York *World*. Answer: Our correspondent refers to a sensation article which appeared in the *World* some time ago, in the form of a letter from a correspondent who alleged that, by a new and peculiar process, using carbonic acid gas, he had been enabled to solidify the vapor into pure carbon, thus producing diamonds artificially. In one night, he said, he had made himself a millionaire, etc. The letter was simply newspaper gas.

R. H. A., of Md., says, in reference to our reply to C. A. S., page 282: It seems to me that the reply is rather too strongly stated. I suppose Glaisher's hygrometer—that chiefly used at government offices—to be one of those alluded to. Now this instrument holding one of its thermometer bulbs covered with water-saturated fabric, and exposed to a slight current of air only partially saturated, does not regularly and quietly give a true indication of the quantity of moisture, unless it is fully up to the dew point, and for this reason: A current of partially saturated air, projected upon a fabric fully saturated, removes water by evaporation more rapidly, and of course refrigerates more and gains a higher indication than it would if the same air were in quiet contact. This instrument, and those of similar plan, beautifully work out the laws of Nature, and it is their accuracy of work that renders them at times unreliable. They only indicate the condition of the air within one inch of the thermometer bulb. In contrast with this device is a woody fiber, formed by Nature, which, from the point of total dryness just short of disintegration, up to that of saturation, expands with regularity and exhibits no fitful or deceptive impulses, such as are to be found in the ingenious instrument with two thermometers. The dew point of a hygrometer made of woody fiber is fixed by adjustment in the same way as thermometers are marked; the bulb and tube are first made and the scale is then marked to suit.

HOW TO FIND THE RELATIVE DISTANCES OF THE EARTH FROM THE SUN.—Your correspondent D. who makes the above enquiry, will not be aided by the reply of J. T. N. in the SCIENTIFIC AMERICAN of October 26. But D., may easily satisfy himself in the following manner: The further a body is from you, the smaller are its apparent angular dimensions, and the nearer it is to you, the greater are its apparent angular dimensions. If, by means of a telescope with cross hairs, D. observes the times of the transit of each limb of the sun at noon about June 30 and December 30, he will at the first date discover the sun's diameter to be about thirty-one and a half minutes of space, and at the latter about thirty-two and seven twelfths minutes of space, showing the sun to be farther from us in June than in December. The distances at the two periods are inversely proportional to the sines of half these angles, or, as the angles are small, are inversely proportional to the angles themselves, nearly; that is, the distance in June is to the distance in December, as 1955 to 1890, or as thirty-two seven twelfths to thirty-one and a half, nearly. The difference between the angular diameter of the sun at the two times mentioned equals 65 seconds of space, which can be easily measured. Suppose the first limb of the sun at noon passes a central wire 2′ 06″ before the second limb passes it, then (omitting a very minute correction), there being 1440 minutes of time in a day, and 21600 minutes of space in a circle if 1440 minutes of time give 21600 minutes of space, 2 minutes and 6 seconds of time will give 31 ½ minutes of space, equal to the sun's angular diameter on that day. If this operation be repeated twenty times in a year at equal angular intervals; and distances inversely proportional to the sun's angular diameters, expressed, let us say for convenience, in seconds of space, be set off on straight lines drawn at these equal angular intervals from a fixed point, then the extremities of these lines will be found on the periphery of a closed curve, called an ellipse, of which the fixed point from which the distances are set off will be the focus. Thus the earth describes an ellipsis about the sun, which is in the focus. Perturbations slightly alter the curve.—A. E.

D. W. S., of Ill., asks the old question: How many times will a wheel turn on its own axis in moving once around the circumference of a fixed wheel of the same diameter? He says the enquiry is creating some excitement in his vicinity and wants our opinion on the subject. Answer: This question was very fully discussed in the SCIENTIFIC AMERICAN, a few years ago, and caused almost as much excitement, not to say bitterness, in mechanical circles as the recent political contest between Grant and Greeley. One side claimed that the wheel turned *once* on its own axis, and were sure they were right; the other side alleged that the wheel turned *twice* on its axis, and denounced all who thought otherwise as fools, knaves, or villains of some sort. On account of the ill feeling likely to be engendered, we shall not at present renew the discussion in our columns. The appearance of an object often depends upon the color of the spectacles through which one looks. Such is apparently the case in regard to this wheel question. To him who sees that it turns once, it makes a single turn. To him who observes that it revolves twice, it makes two revolutions.

To B. F. R., query 15, page 281.—Cartridges are covered with common paper or cloth; and the covering is not dipped in any combustible solution, but the end is simply bitten off and the powder exposed to the flash of the percussion cap.—F. S. B., of Me.

To G. B. M., query 7, page 281.—Zinc can be freed from its impurities by exposing it to a white heat in an earthen retort, to which a receiver full of water is adapted; but the first portions, being liable to contain arsenic and cadmium, should be rejected.—F. S. B., of Me.

Recent American and Foreign Patents.

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

WASHING MACHINE.—William H. Derascar, Primrose, Iowa.—The invention consists, first, in reciprocating the two rubbers of a washing machine simultaneously with a pressure toward one another, and in reverse directions over the clothes placed between them; also, in a stationary spring presser, applied to produce a continuous but yielding pressure upon the rubbers and clothes; also in the mode of arranging the springs and adjusting them to different tensions.

SOLDERING FURNACE.—Samuel A. Ewalt and John A. Tillery, Baltimore city, Md.—The invention consists in constructing a soldering furnace with a nonconducting chamber under the top plate and heating spaces under a side plate or plates, so that the can may be soldered by simply turning it in suitably shaped recesses on the outer surface of said side plates and then sliding it on top, where it remains until cooled. Thus the side plates become the soldering tool, while the top plate is a cooler in juxtaposition thereto.

LONG SPAN PARABOLIC BRIDGE TRUSS.—George E. Harding, New York city.—The invention consists in a stiff upper chord of metal or wood, arranged in the form of a double rubber arch, braced and counterbraced so as to equalize the strain upon upper and lower chords, and rigidly connected at each end with a double lower catenary cord, braced and counterbalanced by vertical tension rods.

ROLLS.—William D. Hillis, Elgin, Ill.—The invention relates to rolls for the manufacture of metallic fence rails from round rods, and consists in combining one smooth roll with another that has been longitudinally grooved and the grooves placed at intervals about its periphery. The rail is thus made flat between the posts and with a shoulder on each side thereof.

PRESS FOR EXTRACTING LIQUIDS FROM SOLIDS.—Washington F. Pagett and Christian F. Rohrer, Fremont, Ohio.—This invention relates to that class of presses which are provided with foraminous press boxes and followers for extracting liquids from various solid substances, such as lard, fruits, cheese, etc. The invention consists principally in the provision of a vibrating or movable post or block which is applied to the follower of the press for transmitting to the same the pressure exerted by a lever which has its fulcrum point in a stationary ratchet plate.

GRINDING APPARATUS.—Albert Assman, Linden, N. J.—This invention relates to a new apparatus which is to be used for grinding or smoothing the surfaces of metallic springs or other flat metallic surfaces, and in which a feed roller is employed above a grindstone, and geared together therewith in such manner that, as the grindstone wears smaller, the feed roller will follow down and still remain in gear.

KEY SEAT CUTTING MACHINE.—Thomas R. Bailey, Lockport, N. Y., assignor to himself and L. W. Vail, of same place.—This invention relates to improvements in that class of machines for cutting key seats in the center holes of pulleys and gear wheels, in which a vertical saw is used for working through the eye of the wheel while lying on the table; and the first part consists in connecting the saw to cross head by an oscillating block journaled thereto. Second, it consists, also, in attaching saw to block by screws passing through trunnions of block into sockets of straw.

CAGE FOR GLOBE VALVES.—John Wood, Franklin, Pa.—This invention relates to an improved construction of cage for globular pump valves with the object of preventing the clogging of the valve by means of sand, gravel, or other impurities entering along the bars of the cage. The invention consists in making the bars of the cage convex or with a sharp edge in cross section on the inner side, so that the ball will be in contact with the least possible extent of surface within the cage. The invention is applicable to steam engines, cold or hot water pumps, and other devices.

APPARATUS FOR CLEANING GRAIN.—Peter Provost, Rochester, Minn.—A perforated cylinder or screen is inclosed by a sheet metal jacket, into which said jacket steam is admitted through a pipe for enveloping the wheat which passes through the screen in an atmosphere of steam, for softening the matters adherent to the wheat; also the hull, to facilitate the removal of all extraneous matters, and as much of the hull as possible in the smutting or scouring machine, to which the wheat is conducted immediately after being so steamed. The wheat is admitted to the screen from the hopper through a pipe, and is discharged at the lower end above the spout, for conducting it away above a perforated partition, which prevents it from going down to the escape pipe for the steam and water of condensation. The matters separated from the wheat by the screen fall upon a slide and are discharged into the spout which conducts them to the proper receptacle. The spout conducts the wheat into a hollow sheet metal cylinder, inclosed by a jacket, in such manner that steam may be used in the said jacket for drying off the moisture on the surface of the wheat in cold weather, which is sometimes necessary. The cylinder projects at both ends through the heads of the jacket, which are fitted as closely to it as to prevent the escape of steam at the joints, and the wheat enters said cylinder at one end outside of the jacket and discharges from the projecting end at the other, through the spout which is to conduct it to the smut machine.

PLOW.—Sewall J. Leach, Tuscaloosa, Ala.—This invention has for its object to furnish an improved plow, which shall be so constructed that its parts may be conveniently put together, and, when put together, will be securely held. Upon the inner side of the middle part of the land side is cast an upwardly projecting hook, which hooks over a brace, which crosses the angle between the mold board and standard, and is cast solid with said mold board and standard. A simple, convenient, effective, and reliable lock is formed for securing the land side to its place. Upon the inner side of the rear part of the land side is cast a seat for the lower end of the handle which is secured in place by a bolt, as indicated by the bolt hole in said land side. A plow point fits upon and is secured to the forward edge of the mold board. The entire plow is thus cast in three pieces, which may be quickly put together and secured to each other.

HORSE POWER.—Lemuel B. Morris, Hopefield, Ark.—The object of this invention is to furnish a horse power for driving cotton gins and other machines, and it consists in the arrangement of studs and braces with the driving wheel and draft levers. The levers are placed at a proper hight from the ground for the application of the power, and necessarily some feet below the driving wheel. The stability of the driving wheel, *therefore*, depends upon the manner in which it is fastened, to the driving lever, and braced. By this system of bracing, this connection is made very permanent and durable and the objections to this description of horse power are obviated.

STEAM PUMP.—John North, New York city.—This invention relates to the combination of two inventions—one an improvement in steam valves, and the other an improved pump—with each other, with the object of utilizing their advantages jointly, and thereby increasing their effectiveness and utility. The present invention consists in extending the stem of the rocking steam valve toward the pump, and in so connecting it with the stem projecting from the oscillating cylinder that is fitted into the pump cylinder, as to impart the necessary vibrating motion thereto. The action of the steam on the inlet valve will thus also be brought to bear on the rocking pump cylinder, thereby economizing complex link mechanism, and taking none of the power imparted to the piston from it for valve-setting purposes of any kind.

RECIPROCATING STEAM ENGINE.—Johann Rudolf Eichenberger, Baughman, Ohio.—The object of this invention is to increase the power and efficiency of the steam engine, and it consists in increasing the steam surface or area of the piston by making it either convex or concave instead of flat, one third more or less, as *may* be desired, thus being added.

WINDMILL.—Isaac Lehmer, Lima, Ind.—This invention has for its object to furnish an improved windmill, which shall be more readily controlled than windmills constructed in the ordinary manner. It is so constructed that, as the wind increases in power, the form of the wings and the centrifugal force engendered by the revolution of the fans tend to turn the wings into a horizontal position or from the wind, carrying the spiders in the opposite direction from that in which the central spider is moving. As the motion decreases, the spiders are drawn back, turning the wings to the wind by means of a *suitably arranged* coiled spring. The motion of the spiders is retarded to allow the inner spider to advance relatively, and thus *throw* the wings from the wind and stop the wheel by means of the brake, which should be so formed as to bear first and with greater force upon the inner spider.

BRIDGE.—Samuel P. Hastings, Tonawanda, N. Y.—This invention relates to improvements in the construction of bridge arches, beams, connecting links, and splices, with the object of increasing the strength and durability of parts and simplifying their connection. The invention consists in the arrangement of a counter arch and inwardly projecting stays over the main arch; in the construction of simple links, which connect the arch braces, to allow their playing one upon another; in the use of arched sleepers, which do not touch the cross beams except under great weight; and in the introduction of a novel simple splice for any of the parts to be connected.

TOOL HOLDER.—Alfred Belchamber, Ripley, Ohio.—This invention relates to a device for facilitating the grinding of plane bits and chisels on grindstones, and consists in a holder and fulcrum stand arranged in combination with the grindstone. With this holder, the plane bit or chisel can be ground with a true bevel, and much more accurately than it can in the ordinary way, and the bevel may be varied and made long or short by varying the position of the tool back or forward in the holder or fulcrum stand, either vertically or laterally. The holder is readily removed from the stone, and the tool is released from the holder by simply turning the thumb screw.

PORTABLE STREET CAR HOSE JUMPER.—James S. Hagerty, Baltimore, Md.—This invention relates to jumpers which allow the cars to pass over hose, lying across the track, without injury thereto. The two improvements in this special class of invention consist, 1st, in combining with angular faces an opening for hose of a horizontal bottom face on each side of jumper, provided with a groove that receives the spikeheads and enables the jumper to sit firmly in its place on the rail; and in combining side and end braces so as to prevent any lateral or longitudinal movement of the jumper.

DREDGE.—Isaac A. Ketcham, Breslau, N. Y.—The invention relates to dredges or machinery for taking oysters, coal, or other objects that lie upon the bottom of a stream, bay, or other body of water, and it consists in a lever regulator by which the teeth of the dredge are set at different lengths, according to the softness or hardness of the bottom, while, at the same time, said lever serves as the ordinary fender, to clear the roller or sides of ship when being taken on board.

MILK COOLER.—Bruce C. Bort and Timothy Bryant, Chateaugay, N. Y.—This invention is an improvement upon the cooler patented June 18, 1872, and consists in dispensing with the bottom of said cooler, by which a large percentage of metal is saved, the milk brought more directly into contact with the cooling surfaces, and the cooler brought within the milk pan.

CONTINUOUS RAILROAD RAIL.—John Downey, Johnstown, Pa.—The invention relates to an improvement in the class of railroad rails formed of three parts, namely, a central piece whose head forms the tread and is provided with a lengthwise tongue; and two bars adapted to fit against the respective sides of the tongue. The invention consists in the mode of setting the rail in transverse slots in the sleepers, and in the use of a clamp bar for securing the three sections of the same together. The sections are arranged to "break joints," and thus form continuous rails.

TOOTH BRUSH TRIMMER.—Jabez Stone, Waterford, assignor to Julius Kayser, New York City.—This invention relates to a new machine for trimming the ends of the bristles in tooth brushes, making the rubbing edges of the brushes either quite flat or convex laterally. The invention consists principally in the arrangement of a rotary cutter in connection with longitudinal guides, on which the brush is moved toward the cutter, and with a slotted fork for holding the brush. The latter is moved at right angles to the axis of the cutter, the edges of the knives being either straight or concave, according to the shape to be imparted to the brush. The invention also consists in the arrangement on the machine having the straight cutters of a transverse rocker, in which the brush can be held and vibrated whenever it is desired to cut it convex by means of straight knives.

HAME FOR HARNESS.—Mason Ellis Abbey, Sardis, Miss.—The trace is looped around the hame and protected by a shield. The hame is made wholly of iron and bent outward to provide room between it and the collar for the trace straps; a friction sleeve is put on it, inside of the loop, to take the wear.

HARNESS SADDLE.—Mason Ellis Abbey, Sardis, Miss.—This invention relates to improvements in the class of harness pads made of wood or other hard substance; and consists in forming pads of wooden or other hard blocks and sheet metal plates inclosing or covering the same on the under side, and in the manner of connecting these parts with each other and the top plates of the pad.

GRAIN BINDER.—Hugh S. L. Bryan, Kearney, Mo.—The invention consists in combining a fork and sliding rake to compress and hold the bundle, and in springs to expel it; in a twine carrying and wrapping mechanism; in the operation of a needle in connection with the twine; in peculiar mechanism for operating rake and twine carrier; and in the general combination of the essential parts to form a grain binder.

SWINGING CHAIR.—Mark H. Prescott, Jr., La Crosse, Wis.—This invention has for its object to furnish a swinging chair. To the back are attached two open steel spring bands, to pass around the body of the child to secure it in place upon the seat. The chair is suspended by cords fitted with hooks and eyes.

HORSE POWER.—William S. Stone, Pitt's Point, Ky.—This invention has for its object to furnish an improved horse power which shall not be liable to get out of order, and will require a comparatively small amount of power to run it; and it consists in the combination, with a sweep crown wheel revolving on a vertical shaft and wheels that communicate motion to the machine drive shaft, of a drive pinion, arranged on a spindle resting upon a collar beam suspended from the girders of the frame.

INKING APPARATUS FOR PRINTING PRESSES.—George K. Farrington and Bradford S. Potter, Bloomington, Ill.—This invention consists of an ink fountain and feed roller, combined with a distributing disk having a beveled margin of the upper surface, on which disk the said feed roller works in a manner calculated to effect a more equal distribution of the ink than can be had with the ordinary fountains. The fountain proper is fixed in connection with the feed wheel detachably, so that interchangeable fountains, containing different colored inks, may be used.

HARNESS.—Mason Ellis Abbey, Sardis, Miss.—This consists of an arrangement of the side and back straps of the breeching for lengthening and shortening, to adjust the breeching for large or small horses. It is a wide strap for traces, breeching, and analogous uses, made with margins lapped and secured with rivets and washers.

TOOTH BRUSH TRIMMER.—Jabez Stone, Waterford, assignor to Julius Kayser, New York city.—This invention relates to a new machine for trimming the bristles of tooth and other brushes of such kind, where the rubbing edges are concave lengthwise, and straight or convex laterally. The invention consists in the use of convex cutters on a rotary shaft, in connection with a transversely slotted longitudinally movable brush carrier. The invention also consists in the combination of the brush cradle, described in another application, with the convex cutters, for trimming a brush concave lengthwise, but convex laterally.

SAWING MACHINE.—Michael McCool, Moundsville, West Va.—This invention relates to a new sawing machine for cross cutting, ripping, and other purposes; and consists in a new manner of fastening the saws in the carriage. The saws, of which a suitable number can be used, are fastened to the end of the carriage by a transverse pin and screw clamp. The pin is fitted through all the saw blades and rested on a projecting rib of the carriage and then clamped tight by means of screws. Grooves are cut into the rib and clamp to receive the saw blades and hold them steady transversely. The outer ends of the saw are connected with each other by a cross piece, and thereby held from swaying and kept the same distance apart.

WAGON JACK.—Johns M. Harlan, of Owensville, Ind.—This invention relates to a new adjustable wagon jack, which can be extended at will, for use on all sizes of vehicles. The invention consists in making the stem or standard of the jack extensible, and in combining the vertically adjustable upper part with a pivot lever and pendulum "foot."

TOOL FOR PARING HORSES' HOOFS.—John C. Johnson, of Sulphur Springs, Ind.—This invention relates to a new and improved instrument for trimming the hoofs of horses preparatory to shoeing; and consists in a combined knife and clamp, constructed and arranged as a single edged hoof parer, provided with the T handle, whereby a right or left cut may be easily and conveniently made with the single edged cutter.

FAUCET.—William A. Traver, of Rhinebeck, N. Y.—The object of this invention is to provide ready and convenient means for inserting faucets into barrels containing beer or other liquid or fluid under pressure without wasting the contents and so constructing it that it will fit tap holes of different sizes, the faucet having threaded stem, packing, and tapering sleeve threaded on the inside and outside.

METHOD OF BLASTING ROCK.—James Brodie and Samuel H. Wheeler, of San Francisco, Cal.—The invention consists in the method of blasting rock by means of sand as a filling material for the drill hole, said hole being first bored to a depth requisite for insertion and explosion of several charges, and the sand, or other equivalent material, being removed therefrom subsequent to each explosion to enable the succeeding charge to be placed in the hole to the depth required for the next explosion, the sand in every instance forming a bed for the charge.

COTTON CHOPPER.—Ebenezer T. Mathews, of Galveston, Texas.—By suitable mechanism, when the driving wheels revolve forward they carry the axle with them, but may revolve back without turning the said axle. A bevel gear wheel is placed upon the axle and is attached to the forward end of the shaft that revolves in bearings attached to the front and rear cross bars of the frame. To the rearwardly projecting end of the shaft is attached a wheel or disk. In the wheel are formed seven, more or less, sets of slots, which are made upon the arcs of circles having their centers at the axis of said wheel, to receive the bolts by which the arms are adjustably secured to said wheel. To the forward side of the outer ends of the arms are bolted the shanks of the bars or cutters, so that the hoes may be conveniently adjusted, according to the position in which the frame is supported. The barring-off plows may be adjusted wider apart or closer together, as may be desired. By means of a chain extending to the driver's seat, the choppers and the rear part of the rear frame will be raised from the ground for convenience in turning around or passing from place to place.

[OFFICIAL.]

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FOR THE WEEK ENDING OCTOBER 22, 1872, AND EACH BEARING THAT DATE.

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On each Trade-Mark	$25
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APPLICATIONS FOR EXTENSIONS.

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

22,607.—Soda Water Apparatus.—E. Bigelow. January 8, 1873.
22,902.—Water Wheel.—J. Temple. January 22, 1873.
23,264.—Tool for Cutting Metal.—L. F. Goodyear. March 12, 1873.
23,445.—Paper Folding Machine.—C. Chambers, Jr. March 19, 1873.

DESIGNS PATENTED.

6,210.—Sewing Machine Cover.—G. L. Du Laney, Brooklyn, N. Y.
6,211 to 6,213.—Oil Cloths.—C. T. and V. E. Meyer, Lyon's Farms, N. J.
6,214 & 6,215.—Floor Oil Cloths.—J. Meyer, Lansingburg, N. Y.
6,216.—Whip Rack.—C. A. Warren, Watertown, Conn.
6,217 & 6,218.—Tea Sets.—H. C. Wilcox, West Meriden, Conn.
6,219.—Fork and Spoon Handles.—H. C. Wilcox, West Meriden, Conn.

TRADE MARKS REGISTERED.

1,034.—Whisky.—G. Clark, New York city.
1,035.—Shawls.—T. Dolan, Philadelphia, Pa.
1,036.—Pistols.—Asa Farr, New York city.
1,037.—Cigars.—Haworth & Williams, Newark, N. J.
1,038.—Cherry Juice.—Mayer Brothers & Co., New York city.
1,039.—Paints, Colors, etc.—D. F. Tiemann & Co., New York city.

EXTENSIONS GRANTED.

21,928.—Furnaces for Tempering Steel.—Perry G. Gardiner.
21,917.—Hulls of Steam Vessels.—Ross and Thomas Winans.
13,897.—Gimlet.—Chester C. Tolman.
16,814.—Circular Sawing Machines.—C. P. S. Wardwell.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

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

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How Can I Best Secure My Invention ?

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

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

Preliminary Examination.

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

To Make an Application for a Patent.

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

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

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A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

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American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

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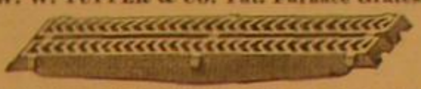

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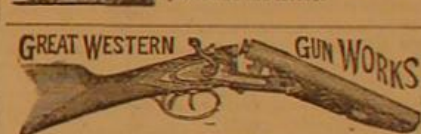

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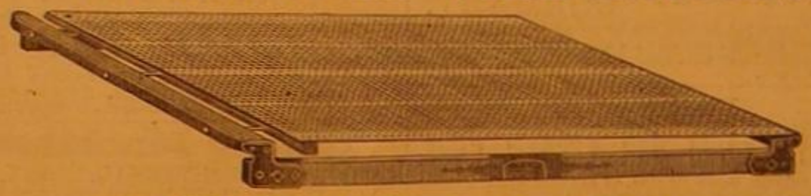

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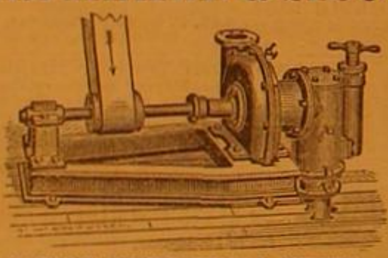

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Ever since the breaking out of the Cuban rebellion, the manufacture of cigars in this city, by exiles from the "ever faithful isle," has been steadily advancing to the position of a staple industry. Numerous factories have been established which, although they employ hand labor solely, carry on successful competition with those in which the work is performed entirely by machinery. The tobacco used is imported directly from Cuba, and costs from three dollars to ninety cents per pound. American tobacco is not used, the manufacturers not agreeing in the general opinion that it makes the best wrappers.

On being received at the factory, the tobacco is first carefully inspected, in order to ascertain its quality, and the leaves or fillers, which are to be used for the interior of the cigars, are carefully examined. This consists in simply removing the large stem which passes through the center of each leaf. The larger and finer leaves used for wrappers, or outside coverings, are then treated in the same manner, and passed to the foreman who, after examining them, distributes them to the workmen who make the different varieties of cigars.

It is a noticeable peculiarity in this trade, that each man knows how to make but one kind of cigar. The workman who makes a *concha* cannot make a *regalia*, nor is he required to do so, nor can an *española* be rolled by the man whose specialty is the *partaga*. For the benefit of our non-smoking readers, we should mention, *en passant*, that a *concha* is a short thick cigar, its name being derived from its shape, having a fancied resemblance to that of a shell; the *regalia* is generally large in size and finely flavored; *española* takes its name from red and yellow ribbons, the colors of the Spanish flag, with which the bundles of the cigars of that brand are tied; and, finally, a *partaga* is of large size, rather long, and is named from the owner of the manufactory in Havana at which the variety was first made. Of course, there are countless other brands, all christened with different names, according to the fancy of their makers, but those above mentioned may be considered the principal ones and the most generally recognized throughout the trade.

Our artist has represented the workmen in the act of rolling the cigars. The process, although very simple and apparently remarkably easy to perform, nevertheless requires the greatest skill and long practice. The men are seated in rows, each one having before him, on his table, a thick slab of hard wood, and on either hand a heap of dampened leaves, consisting respectively of wrappers and fillers. A wrapper is selected, smoothed on the slab until it is free from creases and wrinkles, and then cut with a peculiarly shaped knife, somewhat resembling that used by shoemakers in trimming soles, into a nearly semicircular form. The workman then takes as many of the short leaves, to be use as fillers, as he thinks will make the cigar, in his left hand, and squeezing them into a loose bundle, places them on the wrapper before him. By a dexterous twist, the edges of the latter are brought up, a quick roll is given to the whole, and the bundle is tightly enveloped. The end for the mouth is now carefully manipulated into the required conical shape, and the point secured by a drop of paste; the other extremity is cut off smooth. The cigar is then placed on the slab, rolled a few times under the flat of the knife blade, and it is ready for smoking. This process, of course, requires a much greater expenditure of time than if the cigars were merely pressed into molds, but it has been found that those made in the latter manner have the defect of not burning evenly, and are besides inferior in many other respects.

Messrs. Mora & Co., one of the largest manufacturing firms in this city, inform us that the workmen are paid according to the number and quality of the cigars they roll. Makers of *regalias* receive $20 per thousand, of *conchas* $20, and of *españolas* $18. An ordinary quick worker will finish two hundred cigars per day, and as many as four hundred are made by the oldest and most experienced hands. The men are all Cubans, and some of their customs would doubtless seem odd to an American workman. They club together, contributing twenty-five cents a week each, with which they hire a fellow exile to read aloud to them during their work. The position is no sinecure, for the reader is expected to keep up an incessant flow of words from 7 A. M. to 6 P. M., with the exception of one hour's rest for refreshments. The workmen thus become posted in the news of the day, and in addition occasionally listen to the perusal of Spanish history, or some work of fiction. There is another tax which they impose upon themselves, to the payment of which they religiously adhere, which is to lay aside a certain sum every week from their wages, to be sent to their struggling compatriots in Cuba, for arms and supplies.

The sorting of the different kinds of cigars, as regards strength, is carried on by another set of workmen, who seem to be possessed of the most unerringly delicate judgment. Standing before a heap of cigars, thrown indiscriminately on a table, they pick them out one at a time, hold them so that the light will fall on them from a certain point, instantly tell their exact grade of strength, and toss them to their proper heaps in almost a single motion and with incredible celerity. If the cigars are to remain cylindrical in shape, they are then tied in bundles, another proceeding requiring considerable manual skill. The ribbons to be used in fastening the bundle together are first stretched out on the table, and the cigars heaped upon them in quantities of twenty-five or more. The workman then takes the ends of the ribbons, brings them together, gives them another of those indescribable twists, ties the knots, and drops the bundle into the box in less time than it has taken to pen this sentence. The bundle, however, is a little too large for its case, and consequently has to be forced in by a screw press; the cover is then nailed down, the Government stamp affixed, and the box is ready for the market. In case, however, it is desired to press the cigars into those irregular triangular or quadrangular forms in which they are sold, they are first dampened, then packed in bundles, and finally enveloped in strong wet paper. The latter, in drying, forces the cigars together, causing them to assume the required shape.

The stems and refuse of the tobacco are not used. The odd ends or cuttings of the manufactory are sold in bulk for filling for cheap cigars, the wrappers of which are generally Connecticut leaf.

CIGAR MAKING.

Steam Street Car.

The Remington steam street car, from Ilion, N. Y. (Baxter's patent), heretofore described in the SCIENTIFIC AMERICAN, was recently brought to this city, and has been successfully tried on the track of the Bleecker street railway. This road runs through the most crowded and difficult parts of the city, its curves are sharp, and its grades unusually heavy; it is safe to say that any steam car that can pass over its track is able to meet the requirements of all city railway traffic. Some of the curves of the Bleecker street line are less than 50 feet radius, while there are grades as steep as 1 in 13. There are also innumerable crossings of other tracks to be passed, so that the difficulties presented to the steam car, on this line, are unusual.

We are happy to say that the Remington car has proved a decided success. On the recent trial it easily turned the sharpest corner, and on the top of the steep grade in Elm street it was stopped, reversed, and backed down the declivity, returning without the slightest hindrance. It is of the size of an ordinary street car, and has nearly the same appearance: the machinery, embracing a compound engine of five horse power, occupying the front platform, which is also provided with a box containing coal enough for half a day. A conductor and engineer only are required to run the car, which can be stopped very quickly by suddenly reversing the engine. With a light load and on a straight track, it is said to have run at the rate of twenty-five miles an hour.

Krupp's Steel Works.

The establishment of F. Krupp, at Essen, Prussia, manufactured last year 150,000,000 pounds of cast steel, against 130,000,000 in 1870; 8,810 workmen, and engines amounting to 9,595 horse power, are employed. Five hundred and twenty-eight furnaces for smelting, heating and converting; 169 forges, 260 welding and puddling furnaces, 245 coke furnaces, 130 various other furnaces, 342 turning lathes, 130 planing machines, 78 cutting machines, 172 boring machines, 94 grinding benches, 209 various other machines, 174 steam boilers, 265 steam engines (from 1,000 horsepower downward), and 58 steam hammers (from 30 tuns downwards), are in use. The various articles manufactured consist of axles, wheels, tires for railroads, rails, springs for railroad and tramway cars for mines, axles for steamships, boiler plates, rollers, tool steel, cannon, gun carriages, etc.

COATS, the celebrated English thread maker, has moved his establishment to this country, and at Pawtucket, R. I., now has a large thread factory where he employs three hundred persons.

THE INSTITUTION OF CIVIL ENGINEERS.

The following list of subjects for papers for the Session 1872-73, has been issued by the Council of the Institution of Civil Engineers, London, who invite communications dealing in a complete and comprehensive manner with any of the subjects comprised therein, as well as upon others, such as:—

a. Account of the Progress of any Work in Civil Engineering, as far as absolutely executed (Smeaton's Narrative of the Building of Eddystone Lighthouse may be taken as an example.)

b. Descriptions of distinct classes of Engines and Machines of various kinds.

c. Practical Essays on Subjects allied to Engineering, as, for instance, Metallurgy; and

d. Particulars of Experiments and Observations connected with Engineering Science and Practice.

LIST.

1. On the Application of Graphic Methods in the Solution of Engineering Problems, and in the Reduction of Experimental Observations.

2. On the Elasticity, or Resistance to Deflection, of Masonry, Brickwork, and Concrete, with observations on the Deflection of the tops of Bridge Piers, by unequal loading of the Arches abutting on them.

3. On the Methods of Constructing the Foundations of some of the Principal Bridges in Holland and in the United States.

4. On bridges of large span, considered with reference to examples, now in progress or recently completed, in the United States; including an account of the testing, and of the effects produced by variations of temperature.

5. On the Theory and Practical Design of Retaining Walls for sustaining earth or water, and on experimental tests of the accuracy of the various theories.

6. On the Different Systems of Road Traction Engines, with details of the results in each case

7. On the Use of Concrete, or *Béton* in large masses, for Harbor Works and for Monolithic Structures.

8. On Dredging Machinery, and on the cost of raising and depositing the material.

9. On the Appliances and Methods for Rock-boring and Blasting, in this country and abroad, and on the results obtained.

10. On the Gage of Railways.

11. On the Systems of Fixed Signals on Railways, and on the connection between the signals and the points.

12. On Modern Locomotive Engines, designed with a view to economy, durability, and facility of repair, including particulars of the duty performed, of the cost of repairs, etc.

13. On the different Systems for Surmounting Inclines on Mountain Railways.

14. On the various Modes of Dealing with Sewage, either for its disposal or utilization.

15. On the Separate System of Sewering Towns, with a detailed description of the works in a town to which this system has been wholly or partially applied, and particulars as to the results.

16. On the Ventilation of Sewers, with a *résumé* of the Experiments as to the motion, pressure, etc., of Gas in the Sewers.

17. On the Constant Service of Water Supply, with special reference to its introduction into the metropolis, in substitution for the Intermittent system.

18. On Street Railways and Tramways through Cities and Towns, and on the best mode of working them.

19. On the Application of Steam as Motive Power for pumping Water or Sewage, with a comparison of the advantages of different classes of Engines, and details of the cost of working for long periods.

20. On the various descriptions of Pumps employed for Raising Water or Sewage, and their relative efficiency; and on the employment of Water as a Motive Power for pumping, by means of Water Wheels, Turbines, Water Pressure Engines, or other Machines.

21. On the Employment of Steam Power in Agriculture.

22. On the laws governing the Flow of Steam and other Gases through Orifices, Pipes, etc., and on Experiments to determine these Laws.

23. On the Methods of Transmitting Force to distant points.

24. On the best practical Use of Steam in Steam Engines, and on the effects of the various modes of producing Condensation.

25. On the modern practice of Marine Engineering, having reference to Economy of Working Expenses, by Superheating, Surface Condensing, great Expansion, High Pressure, etc.

26. On the Present State of Science in regard to the Manufacture of Gas for the purposes of Illumination.

27. On the Construction of Sluices, for the expeditious filling and emptying of Locks of large size on navigable Canals.

28. On the Harbor and Dock Works at Spezzia.

29. On the Maintenance, by Sluicing, of the Harbors on the Coasts of France, Belgium, etc.

30. On the Practice and Results of Irrigation in Northern India.

31. On the Sea Works at the mouth of the Adour, and the effect produced by them on the bar of that River.

32. On the Sea Works at the mouth of the River Maas, and the effects produced thereby.

33. On the Manufacture of Iron and Steel as now pursued, the effect on strength and tenacity of the admixture of substances with the Ore, and any test, other than fracture, by which the quality may be ascertained.

34. On the various Methods of Draining distant isolated sections of Mines.

35. On Compressed Air as a Motive Power for Machinery in Mines, with some account of its application on the Continent.

36. On the Use of the Diving Apparatus in Mines, especially in Westphalia and in Germany.

37. On the Systems and Apparatus at present used in Telegraphy.

For approved original communications, the Council will be prepared to award the Premiums arising out of special funds devoted for the purpose. They will not, however, consider themselves bound to make any award, should there not be any communication of adequate merit; but on the other hand, more than one premium will be given, if there are several deserving memoirs on the same subject. It is to be understood that, in this matter, no distinction will be made between essays received from a Member or an Associate of the Institution, or from any other person, whether a native or a foreigner.

The communication should be written in the impersonal pronoun, and be legibly transcribed on foolscap paper, on the one side only, leaving a sufficient margin on the left side, in order that the sheets may be bound. A concise abstract must accompany every paper.

The drawings should be on mounted paper, and with as many details as may be necessary to illustrate the subject. Enlarged diagrams, to such a scale that they may be clearly visible when suspended in the Theater of the Institution, should be sent for the illustration of particular portions.

Papers which have been read at the meetings of other societies, or have been published in any form, cannot be read at a meeting of the Institution, nor be admitted to competition for the premiums.

The communications must be forwarded, on or before the 31st. December, 1872, to the house of the Institution, No. 25, Great George Street, Westminster, S. W., London, where any further information may be obtained.

[American Journal of Pharmacy.]

A NEW APPLICATION OF TUBE HYDROMETERS.

BY WILSON H. PILE, M. D.

A plain cylindrical tube of thin glass, closed at its lower end, is to be immersed in pure water, at a temperature of 60° F., and then loaded by pouring in shot or mercury until it sinks about two thirds of its length in the water, the point to which the surface of the water rises being then marked on the tube. If now that part of the tube which was immersed in the water be divided into 145 parts, and these parts numbered from the top downwards, the tube will represent a Baumé's hydrometer for liquids heavier than water; and by floating it in any liquid of greater density than water, its degree will be seen on the tube at the surface of the liquid.

These degrees can be marked on paper, and the paper inserted in the tube and pushed down to the bottom, the upper mark or zero being exactly opposite the mark which had been previously made on the tube.

We will now proceed to show a new application of these tube hydrometers in determining densities.

Having immersed a tube, closed at the lower end as before, in water, we pour water into the tube until it sinks about ⅞ of its length.

It should float upright. We are now to mark the surface of the water in which the tube floats, and also the surface of the water within the tube. The tube below this latter mark must then be divided into 145 parts, either by etching on the glass or, what is more practical, by drawing a scale on paper, numbering the degrees from the top (0°) downwards. In ascertaining the density of any liquid heavier than water, the tube must be emptied and dried by rinsing with alcohol and drawing air through it by means of a long tube, then immersed in water of 60° F., and the liquid to be tried poured in until the tube sinks to the upper mark. It can then be taken out, and the degree of density shown on the tube, if it be etched, or else by holding it on the paper scale in its proper position.

Our illustrations have been thus far for liquids heavier than water; for those lighter than water, the tubes or scales require a different division. Unfortunately, Baumé's method of dividing his hydrometers rendered the degrees of those for light liquids larger than those for heavy liquids, and by comparison we find that they are in the ratio of 145 to 140. In order, therefore, to make a scale for light liquids, we divide the space below the surface of the water within the tube into 140 parts instead of 145 parts, as at first; the degrees are then continued upwards 70 or more parts. These divisions are numbered at the water point 10° (another peculiarity of Baumé's scale), and running upwards so high as desired. The scale below the water point need not be marked, as it can be only used for liquids lighter than water.

The tube is used for all liquids in the same manner, namely, by pouring into it the liquid to be tried until it sinks in water down to the mark made at first on the tube; then by holding it against the paper scale marked as just described. The surface of the liquid will indicate its proper degree of density.

An advantage which the tube possesses, when used in this manner, is the small quantity of liquid necessary, as the tube can be made quite small in diameter, and by increasing its length the degrees are rendered larger, and thus greater accuracy is obtained. It may also be employed in ascertaining the density of extremely heavy liquids, where no hydrometer could be found of service.

Before you ask a favor of any man consider three things. First, can you not avoid it? Second, can the one you apply to grant it? Third, would you, if your places were reversed, do for your friend what you ask him to do for yourself? It is well to think of this, as it may change the whole question.

The Great Fire of Boston.

In a discourse on the Sunday evening after the fire, Mr. Henry Ward Beecher, of Brooklyn, N. .,N made the following observations, which are full of interest and common sense: Last year it was Chicago that was destroyed: now it is Boston. The West and the East are at last united by a common calamity. Boston is thoroughly identified with the whole history of this country, for from it sprang all that is great and good of American ideas. The earliest heroes of liberty were from there; the war of independence began there; it was from there that Jefferson sought the Adams who aided him in making the laws for the newly-formed Republic. Boston has always been the true head of the nation, and never flinched at the call of liberty. American history began in Boston, which city has never ceased to be the brain of the country for knowledge, liberty, and religion. Boston never went back from its duty when other cities swerved from theirs. Hated she may have been by some, but there is not a city in the United States that is not indebted to her for schools, literature and scholars, from the earliest day of the Republic to the present time. No other city of the Union ever gave such a common school education to all as Boston has done; from the highest to the lowest grade, education has she willingly given to her poorest son or emigrant resident. God could not have laid the heavy hand of fire on a city more noble than this. It is a national calamity. Some may say the disaster was sent to humble their pride or their avarice. If such were the case, no city would escape. Under such Providence, where would New York and Brooklyn be? With such a law no spot on the earth ought to be saved. Such an assertion is presumptuous, it is audacious. A sparrow cannot fall without God's knowledge; yet sparrows do fall. Such remarks are in defiance of God's wisdom and equity. Instead of making them, we should take lessons from the disaster, for it teaches a great deal. It teaches us that, in the construction of streets, individual rights should not set at nought the general interests. Why were the streets so narrow? This fire was no accident, for it will be found that it followed a general law throughout. The plague, fever, and fire were the best architects of the London of to-day, and also of many other cities. The fire teaches Boston that it is not needful or wise to have narrow streets to convey the flames from one side to the other, or to act as horizontal funnels to carry the fire from one block to another. But the answer will be that the streets have been so for a hundred years, and there has been no fire. Is it necessary to have such a fire even once in a century? This fire will show that it is not needful to build houses four or five stories high of fireproof granite, and then surmount them with an inflammable box, out of the reach of firemen, for the fire devils to sport in and scatter their sparks all over the city. Architects could not see this result, and bitterly the city is now paying for the experience. Other cities not far from here may also have to pay as dearly for their parsimony in erecting buildings. Why not make every business house a separate fire department? We can carry light and water in the hollows of walls to any part of a building we choose. Why not have the means of extinguishing incipient fires also built in the hollows of walls, and each man in the place a fireman?

American Nickel.

In the arts, nickel is rapidly growing into favor as a substitute for silver in plating steel, iron and other metals. Its commercial demand is rapidly increasing, and as it is much cheaper than silver, it will undoubtedly be adopted in the manufacture of many articles as a substitute for that more precious metal. One mine, the Mine La Motte tract, Missouri, was worked from 1850 to 1855. The ore was the sulphuret, associated with lead and copper. About $100,000 was realized from the croppings of the vein. Croppings of nickel ore are found also in Madison, Iron and Wayne counties, Missouri. The refined metal is worth $3 per pound. For small coins, it is very useful. The principal supply is at present derived from a single mine in Lancaster county, Pa. It has been worked for seventeen years, and developed to a depth of 200 feet. The length of this lode is between two and three thousand feet, and it produces from four hundred to six hundred tuns per month, employing in the working of the mine a force of 175 men.

A CRIPPLED rogue in Philadelphia has found a new use for an artificial leg. He worked in a pipe factory and was in the habit of filling his porcelain limb each day with a choice assortment of meerschaums, which he disposed of on his own account. When discovered, he had made about $800 by this illegitimate traffic. In this way he was walking off with a goodly share of the profits of the establishment.

CALIFORNIA does everything on the biggest sort of a scale. A bee hive in the rocks in Los Angeles county is reported, and is said to be 160 feet deep, entrance 30 feet wide and 17 feet deep; it contains several tuns of honey. In fact the sweet liquid runs, on warm days, in a small stream from the hive, from which the settlers supply themselves.

A MAINE sea captain suggests that telegraph wires be extended to all the lighthouses on the coast, and that a system of signals be arranged to be exhibited from the lighthouses to give notice to passing vessels of approaching storms or changes of wind. The idea is a good one.

CELERY, as an article of dish, is highly recommended for nervousness. A correspondent says he has known persons cured of nervousness, whose hands shook like aspen leaves. He recommended the daily use of it at meal times.

SEVEN patents have been granted for policemen's clubs.

REMARKABLE STRUCTURES OF THE ANCIENT AMERICANS.

In a review of the work on "Ancient America," by John D. Baldwin, the London *Athenæum* says: Not many perhaps, of those who habitually speak of the "Old and New Worlds" as a geographical expression fully realize the idea of a dual world of civilization and progress; yet it is certain that, side by side with that of Egypt and Assyria, there grew up in America another culture, equal, at one time, in art, power, and extent, and although, in so far as our existing evidence enables us to judge, unconnected, yet greatly resembling in system that on which our own civilization has been established; and were it not that these two cultures unfortunately came in contact during the climax of Spanish ecclesiastical bigotry and intolerance, the so called new world might have boasted of an ancient history corresponding to our own. So completely, however, has the law of the survival of the strongest asserted itself under the influence of the monkish exponents of Christianity—so effectually did they succeed in snuffing out all trace of art and culture amongst the people whom they had conquered—that writers may now be found who, in the face of the evidence afforded by ruined cities, palaces, aqueducts, and paved roads, deny the claim of the American continent to any ancient civilization higher than what might have been derived from the wild Indians, such as the Iroquois and the Algonquins, whom the Pilgrim Fathers encountered in the seventeenth century. Such views as these receive no support from Mr. Baldwin. The relics of ancient American civilization are to be found in these separate but nearly contiguous areas situated near the point of junction of the two continents.

Commencing with the northernmost of these divisions, commonly known as the region of the mound builders, we find in the neighborhood of the lakes, at the northern apex of the triangular region above mentioned, in Michigan, Iowa, Missouri, and particularly in Wisconsin, a tract of country characterized by the presence of large mounds designed in the form of animals, birds, serpents, or men, in huge relievos. Next to this we have a district of which the State of Ohio may be regarded as the nucleus, but which occupied the whole valley of the Ohio and its tributaries, extending into Western Virginia, Indiana, Michigan, Illinois, and Missouri. The special characteristics of this area consist of pyramidal mounds, usually from six to thirty feet high, but rising in some cases to sixty and ninety feet; they were generally square or rectangular, and were ascended by winding staircases on the outside. This district is also remarkable for lines of entrenchment, from five to thirty feet high, inclosing usually from one to thirty acres, but extending at times to 100, 200, and even 400 acres. They frequently consist of combinations of square and circular figures, the accuracy and perfection of which prove, as Messrs. Squier and Davis have remarked, that the builders possessed some standard of measurement, and had the means of determining angles. There are no less than 10,000 of these mounds and 15,000 inclosures in Ohio alone. Lower down in the valley of the Mississippi, and along the fertile plains bordering the Gulf of Mexico, and to westward over the Rio Grande, the inclosures are smaller and less numerous, and the mounds, though of the same character and more plentiful, are lower, and consist of truncated pyramids and pyramidal platforms. Broad terraces, elevated passages, aguadas or artificial ponds, and the use of sun-dried bricks, are peculiar to this region, the remains of which approach more closely in character to those of Central America than the ruins to the northward. Taken as a whole, the mound builders appear to have been inferior in culture to their Central American and Peruvian neighbors. They were an agricultural people: yet they made use of spun cloth, their pottery was in some cases almost equal to that of Peru, and there are grounds for supposing that they had a knowledge of astronomy. Their tools and other relics were composed of copper, silver, porphyry, greenstone, and obsidian. Metallurgy, in the proper sense of the term, does not appear to have been introduced amongst them, for their copper tools were beaten into form, and contained in some cases blotches of silver just as it is found in the matrix in the pure state on the shore of Lake Superior, where they worked it in open cuttings from the surface.

Turning to Mexico and Central America, we find here also the antiquities of this central region distributed in three distinct areas. In Chiapa, Tabasco, Oxaca, Yucatan, Honduras, Tehuantepec, and Guatamala, the ruins consist of stone-built cities of great extent, palaces richly ornamented, and standing upon raised platforms similar to those found in the lower portion of the Mississippi valley, in all probability, severed the same purpose. Most of these ruined cities are thickly overgrown with trees; and it is known that other cities lie buried in the forest districts, which have been as yet but little explored. More is known respecting the Mexican area from its having been the center of Aztec civilization at the time of the conquest; and though some doubt has been thrown upon the accounts of the city of Mexico given by the Spaniards, it is certain that a comparatively high state of civilization, although inferior to that of Central America, existed in the valley of Mexico at that time. Their city had considerable architectural pretensions, and their temple was a rectangular terraced pyramid, ascending by a flight of steps on the outside, like the pyramids of the mound builders; but they did not possess the phonetic alphabet of the Central Americans, and their records consisted of picture writings.

The third sub-division of this central area is found in New Mexico and Arizona amongst the Pueblo Indians, the chief characteristic of whose culture consists in their residence in large communal buildings, each of which contains an entire town or village of small rooms ranged in three or four stories above each other, forming a huge rectangular structure not altogether unlike some of the great edifices in the ruins of Central America, such as the palace of Palenque or the Casa del Gobernado at Uxmal, but yet differing from them both in character and purpose. These buildings were in use at the time of the conquest, and are still inhabited in some places. The Pueblos are vastly superior in culture to the wild tribes of Indians on the north, with whom they are constantly at war.

The Peruvian ruins consist of cities, palaces, fortresses, aqueducts, one of which is 450 miles long, and great paved roads, admirably constructed throughout the whole length of the empire, which latter were originated during the earlier civilization, and restored by the Incas. Their work was admirably done; but it is everywhere seen that their masonry, although sometimes ornamented, was generally plain and massive in style. They had no inscriptions, though it is thought that at the time of the conquest they possessed the art of writing in hieroglyphics. Their temples were not high truncated pyramids, and their great edifices were not erected upon terraces, as in Central America; but the doors in the older buildings around Lake Titicaca had the peculiarity of being narrower at the top, like some of the prehistoric structures of Europe. Their tools were of bronze; but it has been conjectured that, although iron was unknown in the times of the Incas, it may have been employed in the earlier times, as that ore is abundant in Peru, and some of the existing languages, if not all, have names for the metal. In their knowledge of astronomy, they appear to have been inferior to the Central Americans.

The antiquity of the mound builders is established by the growth of forest surmounting their remains. In the *débris* covering the ancient copper mines of Lake Superior, trees showing 395 rings of annual growth have been found growing; and Sir Charles Lyell counted 800 rings in the trunk of a tree growing on one of the mounds at Marietta. It is evident also, in both cases, that several generations of trees have preceded those now standing in the soil. In the valley of the Mississippi, four terraces are usually seen, marking four distinct eras of subsidence since the river began to flow. The ancient works, mounds and enclosures are found on all these terraces, except the fourth or lowest; showing that this last terrace, which probably marks the longest period of any, was formed since the works were erected. Some of the mounds have also been destroyed by streams that have since receded more than half a mile, and which, at present, could not reach them under any circumstances. The antiquity of the latest relics of the mound builders is further confirmed by the state of decay in which all the skeletons of these people are found. Although the soil is not unfavorable to their preservation, only one or two skulls have been found in a condition to be restored. In Central America, similar evidence of great antiquity is afforded by the growth of timber, and by the fact that everythiug perishable has disappeared, except the lintels of some of the doors of the more modern structures of Yucatan.

In Peru, Mr. James Wilson found, at various points on the coast near Quito, ancient pottery and other manufactured articles finely wrought, and some of them of gold, beneath a marine deposit of six feet, having trees growing on the surface which were older than the Spanish invasion; which proves that this land must have been submerged beneath the ocean and again elevated to its former position since these relics were deposited.

Decisions of the Commissioner of Patents.

Improvement in Lubricators.

T. W. GARRATT *vs.* N. SIEBERT.—*Interference.*

The one first to invent a new and useful device is entitled to the protection of a patent, even if its production was accidental and not appreciated at the time. Priority awarded to Garratt.

Woven Wire Mattresses.

G. C. PERKINS.—*Appeal.*

Application of Geo. C. Perkins for patent for WOVEN WIRE MATTRESSES.

LEGGETT, *Commissioner:*

Applicant claims—

1. A wire mattress or cushion having a web of coiled springs linked together in pairs, substantially as described.
2. A wire mattress or cushion having a web of coiled springs linked together in sets of three or more, substantially as described.
3. A fabric of spiral wire springs interlocked two and two or three and three, substantially in the manner herein described.

The *references* show, in the case of Rouillion, a mattress made by placing one coiled cushion, composed of single wire coils, over another similar one and interlocking the two; and in the case of Leemann, a mattress composed on the margin of double coiled wires and in the middle of single coiled wires. This plan it was supposed would give sufficient strength and save the extra material and cost of making the whole mattress of double wire coils. If it did not, as a matter of course the double coils would be further employed, either to wholly or in part compose the center of the cushion. Once the plan being adopted of employing double coils in the manner shown, to give additional strength, how many or how few to use, becomes simply a matter of judgment. The same of the number of wires employed in each coil. After two have been used, and a third can be employed in the same by simply adding it to the strand, there is no more invention involved in so adding it and forming a stronger cushion than there is in driving an additional nail when there are no difficulties in the way and two are not sufficient to hold. Applicant has invented nothing. He has done nothing more than to make a stronger mattress than Leemann did by employing more double coils than he did precisely as he did, there being no difficulty to overcome in so doing.

Application rejected.

Tubular Legs for Portable Furnaces.

Application of De Witt C. Baxter for patent for PORTABLE FORGE.

LEGGETT, *Commissioner:*

The claim on which the appeal was taken is as follows—

The combination of the hearth plate of a portable furnace with wrought iron tubular legs connected together, all substantially as set forth.

The improvement which applicant has made in portable furnaces—and I have no doubt he has made one—consists in supporting them upon hollow wrought iron legs, whereby sufficient strength is obtained in the legs and at the same time they are rendered lighter than those heretofore made of solid cast iron. But the difficulty is, as the Examiner says, that the improvement "does not indicate in any degree invention." It is simply the result of the exercise of that judgment and the application of that knowledge—in view of the fact that wrought hollow tubes are used in so many analogous situations where strength, lightness, and economy of material are requisite—which is expected of every competent mechanic. In a less developed state of the art of making and applying tubular legs and supports it is possible a patent, such as applicant seeks, might be legally granted, but not now. The references cited by the Examiner are in point as showing the various applications of tubular supports analogous to applicant's, and exhibiting his as barren of invention.

The decision of the Board is affirmed. Application rejected.

Decisions of the Courts.

United States Circuit Court, District of Massachusetts.

SANFORD *et al. vs.* MESSER *et. al.*

This was a suit in equity upon letters patent granted April 10, 1866, upon the joint invention of Frederick S. Sanford and Dwight Wheeler, assignors to Glover Sanford & Sons and Dwight Wheeler, relative to improvements in sewing machines, and designed to adapt the ordinary sewing machine to the work of sewing sweat linings into hats. Glover Sanford and others complainants, and Matthew Messer and others defendants.

The main points of the defense were: First, that the patent was void for lack of novelty in the invention; second, that the bill was defective for want of parties, it appearing that the complainants had parted with the exclusive right to *use and vend* the patented improvement in and for the State of Massachusetts, which made it necessary, it was urged, that the guarantees of this right should be joined as complainants.

SHEPLEY, *Judge:*

This is a suit in equity founded on letters patent granted by the United States "for a new and useful improvement in sewing machines, applicable to the ordinary sewing machine, by which it may be adapted to sew sweat linings into hats without any alteration in the organizations of such machines."

An objection is made that the bill is defective for want of parties. Defendants claim that since the date of the patent the plaintiffs have transferred such an interest, in the patent in and for the State of Massachusetts, that they have not the exclusive ownership of the patent, and are not entitled to maintain the bill of complaint. It appears that the patentees conveyed to Stanwood and Bailey all their interest in the invention as secured to them by the letters patent for, to, and in the State of Massachusetts, except the right to build said machines. Any assignment which does not convey to the assignee the entire and unqualified monopoly which the patentee holds in the territory specified, or an undivided interest in the entire monopoly, is a mere license. The monopoly granted to the patentees is for an entire thing. It is the exclusive right of making, using, and vending to others to be used, the improvement described in the patent, and for which the patent is granted. The instrument introduced in evidence by the respondents purports to convey to Stanwood and Bailey the exclusive right in certain specified territory to use, and vend to others to be used, the patented invention, but it does not convey, but expressly reserves to the grantors, the right to make the machines.

As well stated by Chief Justice Taney in *Gaylor et. al. vs. Wilder*, 10 Howard, 494, it was obviously not the intention of the legislature to permit several monopolies to be made out of one and divided among different persons in the same limits. Unquestionably a contract for a purchase of a portion of the patent right may be good as between the parties as a license, and enforced as such in the courts of justice, but the legal right in the monopoly remains in the patentee, and he alone can maintain an action against a third party who commits an infringement upon it. The bill of complaint in this case charges that defendants have made and do make the patented invention in violation of complainants' rights under the patent. The bill can unquestionably be maintained for that infringement of the exclusive privileges of the complainants, even if it were necessary to join other parties as complainants in a bill alleging infringement only by vending and using.

The next inquiry is whether Sanford & Wheeler were the original and first inventors of the improvement described in the specification and letters patent. As to this, Judge Shepley decides that they are and sustains the patent.

J. B. Robb and *C. O. Morse*, for complainants.
C. Smith and *W. W. Swan*, for defendants.

United States Circuit Court, District of New Jersey.

SAMUEL WETHERILL *et al. vs.* THE PASSAIC ZINC CO. *et al.*

[*In Equity.—Before Mr. Justice McKennan.*]

CONSTRUCTION OF LICENSES AND GRANTS—RIGHTS OF GRANTEES UNDER A PATENT AFTER IT IS EXTENDED.

Held as follows:

A conveyance of buildings, machinery, etc., "with rights to use" certain patented processes, for working which they might be adapted, is a license to use the processes in those buildings only and not a general license.

Words restricting a grant of certain patented processes to such as the grantor "holds in his own right" are to be understood as meaning such as he holds for the benefit of others, and not those of which he owns only a part interest, and they pass under the grant.

A grant of all the patents which the grantor "now has, or has in contemplation to obtain," does not embrace the extended terms of those patents.

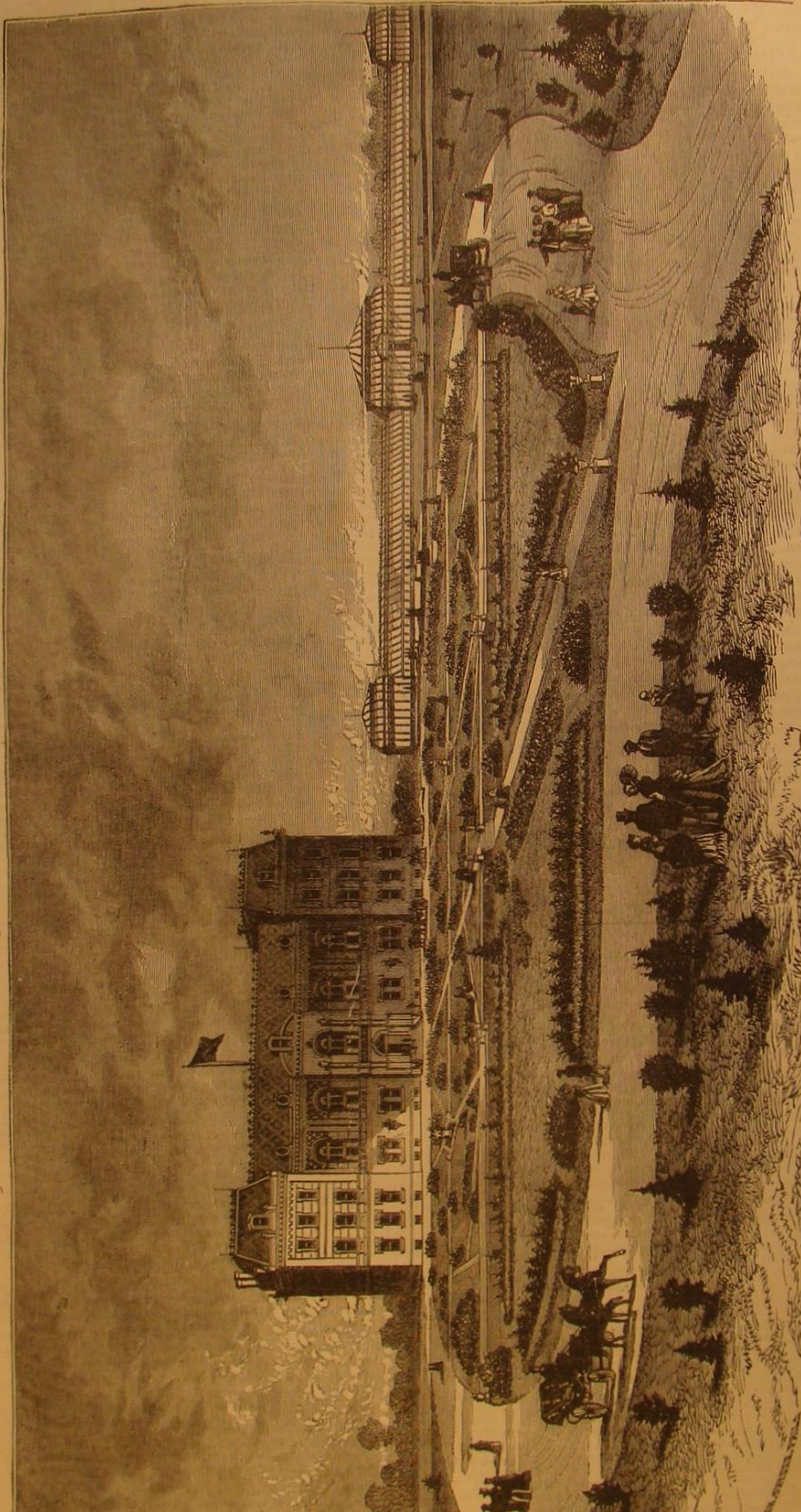
A license to use an invention "for the whole term of the patent which may be granted," given before the issuing of the patent, does not authorize the use of it under an extension of the patent.

The right to use a patented process during the original term of the patent does not, under the 18th section of the act of 1836 (re-enacted in 1870,) authorize the use of it after the patent is extended.

The grant of the right to use a patented process, and of apparatus which, though capable of being adapted to the process, was constructed to accomplish the same object by different means, does not, after the patent is extended, authorize the use of the process in the apparatus.

Geo. Harding, for complainants.
E. W. Stoughton and *Geo. Gifford*, for defendants.

THE great joiner—the lawyer; he can replace a tenant, impanel a jury, box a witness, bore the court, chisel his client, augur the gains, floor a witness, nail a case, hammer the desk, file his bill, and gouge the whole community.



THE AGRICULTURAL DEPARTMENT, WASHINGTON, D. C.

THE AGRICULTURAL DEPARTMENT AT WASHINGTON.

It is a matter of surprise and regret that it is but recently that the claims of agriculture have received national recognition, and that the Government should not have appreciated at an earlier date the necessity of applying a portion of the national wealth to such development of the resources of the country. Some thirty years ago, the first appropriation, the merely nominal sum of $1,000, was, at the instance of the Commissioner of Patents, Hon. H. L. Ellsworth, devoted by Congress for this purpose. For two years previously the above mentioned patriotic gentleman had been distributing seeds and plants gratuitously, and for nine years, during his entire term of office, did he continue his good work. His successors in the Patent Office kept up the practice, but it was not until 1862 that the Department of Agriculture was formally organized.

The appearance of the building and its adjacent gardens is well depicted in our engraving. The grounds and conservatories are filled with specimens of almost every plant and tree indigenous to our country—from the luxuriant tropical vegetation of the Southern States, to the dwarfed and hardy foliage of our northern borders. A division is devoted to horticulture and the propagation and acclimatization of new and foreign species. Studies in ornamentation, in the best means of hybridizing, budding, pruning and grafting in treating diseases of plants and trees, are thoroughly pursued in the experimental gardens. Seeds of new varieties and of superior quality, as soon as they are obtained, are freely distributed throughout the country on application to the Commissioner of Agriculture.

The Department maintains at least one correspondent in every county of the United States, through whom statistics of quality and quantity of crops and other facts are forwarded to Washington, to be there distributed by means of the monthly and yearly reports. Specialists are also employed to prepare for these reports instructive articles on suitable topics. Questions from agriculturists are freely answered and the fullest possible information afforded. The purchaser of a farm situated in a region with which he is unacquainted has only to inquire, and the department will tell him the crops likely to prove remunerative in the special locality, advise him regarding cultivation, and warn him of obstacles to be surmounted and the best means of overcoming them. A chemist will analyze the soil, report as to its properties and the value of fertilizers to be used thereon; a botanist will give every particular regarding the natures and diseases of plants, and will point out in what families to seek needed products and what effect a change of soil will have upon them. An entomologist will give advice regarding the insects which destroy vegetation, and as to the best mode for their extermination.

As compared with the other national bureaux, the expense of this department is remarkably small. The cost of the library and museum was $140,000, and the conservatories were built at an expense of but $52,000 more. The library contains a valuable collection of agricultural literature in several languages. Volumes of rare pictures are arranged on long tables—one work a present from Francis Joseph I, Emperor of Austria, entitled "Nature Printing," containing representations of ferns so exquisitely printed that it is difficult to believe them unreal. In the museum are specimens of fibrous products, cereals of this and other countries, stuffed birds and plaster casts of fruits from all the different sections of the United States, arranged so as to show at a glance the products of each region and the specific changes caused by transportation. On the walls of the fruit cabinet are hung diagrams, showing the character and habits of the different insects that prey upon fruit and fruit trees, and in glass cases are preserved the native birds that feed upon destructive insects and should be protected by the kind treatment of the agriculturist. The whole arrangements are neat and handsome, and well repay a visit to this department of science and agricultural art, which is filled with rare specimens of artistic excellence and skill.

Ammonia in Snow Water.—Dr. Vogel refers to Dr. von Liebig's researches, made in 1826 and 1827, on the quantity of ammonia as nitrate in rain water, and then records at length his own researches on the presence and quantity of ammonia contained in snow and snow water. By the method employed by him the following results were obtained, 1 liter of snow water being the unit:—Freshly fallen snow, collected in a porcelain basin, at 0° gave 0·003 gramme; at —3° gave 0·002; at from —9° to —15° gave 0. Snow water, from snow which had lain for twenty-four hours, on a piece of garden ground manured during the previous autumn, contained 0·012 gramme. Snow water from snow which had been twenty-four hours on a meadow contained 0·009. Snow which hda been twenty-four hours on a zinc roof contained 0·004.

[From Journal of the Franklin Institute.]

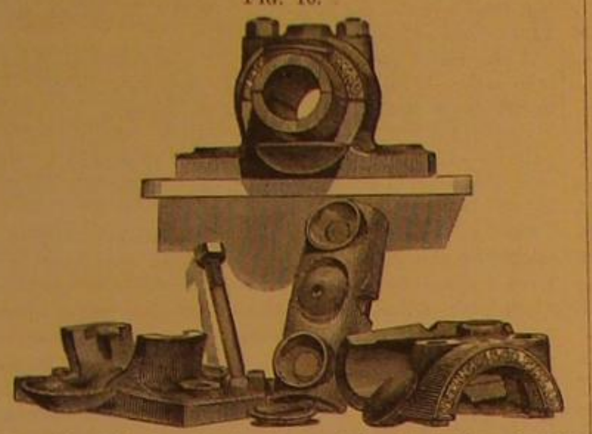
TRANSMISSION OF MOTION.

A Lecture delivered by Coleman Sellers, at the Stevens Institute of Technology, Hoboken, N. J., February 19th, 1872.

NUMBER III.

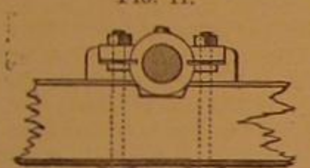
What I have said in description of the modern hanger holds good in the various forms of bearing, suited to various uses where hangers are not admissible. Thus, when the shaft is to be carried by stone piers, not likely to lose their horizontal adjustment, or in cases of vertical shafts, pillow blocks are used in place of hangers. I have an example here

FIG. 10.



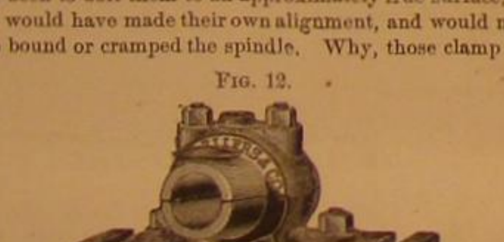
(Fig. 10). The box is furnished with spherical surfaces to fit in sockets in the casting or frame; it is self-adjusting as to line, but cannot be raised or lowered as in the case of the hanger. It takes the place of what is known as the clamp box, and of any rigid bearing not adjustable. It was a clamp box that I found among the many ingenious illustrations of mechanical devices in the cabinet in the room of your Professor of Mechanical Engineering. I have it here (Fig. 11).

FIG. 11.



It is very simple in construction. It is made of two pieces only; don't look as if it would be expensive to make, and just the thing for the "anything-is-good-enough-so-that-it-is-cheap-people." But does first cost constitute cheapness? Let us see. Once upon a time I thought a circular saw, operated by foot power, would be a very good thing to have in the house. I had a suitable band fly wheel and treadle; all I wanted was a saw mandrel and circular saw. These were furnished by a saw maker of renown, at a very moderate cost, say seven dollars and fifty cents. For bearings it had clamp boxes, lined with Babbitt's metal. A neat wooden framework was soon made to receive the boxes, and the work of fitting them to place begun. This did not take very long, it is true; but when I came to screw up the holding down bolts, the spindle would not revolve, so a little more cutting and carving was needful; and at last, after much patient labor, it seemed all right, and the saw was turned very satisfactorily. In a few days, however, it was fast again, and I found the frame had sprung from warping, and had to be refitted. All this careful work would not have been requisite had the saw been driven from a steam engine; but foot power is of limited capacity, and any serious loss from friction is soon felt. Now had this spindle been provided with ball and socket bearings, all the work needed would have been to bolt them to an approximately true surface, and they would have made their own alignment, and would never have bound or cramped the spindle. Why, those clamp box-

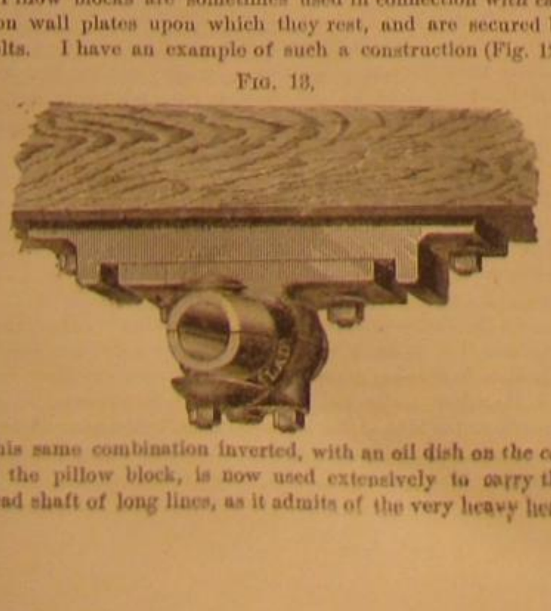
FIG. 12.



es would have been dear at half the money, when the cost of fitting, etc., is taken into consideration. I have seen a saw mandrel, with an 18" saw, running in cast iron ball and socket bearings, working well after 16 years' hard usage, and during that time never having been adjusted, and that spindle is to-day as good as when it was made.

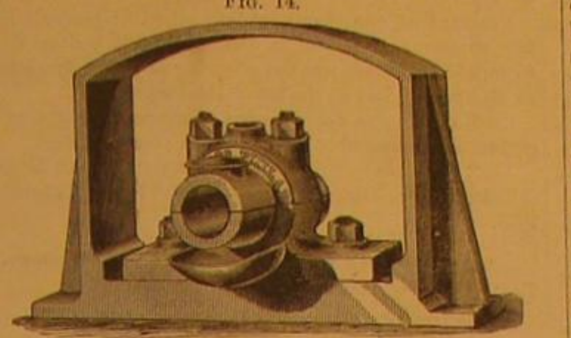
Pillow blocks are sometimes used in connection with cast iron wall plates upon which they rest, and are secured by bolts. I have an example of such a construction (Fig. 12).

FIG. 13.



This same combination inverted, with an oil dish on the cap of the pillow block, is now used extensively to carry the head shaft of long lines, as it admits of the very heavy head shaft, with large pulleys, being hoisted into place, and then secured by the cap and bolts. A head shaft, or the first shaft of any line, usually rests in two bearings. Fig. 13 shows such an inverted pillow block. Sometimes it is requisite to build bearings in a wall, in which case what is called an arched wall box (Fig. 14) is used in connection with the pil-

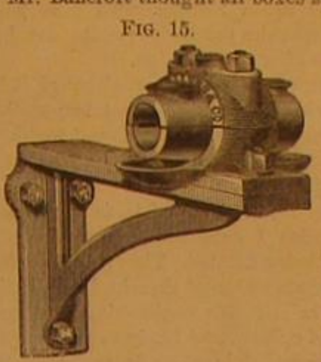
FIG. 14.



low block. Very often it is advisable to support the line shaft from the face of a wall, in which case pillow blocks, secured to knees, are very convenient (Fig. 15).

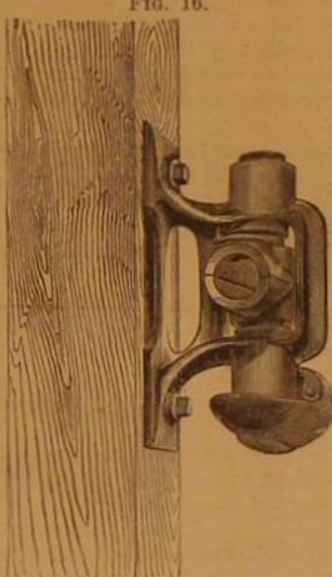
Mr. Bancroft thought all boxes should be made five diameters of the shaft long, namely, a box for a 2 inch shaft should be ten inches long; but it has since been demonstrated that four diameters is sufficient, and that has been the practice for many years. I have here also an example of a hanger to be fitted to a post; it is called in that form a post hanger (Fig. 16). It is in all essential particulars like the ordinary hanger, so far as its adjustment and swivel-ing principles are concerned.

FIG. 15.



Before leaving the subject of bearings, I would mention that there are examples of cast iron boxes, in use in woolen factories where high speed shafts are running, which show no appreciable wear after 22 years' use. In 1867, I read a paper on journal bearings before the Franklin Institute, in Philadelphia, and while preparing that paper I took occasion to examine a bearing in which had been running, for 16 years, a $4\frac{1}{2}$ inch shaft, with a pulley 72 inches diameter and 20" inch face, close to the bearing, taking all the power from an engine of 16 inch cylinder, 3 feet stroke, making 50 strokes per minute—say transmitting forty-two horse power. This bearing showed a bright surface over the extent of one third of the circumference of the shaft on the bottom half box.

FIG. 16.



The box had been originally made to fit the journal loosely, and it had not worn enough to make it fit over one third of the circumference of the shaft. In the use of cast iron bearings, lubrication must be attended to, else the bearing will soon be cut and rendered useless; but lubrication is so easy, and so little oil is needed for the purpose, that there can be no reasonable excuse for neglect. You will observe in the sample of the hanger now before you, two large cavities in each end of the top box; these cavities are called tallow cups. They should be filled with tallow and oil, mixed so as to be of such a consistency as not to be fluid in warm weather. Should the journal heat from any cause, this same solid lubricant will melt, and, running into the bearing, will protect it for the time being. The box should be oiled in the center, and oil holes are provided for that purpose in the recess around the spherical portion of the top box. There is also a hole in the very center of the ball on top, and the top plungers, which rest on the ball, being hollow, a self-feeding oil cup can be placed on top, and thus deliver oil regularly to the bearing. As to the quantity of the oil needed, I would remark that shafts running in self-adjusting hangers, with bearings four diameters long, at a speed of 120 revolutions per minute, require, on an average, $2\frac{2}{10}$ fluid ounces of oil per bearing for six months' oiling, and self feeding oilers, placed on top, should not deliver any more than this quantity.

From time to time a great deal is said about self-oiling boxes; by this term is meant boxes that are made to contain oil in some reservoir usually under the shaft and from which reservoir oil is *fed* to the shaft, and then allowed to run back into the reservoir and thus be used over and over again. It is said that bearings in self-oiling boxes have been made to run for a year or more without attention, but I have never known a self-oiling box to be made to work well with so little oil as $4\frac{4}{10}$ fluid ounces in it. Some of them hold a pint each, and only the other day I was called upon by a manufacturer who required some shafts, couplings, and pulley, but who did not want hangers, as he would make his own self-oiling hangers. I asked him how much oil he put into each box. "Oh, about one pint," he said; "I do not think them safe with less." One pint is 16 fluid ounces, quite enough oil to last four years, if properly applied, and yet it would never do to trust that quantity of oil for that time, as it would become deteriorated by age. Self-oiling boxes are rather more costly, and take more oil to run them, than properly made bearings oiled by hand. Self-oiling boxes are good things to sell—better than to use; they are good things to talk about to those who do not know what true economy in oiling is. Glass oil cups above the bearing, feeding oil at such a rate as to consume $2\frac{1}{4}$ fluid ounces in six months to, say, hangers for $2\frac{1}{4}$ shafts, are the best, and oil fed at this rate will not run out of the box ends, but will just supply the waste from consumption.

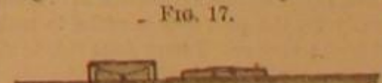
All shafts, long or short, must be provided with some means of preventing end motion. Line shafts should have one pair of collars fitted to one of the bearings only. The collars placed usually on the first or head shaft should control the position of the entire line; more collars are apt to cause needless friction. When shafts are collared, the collars should be fast to the shaft; loose collars held in place by set screws are sometimes used, but are more expensive and cumbersome than the fixed or fast collars. Some engineers prefer necking in the head shaft to some smaller size in the journals. Suppose the first or head shaft require to be made of iron $6\frac{1}{2}$" diameter, to sustain the driving belt. This shaft might be necked in, and be carried by bearings, say $5\frac{1}{2}$" diameter, and the ends still further reduced to the size of the shaft to be coupled to it. This practice of necking in the bearings of the head shaft, common in modern cotton mill practice, has the advantage of diminishing the velocity of the surface motion and of the shaft in the box; for by diminishing the diameter we diminish the speed of the rubbing parts, and the tendency to heat is much increased with increase of velocity.

To determine the size of shafts for the transmission of a given power, a safe formula is D= the cube root of $[(P \div R) \times 125]$ D being diameter of shaft, P the horse power, and R the number of revolutions per minute. This gives a shaft strong enough to resist flexure, if the bearings are not too far apart. The distance apart that the bearings should be placed is an important consideration. Modern millwrights differ slightly in opinion in this respect; some construct their mills with beams 9' 6" apart, and put one hanger under each of the beams; others say 8 feet apart gives a better result. I am clearly of opinion that with 8 feet distance, and shafting lighter in proportion, the best result is obtained. The tendency now is to increase rather than diminish the speed of line shafts, and good practice is to run shafts for machine shop purposes at 120 revolutions, for wood-working machinery at 250 revolutions, and for cotton and woolen mills at from 300 to 400 revolutions per minute. Hollow or pipe shafting has been made to run at 600 revolutions per minute, very satisfactorily. This kind of shafting is too costly to be generally introduced.

Mr. James B. Francis, of Lowell, writes me that since the decrease of the water power in that town, or rather the rapid increase of the factories, they have been obliged to economize their power, and they are doing so by using smaller shafts at higher velocities, and have even made extended lines only $1\frac{1}{2}$ inch in diameter. They so arrange the mill as to secure a hanger close to each transmitting pulley. The torsion in long lines limits the smallness of the shaft used, and in all probability the best result will be found to be obtained in the use of not less than $1\frac{1}{2}$" diameter for the smallest line shafts in cotton mills.

There are now running in some factories lines of shafting 1,000 feet long each. The power is generally applied to the shaft in the center of the mill, and the line extended each way from this. The head shaft being, say 5" diameter, the shafts extending each way are made smaller, and small in proportion to the rate of distribution, so that from 5" they often taper down to $1\frac{1}{2}$. In coupling shafts of different sizes, it is customary to reduce the end of the larger one to the size of the smaller shaft, and then to use a coupling suited to the smaller size. Fig. 17 shows an example of this method of reducing the larger shaft to the size of the smaller one. The rapidity with which the reduction of the size of the sections is made must depend, in all cases, on the distribution of the power. For instance, if a line of any length whatever receives its power at one end, and transmits the same amount of power at its other end, such shaft must be of uniform diameter; but if it distributes its power at regular intervals along its length, the shaft may be made in sections of a size proportioned to the power given off.

FIG. 17.



It would be impossible in one lecture to detail all the contingencies that influence this reduction, as questions of expediency will often have a decided influence. While speaking of the relative velocity of shafts, I would like to call your attention to one consideration touching on the economy of fast running shafts. To run a shaft of a given size and weight, say 200 revolutions per minute, must take more power than to cause the same shaft to revolve 100 revolutions, but with increased velocity the diameter of the shaft may be diminished, and with it the diameter of the driving pulleys may also be lessened; and hence the weight on the bearings will be reduced and the velocity of the surface of journals not much increased. With the formula I have already given you for computing the proper size of the shaft for the transmission of a given power, at a given velocity, you can readily work out comparative examples, and thus demonstrate the advantage of high speeds over low ones.

Correspondence.

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

The Vienna Exposition.

To the Editor of the Scientific American:

The epidemic of personal abuse which has pervaded the country for the past few months seems, at last, to have reached the office of your journal.

From an article under the above heading, in your issue of November 16, I extract the following: "Then there is General Van Buren, the United States Commissioner for this show, who will also come in for emolument. At present his office is purely honorary; he draws no pay and knew this when he accepted its functions. But of late, he has been very arduously engaged in his exhibition duties, stumping eloquently around the country to urge the election of General Grant, and the administration will of course be expected to provide for his trip to Europe." But once before has any personal assault been made upon me in connection with my official duties, and that was in a communication to one of our daily papers, from a person to whom I had refused the appointment of assistant commissioner. I am not aware of having similarly disappointed any gentleman connected with the Scientific American, and am therefore at some loss to know to what to attribute the paragraph I have quoted.

While glancing at your article, my eye was caught by certain prominent figures at the head of your editorial columns, which advise the public that your journal is furnished to subscribers at three dollars per year. And, upon turning the page, I find, as the frontispiece, a very excellent representation of a weaving loom attended by an attractive young woman. I might perhaps, be considered personal if I should suggest that your paper was a "show paper," notwithstanding its high sounding title, and that you published it for "pay" and not in the interests of science. And if further I should say that, in your opposition to the International Exhibition at Vienna, you had been moved by a desire to commend your paper to American inventors as the especial champion of their interests, with a view to increasing your circulation and drawing to your net applicants for patents, and thus add to your incoming wealth, I should doubtless find many who would credit the assertion, whatever might be said of my taste in making it. If, in addition, I should announce that you had labored zealously to secure the election of Mr. Greeley to the Presidency, your judgment would probably, in many quarters, be criticized, but your right as a citizen to do even this would not be questioned.

Now, with these comments, let me at once admit the truth of your statement that my office is without pay, and that I knew this fact when I "accepted its functions;" but permit me to add that I did not seek the position, and I only assumed its duties when made to believe that I could thus render some service to the country. And, further, let me say that I have no intention of going to Vienna and giving a year more of my time and exertion at my own expense, and, in addition, pay out of my own pocket the expenses of the Government. If you have any disinterested individual connected with your editorial department who is anxious to do all this, send him along, and he can take the position at once. Neither can I well see why I should thus devote myself to public interests by taking charge of, what you are pleased to term, "a show" at Vienna, where American inventions are exhibited and their superiority established before the whole world, while you demand hard cash for publishing what *I* may please to call a *show paper* to a limited number of subscribers. Your assertion also that I have been "stumping eloquently" for the election of General Grant I will not deny, but when you say that I have in that way "been arduously engaged in my exhibition duties," thus insinuating that I have neglected my official duties and taken to the stump with a view of having a claim for compensation as commissioner, you invent a foul calumny which I respectively insist even newspaper editors have no patent right to do.

Ever since the formation of the Republican party, I have taken an active part in its contests, and, while I believe in its principles, I shall continue to do so. While doing this I have never neglected more important duties, nor have I ever been the hired advocate of any committee or clique, for I have uniformly refused compensation and paid my own expenses. As commissioner to the International Exhibition at Vienna, I have labored zealously for the past four months to make the American Department a success. I have done this to the entire exclusion of my own personal business, and without reference to my own interests, or as to whether I should continue in the commission and go to Vienna or not. While thus engaged, I have earnestly striven to secure a convention and treaty in the interests of our inventors. The Governments of Austria and the United States have ratified a treaty upon trade marks which goes far to secure the rights of our citizens, but I have desired farther to procure an abrogation of certain obnoxious requirements of the Austrian patent laws, and I have caused to be prepared and sent to Washington a draft of a treaty to that end; such a treaty the Scientific American has professed to be strongly in favor of. If its assistance is to be of the character of the articles thus far published in its columns upon the subject, I may be pardoned for saying it will not prove valuable.

I take pride, in this connection, in stating that all my applicants for space thus far have expressed their determination to send their goods to the exhibition if they have to do it at their own expense; and that in no instance have they asked that their board bills be paid by Uncle Sam.

It may be witty to call the International Exhibition "a show," and to insist that exhibitors are only so many advertisers who ought to pay for their advertisements. "This world is all a fleeting show;" and yet there are many people who are foolish enough to be exceedingly interested in its affairs; and I fully believe that our country will see something more in the grand collection of the industries of all nations at the Austrian capital than a great advertising agency.

I regret that one of our leading scientific journals should take so narrow a view of it, and would fain believe that the editorial in question was the offspring of a bad dyspepsia, or an election bet lost on the late "tidal wave."

I will not do you the injustice to express a doubt of your giving this communication a place in your columns.

THOMAS B. VAN BUREN.

United States Commissioner for the Vienna Exposition of 1873.

The Bursting Strain on Cylindrical Boilers.

To the Editor of the Scientific American:

The Scientific American holds the position of the leading scientific and mechanical paper of the most influential nation on the face of the globe. By constantly reading it, more practical and useful knowledge can be obtained with less effort than from all other periodicals and books combined. As such, I have time and again recommended it to young men generally, and to mechanics particularly. As one holding these views, I wish to offer a suggestion.

Every paragraph appearing in your paper, although it be a correspondence for which the paper is "not responsible," bears a *quasi* endorsement as having been found worthy to enter your columns, being selected from among a number, the majority of which are rejected.

In your issue of October 19, 1872, page 244, is an article on "Cylindrical Boilers," which I supposed to have been inserted for the purpose of being refuted. The error it contains is made plausible, and stands endorsed therein by Fairbairn, "so extensively known in scientific engineering." A mere expression of difference of opinion was likely to go unheeded as against such endorsement. Therefore, in my communication to you on the subject, I used ridicule to show more strikingly the absurdity of the position taken. This went into the "basket," and the error asserted by Bakewell still stands in your columns unrefuted, teaching to my young friends, whom I have advised to examine the Scientific American for knowledge, that which is totally erroneous.

Imagine my surprise when to-day, in your answers to correspondents, I perceived that my communication, intended to ridicule Bakewell's proposition by showing its absurdity, could have been understood as expressing my own belief, you putting down your "constant reader" for so many years as a believer in perpetual motion—"the unkindest cut of all."

The pressure in any vessel cannot be greater in one direction than in the opposite direction. Hence, I chose, as strikingly illustrating the error, the semi-circular shape on one side, and a diameter or flat side on the other. On the latter, Mr. Bakewell will hardly contend, unless he irretrievably belongs to the perpetual motion school, that the pressure is greater than at the diameter. How, therefore, can he claim that on the semi-circular portion it can be any greater? His mode of reasoning by "resolution of the radial forces into horizontal and vertical," and again, "of vertical forces so obtained into horizontal," etc., at once points out the error in his mode of reasoning.

Believing that with your great experience and knowledge you always admit an oversight, and set your columns right, I continue your appreciating and constant reader,

ROBERT CREUZBAUR.

[We printed Mr. Creuzbaur's answer on page 298, and called his attention to Mr. Bakewell's letter, which did not state that there was a greater pressure on the convex part of a boiler than on the flat. His assertion was that the bursting strains of boilers vary as the semi-circumferences, and not as the diameters. We shall publish next week a letter, which is to the point in Mr. Bakewell's theory.—Eds.]

Transmission of Motion.

To the Editor of the Scientific American:

I have read the criticisms by Mr. James Garland on a lecture delivered by Mr. Coleman Sellers on the above subject, and I am surprised to find even a comparative advocate of the plate coupling.

When, two years ago, I first became acquainted with American mechanical engineering, there appeared to me nothing in this country more strikingly superior to English mechanical engineering than the American or specially Sellers' way, here generally adopted, of constructing shafting, coupling, hangers and all appliances connected with the transmission of motion.

Mr. Garland is perfectly correct in saying that, in England and elsewhere, the way to keep shafts in the plate coupling in line is to let one shaft enter the opposite part of the coupling a short distance, but I have also known engineers in England who advocate and practice the mode described by Mr. Sellers, of true-fitting bolts in preference to fitting the end of a shaft in the coupling of a shaft of different diameter.

There is no doubt that a worse contrivance than a true-fitting plate coupling, or the one Mr. Garland saw fifteen years ago, may be invented; but the advantages of the double cone coupling, as compared with the former, appear to me to allow of no dispute. If Mr. Garland is correct that it is not considered good practice in England to enlarge the shafts for the reception of couplings, then there is certainly a great amount of bad practice in England. I have seen not only the ends of the shafts for the reception of the couplings, but also the seats for the pulleys, enlarged, and this I would call good practice, if it were not for its costliness. I have had for years the best opportunity to become acquainted with English and Scotch engineering, through personal visits to the engineering establishments in those countries; but to give Mr. Garland other authority, I refer him to any of the English publications on engineering practice.

Philadelphia, Pa. L. SCHUTTE.

Shifting Belts on Pulleys.

To the Editor of the Scientific American:

S. W., in the article on the transmission of motion, page 292 of the present volume, suggests an idea that may be a valuable one. The same idea occurred to me long ago, but without trying it, I had not thought it practicable to shift a belt from a pulley not in motion. Will J. W. please inform us if he has seen an actual trial of it?

A plan that I have tried somewhat, and which works well, is to make the loose pulley smaller than the tight one, so as to relieve the strain of the belt and the pressure on the bearing when the belt is on the loose pulley. Where the tight pulley is of wood, so that the edge can be beveled, a difference of an inch in the diameters is no hindrance to the shifting of the belt.

Good authorities say that the adhesion of a belt is as the square of the amount of circumference enveloped by it. Then it seems to me that it is a good policy to cross belts where it is possible, for the gain in adhesion must, in most cases, be more than the extra wear by crossing.

Buchanan, Mich. W. G. BLISH.

An Invention wanted for Dressing Ramie.

To the Editor of the Scientific American:

A machine is now wanted by the agricultural industry which will largely pay the trouble of inventing it. That fine plant called ramie or China grass (*Urtica tenacissima*), is being cultivated in Louisiana, Texas, California, Mexico and Cuba, but the planters find that the way to a large production is obstructed by the want of an efficient and substantial machine for extracting the valuable fiber, and what is most desirable, for extracting it in large quantities.

I wonder that this machine has not been invented in the true land of useful inventions, although Mr. Lefranc, of Louisiana, has tried and succeeded to a certain extent, in extracting the fiber, but only at the rate of 250 to 300 pounds a day. I am sure that the man who should make such a gift to the pioneers of the ramie culture in those States would be amply remunerated by the selling of hundreds, if not of thousands, of such machines.

Havana. A PLANTER OF RAMIE.

The Stow Pavement.

To the Editor of the Scientific American:

In the Scientific American of October 19, in an article on wood pavements, you state that the Stow pavement on Sixth or Seventh avenue is wearing out. I will inform you that there never has been a single foot of the Stow foundation pavement laid down on either of those avenues in the city of New York. Will you please correct your statement in the next issue of your valuable paper?

Buffalo, N. Y. HENRY M. STOW.

[The pavement alluded to should, we believe, have been mentioned as Stafford's.—Eds.]

The August Shower of Meteors as seen in Texas.

To the Editor of the Scientific American:

In regard to the shower of meteors of August 10, I would state to you that on the morning of the 11th, between 12 and 1 o'clock A. M., I beheld the finest display of meteors that I ever saw in my life. They were in the west, at about an angle of 45° from where I stood, and were of many sizes, from the smallest speck up to the largest sized star, and very thick.

Bryan, Texas. P.

[For the Scientific American.]

ABSURD COSMICAL THEORIES.

BY W. T. ROBINSON, A. M.

Dr. Carpenter is not in advance of the Scientific American in ascribing great importance to common sense as a test for scientific theories. This rule, when applied to certain cosmical hypotheses, shows them to be too thin for any practical purposes.

For instance, Dr. Hickok, in his late work on "Creation," claims that matter results from three forces: antagonistic, diremptive and revolving." Antagonistic forces collide, neutralize and form lumps of matter. But what is this force that he freezes into matter? Heat, light, electricity and sound are examples of it. What is sound? It is nothing more than a jarring or vibration of the air or other substance. The "force" or vibration jars the auditory nerve, and produces the sensation of hearing. In like manner, the waves of light impinge on the optic nerve and produce vision. Heat acts in a similar way. But heat is not an entity in itself; it is merely an abstract name for molecular motion. A ball lying still represents no force; start it down hill and it has force proportioned to its velocity; when it strikes at the bottom, its mass motion is converted into molecular motion, or heat; hence, heat and motion are convertible terms. But this motion is not anything in itself; it is simply an abstract name for the process of a substance changing position; and, as all the forces of Nature are merely varieties of motion, it follows that without matter there can be no force, because motion is nothing more than the action of matter. Force is therefore really nothing in itself. Now, common sense rebels at the idea of the learned Doctor bringing two nothings into collision and begetting something, for every effect must have an adequate cause, every bairn a dad!

La Place's nebular theory, as now understood by various cisentists, supposes that matter in the beginning was diffused throughout space, and that, through the action of the laws of matter, all the celestial machinery was developed by a process of evolution. But these evolutionists do not admit that matter was created; if not, then it had no beginning, hence no starting point. Go back as far as mathematics or imagination can reach, and there is still an eternity beyond. The theory is, therefore, not accordant with common sense, because it assumes a condition which could not possibly have existed.

Because our little world, and probably all other matter in the Universe, is revolutionizing, it does not follow that this change is evolution. Plants, animals, races revolve and die; meteors and comets are thrown into chaos, probably suns and systems are "knocked into everlasting smash;" but as the Universe can have no limits, there is no possible chance for a grain of matter or a vibration of force to drift off into the regions of nowhere. So that new suns and systems may arise from the fragments of the old ones, just as new plants grow up from the humus of defunct vegetation. Thus we have all things succeeding in endless rounds, vast, eternal, incomprehensible.

Council Bluffs, Iowa.

FIRE.

Professor C. F. Chandler, of Columbia College, recently delivered an interesting lecture at the Stevens Institute of Technology upon the very timely subject of "Fire." Beginning with general definitions, the lecturer explained the phenomena of combustion, and illustrated the reciprocal nature of combustibles and supporters of combustion by burning oxygen in ammoniacal gas, at the same time causing the latter to ignite in the air. Oxygen was also shown to burn in hydrogen and in an atmosphere of ordinary street gas. After explaining oxidation and the gradual combustion of bodies by decay, Dr. Chandler called attention to the manner of

AVOIDING FIRE,

and executed several experiments with carbonic and sulphurous acid gases. He then explained the principle of fire extinguishers, showing how they contained carbonate of soda in solution, to which, by turning a handle of the apparatus, sulphuric acid is added, thus generating carbonic acid gas, besides forcing out the stream of water. The construction of a well known invention of this kind was detailed, and its mode of operation shown. The lecturer then gave an excellent plan for

RENDERING LIGHT FABRICS FIREPROOF,

and astonished the audience by calmly setting fire to one of a pair of thin window curtains. He then applied a blaze to the other, which refused to be kindled. A similar experiment was made with two children's dresses of thin material: the first burst into flame the instant the lamp was applied, the second, though made of precisely the same fabric, could not be ignited. This effect was caused by mixing with the starch with which the articles were prepared the tungstate of soda, a crystalline and not very costly salt. Dr. Chandler suggested that a fireproof starch; properly prepared with this or some other suitable chemical, would be a very valuable invention.

The greater part of the discourse was devoted to the means of preventing fire.

STATISTICS OF FIRES,

recently compiled, show that 76,000,000 dollars was lost through isolated conflagrations in the United States, Chicago and Boston not being considered, within a space of two years. Investigations into the causes show that although the largest number of fires was due to incendiarism, no less than 12 per cent owed their origin to accidents with kerosene. Examinations, made by the Fire Marshal of New York city, also proved that 18 per cent of the fires occurring within the limits of one year were due to a similar cause. The lecturer then proceeded to explain the manufacture of kerosene, its nature and how it is adulterated. *He stated* that nearly all the

KEROSENE

sold in the city is unsafe, and instanced how he purchased 700 samples, out of which only 28 were not dangerous, and 37 were extremely bad. A very lucid description was given of the method of testing the oil, and the varieties of apparatus used were exhibited. The flash point and not the burning point should be considered, as, of course, the vapor of the oil must ignite before the liquid can kindle. One hundred degrees Fahr. was stated to be the commercial standard for the flash point, but Dr. Chandler considered that this should be raised to at least 130°, so as to preclude all possibility of the oil arriving at the flashing temperature while in the lamp. A *strong* denunciation was delivered against the manufacturers who sell unsafe kerosene and thus imperil human life. It is a common trick to delude customers by setting a little of the oil on fire in their presence to prove that it is non-explosive. If kerosene ignites at ordinary temperatures, it is a sure sign that it is extremely dangerous. The oil never in any case explodes, but its vapor when mixed with air does so. Kerosene which is almost pure gasolene is now sold in New York. One variety is known as "Safety Gas," so called to evade the law. It is sold by one Smith, at No. 40 East Broadway; (we give the individual the benefit of the gratuitous advertisement). To prove the inflammability of this compound, the lecturer poured a little on an old coat hung on a frame. On touching a light to the garment, it instantly burst into a fierce blaze, which continued a sufficient time to burn the wearer, if any there had been, to death. This oil was stated to be as dangerous as gunpowder, and should never be used. The properties of a really safe oil were then explained, and samples of various kinds shown. Among others were the products of several well known firms, the best being mineral sperm oil, which Dr. Chandler stated flashed only at 250° Fah., and was practically as safe as whale oil. Taking a specimen of this liquid, he heated it to a temperature of 212°, lit some cotton waste saturated with it, and actually extinguished the flames in the boiling oil. The same material, when poured on a garment, could not be ignited. Good oil is necessarily more expensive than the inferior qualities, but the very best only costs one half cent per hour, while the worst cannot be sold at a lower rate than one quarter of a cent, for the same period.

LAWS REGARDING THE USE OF OIL

should, said Dr. Chandler, be rigidly enforced; and he called attention to the late English enactment on the subject. The various state laws hitherto passed are virtually inoperative, their principal defect being that their execution is left to inspectors, who can be approached and so caused to neglect their duty. Selling or making dangerous kerosene should be legally made a crime, punishable by heavy fine for every offence. In case human life is sacrificed, the manufacturer should be indicted for manslaughter. Inspectors should be abolished and the evidence of every citizen taken as competent to prove the manufacture or sale of bad material.

CARBONIC ACID AS A PREVENTIVE.

Dr. Chandler alluded to a company which at one time was started in this city for the purpose of introducing carbonic acid gas through pipes into all the houses, so as to have a means of extinguishing fire ready at hand. This, he said, would be extremely dangerous, because in event of a leak in the pipes, the same could not be discovered, and the escaping gas would suffocate the inmates of the dwelling. It was proposed at one time to compress this gas into a liquid and furnish it in iron casks to vessels, so that, when there was danger of fire, the gas might be set free.

STREET GAS

was also discussed. A common cause of fires is the habit of running over a gas pipe with a light in order to detect a leak. This is highly dangerous and often causes explosions. How to use gas was also explained. People complain of their gas when the fault is in the burner. A very large amount of money is yearly wasted simply because gas is improperly consumed. Iron burners are bad because they become rusty; brass are better, and those of soapstone or lava, as they are known in the trade, are the best. The most effective burner is the "argand" and the best the lecturer had ever seen was known as "Sugg's London Burner," made in England. This is an argand burner constructed of soapstone.

FIREPROOF BUILDINGS

were next taken up. Mansard roofs were strongly condemned and also the practice of using inflammable materials in buildings. Pine wood is so cheap in this country that it is employed for house carpentry almost to the exclusion of other kinds, while it is the most dangerous in existence. Dr. Chandler then proceeded to explain the French mode of building, which he said was almost absolutely fireproof. Floors consist first of a number of thin iron beams, much thinner than are used in this country, placed some two feet apart. Across these are laid a number of rods of hoop iron, and across these again more of the same material, until a network with interstices of about a foot in size is formed. A flat platform is then brought up underneath, and liquid plaster is poured over. As soon as this sets, the platform is removed and the floor remains, a solid mass of plaster and iron. Walls are constructed after a similar fashion; a few light scantlings are put in position to give shape and, boards being temporarily placed on either side, liquid plaster is poured in and allowed to harden. All walls and floors therefore are perfectly solid, and consequently fireproof. Dr. Chandler then gave a very entertaining account of a fire in the Palais Royal, in Paris. He said that the inmates of other parts of the house did not manifest the slightest unconcern nor move a single article. Of the Paris Fire Department, he gave an amusing description, saying that it was but a single garden engine and a line of men passing buckets. This, though seeming ridiculous at first, really showed the sense of the people, who, instead of paying immense sums for an elaborate organization, spend their money in rendering their houses incombustible. A fire in one room in a French house spreads no further. It is only necessary to close the doors and let the articles contained in the apartment burn up. No other damage can be done.

In great cities every house should be, by law, fireproof Our so-called fireproof warehouses are manifestly easily consumed, a fact shown by the immense number of windows which are always constructed in them and which offer no resistance to the fierce blasts of hot air from an adjacent burning edifice. All windows should be provided with iron shutters, not swinging, as these are easily curled up by heat, but enclosed and sliding in the wall. Shutters should, however, be double, so as to leave an air space between them.

Dr. Chandler spoke at considerable length on fireproof construction, strongly advocating wide streets and isolation of buildings, and concluded his discourse, which was loudly applauded throughout by quite a large audience, by an appropriate quotation from Schiller's "Song of the Bell."

IT is said that a copper mine has been discovered in Jackson county, Ill., of extraordinary richness, at a depth of only ten feet. Experts, they say, pronounce the ore to contain ninety-five per cent pure metal, and in consequence all the inhabitants of the county have dropped their ordinary occupations and gone to sinking wells in hopes to strike a "lead."

Chemical News Translations from *Comptes Rendus, Journal de Pharmacie, Neues Jahrbuch* and *Revue Scientifique*.]

Formation of Corrosive Sublimate in Powders containing Calomel.

The author has instituted a series of experiments to ascertain the correctness of the assertion that calomel when mixed with other powders becomes converted into corrosive sublimate; the results of these researches may be summarized *as follows*: No corrosive sublimate is formed within twenty, four hours when calomel is mixed with saccharum album-saccharum lactis, magnesia usta, magnesia hydrico-carbonica, and natrium bicarbonicum. After three months no corrosive sublimate is formed in mixtures of calomel with magnesia usta, magnesia hydrico-carbonica, and any kind of refined sugar or milk sugar, but faint traces are formed in mixtures containing calomel, natrium bicarbonicum, and refined lump sugar. By treatment with water, corrosive sublimate is only formed in such mixtures of calomel as contain magnesia usta and bicarbonate of soda. Rather large quantities of sublimate are formed in powders composed of calomel, sugar, and bicarbonate of soda, if the mixture becomes damp and is kept for a long time. No sublimate is formed when a powder consisting of calomel and bicarbonate *of* soda is digested with water acidulated with hydrochloric acid. Pepsin does not favor the formation of corrosive sublimate.—*G. Vulpius.*

Pure Hydrochloric Acid.

The crude hydrochloric acid of commerce is first diluted, by the addition of water, to a specific gravity of from 1·14 to 1·13, and it is next treated with sulphurretted hydrogen gas until it smells strongly of the gas. The liquid is next filtered and then poured into a tabulated retort and heated until the sulphuretted hydrogen is eliminated. The test of solution of corrosive sublimate having been applied, the bulk of the acid is distilled over at a gentle heat, a few fluid ounces only being left in the retort, so that any chloride of iron left in the acid may be retained.—*Th. Diez.*

Starch in Potatoes.

A tabulated form contains the record of experiments with sixty-one different varieties of potatoes, in which the author had estimated the total percentage of dry substance and the total quantity of starch. It appears from this research that the percentages alluded to vary, for dry matter, from 15·64 to 34·25, and the percentage of starch from 8·79 to 26·09.—*Dr. Raab.*

Mejillones Guano.

This material occurs native and in large quantity near the Bay of Mejillones (Bolivia). In 100 parts, this substance consists of—lime, 30·6636; magnesia, 7·9193; peroxide of iron, 0·1466; alumina, 0·0047; potassa, 0·5051; soda, 1·4532; phosphoric acid, 35·86803; chlorine, 2·2250; sulphuric acid, 1·6036; silica, 0·0459; carbonic acid, 1·5956; water driven off at 100°, 7·6858; non-nitrogenous organic matter, 6·5189; nitrogen, 0·7675; granules of granite, insoluble in HCl, 2·2830; loss, 0·7249. The author states that this guano occurs in pulverulent sandy state, and that it is readily acted upon by carbonic acid and water, and thus rendered available for plants, while, in consequence of its high percentage of phosphoric acid, it may be used with advantage for the preparation of phosphate of ammonia and other phosphatic preparations.—*H. Vohl.*

Economical Preparation of Hydrogen.

By first reducing to the metallic state a peculiar kind of iron ore found at Chateauroux (France) by means of oxide of carbon, finely divided iron is obtained, which is used to prepare hydrogen, which thus costs only ¼d. per cubic meter (35·31 English cubic feet) and may be used for various heating, illuminating, and air balloon filling purposes.—*M. Giffard.*

Applications of Sulphurous Acid Gas.

The author proposes to apply sulphurous acid gas—obtained in the usual way from pyrites or burning sulphur—for the purposes of saturating urine, the contents of *fosses d'aisance*, ammoniacal gas water, the waste soap water from woolen and other industries, partly for disinfection, but more particularly for obtaining valuable products by evaporation; the sulphurous acid gas is forced into the liquids by means of blowing fans or force pumps.—*M. Chaudet.*

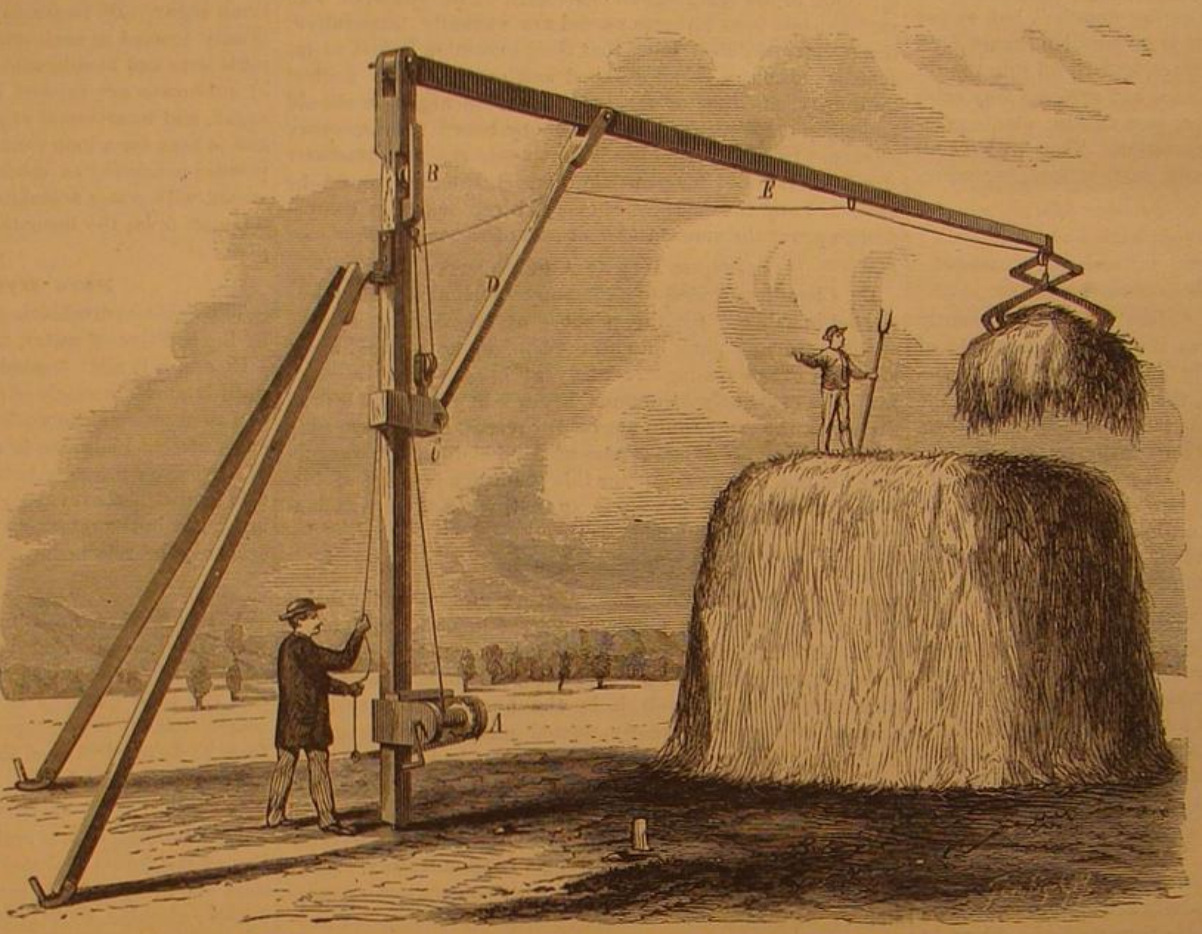
Why the Fire Spread so Rapidly.

All the accounts agree in attributing the fearful spread of the conflagration in Boston, to the presence of the "Mansard" roofs, which proved to be simply huge wooden boxes, mounted upon the summit of granite walls, far above the reach of the firemen. Mr. H. S. Oakley, President of the National Board of Fire Underwriters, New York, cautioned the Boston Board of Underwriters in relation to this very matter more than four years ago, and asked them to use their influence toward suppressing the erection of these immense frame structures above the cornices of their business houses and dwellings. The building in which the fire originated he was well acquainted with, as he had given it his personal examination, and he feared that it and similar structures would at some time or other entail a great loss on the community. It was 60 by 100 feet, and the Mansard was from 20 to 30 feet high, without a break—a great wooden structure surmounting the masonry. The second building ignited stood on the opposite side of the street, and the street was sixty feet wide. It should, however, be stated that if iron framing and iron covering plates are used in the construction of these roofs they are then made perfectly safe. It was a Mansard-roofed building that arrested the spread of the fire in Boston on its recurrence from gas explosions. Doubtless the authorities of Boston will hereafter require the use of iron.

HAY AND STRAW STACKING APPARATUS.

The labor of stacking wheat, rye, oat, or barley straw and hay with an ordinary pitchfork is by no means slight, and indeed it is almost impossible to build stacks by hand high enough to prevent their becoming flat by settling, and their consequent rotting by the soaking in of the rain.

The invention herewith illustrated is designed to enable one man to place straw or chaff on a stack or pen eighteen feet high, as fast as the material can be furnished by the thrashing machine. It consists of an upright resting on a pivot and held erect by two braces, the upper ends of which are fastened in such a manner as to allow the upright to pivot readily in any direction. The lower extremities of the braces are firmly staked in the ground, as shown in the engraving. To the upright is attached a windlass, A, furnished with a ratchet and pawl, and carrying an elevating rope which passes up over a pulley, B, then down around another pulley on a carriage, C, and thence back to a staple on the upright, to which it is made fast. The carriage, C, is provided with friction rollers so as to slide freely up and down the upright, and connects with the lower end of the brace, D, the upper extremity of which is pivoted to the vibrating beam, E. The latter is hinged to the top of the upright as shown, and supports at its further end the tongs or grapple. The construction of this appliance is after the fashion of lazy tongs, and is readily understood from the engraving. To the point of intersection of the grappling arms is attached a cord, which passes through a loop on the swinging beam, and thence is led along down to a point beside the windlass.



BAIRD'S HAY AND STRAW STACKING APPARATUS.

To operate the device, the rope attached to the windlass is slacked until the beam, E, is inclined downward sufficiently to allow the tongs to grasp a quantity of straw. By pulling on the cord attached to the grapple, the jaws are opened to engage the material, and by slacking the line the tongs close of their own weight and firmly hold. The windlass is then revolved and the beam elevated to the proper distance, when the whole apparatus is turned on its pivot until in position to drop its load on the stack. The cord attached to the tongs is then pulled, causing the jaws to open and the straw to fall out. The machine is represented at this stage in our illustration—the figure at the foot of the upright being in the act of drawing the cord.

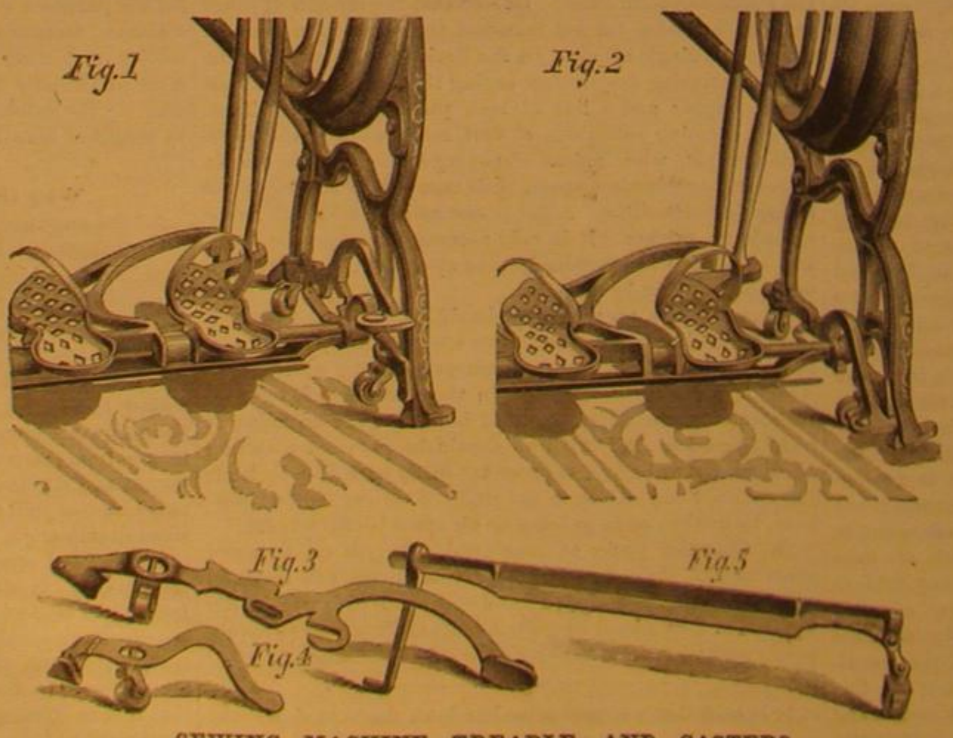
The principal advantages of this invention are the economy of labor and time which it must cause, and also the simplicity of its parts. It can readily be made by any farmer, with the assistance of an ordinary smith in the construction of the metal portions. It is not heavy or unwieldy to manage, and can be easily carried upon the shoulders of two men.

Patented through the Scientific American Patent Agency, September 24, 1872. For further information address the inventor, Mr. D. W. Baird, Lebanon, Tenn.

SEWING MACHINE TREADLE AND CASTERS.

Our engravings represent an improved form of treadle and also an ingenious mechanical combination of levers, whereby the sewing machine may be lifted on or off its casters at pleasure. From Figs. 1 and 2 the arrangement of the treadles is readily understood. There is necessarily an alternate motion, the cranks being on a quarter turn similar to those of a locomotive. The dead center is thus avoided, and the machine can be entirely controlled by the feet, which, acting separately, have a much more natural and less tiresome motion than usual.

Figs. 3, 4, and 5 represent the various portions of the device for actuating the casters, which, in Figs. 1 and 2, are shown respectively out of and in action. The lever (Fig. 3) is attached to the rear right hand leg of the machine, its forward end terminating in a foot plate. Fig. 4 is affixed to the corresponding forward leg, the arm of the lever being inwards, connecting with and moved by the foot lever, Fig. 3. Fig. 5 extends across the machine under the treadles. On its right hand end are an arm and pin, which pin enters the slot shown in the foot lever. A caster is attached to its left hand extremity by means of a short arm.



SEWING MACHINE TREADLE AND CASTERS.

In Fig. 1, the device being out of action, the foot lever is raised, the casters are consequently clear of the floor, and the machine rests firmly on its legs. In Fig. 2 the foot lever has been pushed down and is caught under the catch on the forward leg, which retains it until it is released by the hand. The rear caster fastened to this lever is therefore thrown into action, while the arms of the levers, Figs. 4 and 5, are forced down, causing the other two casters thereto attached to press on the floor and to act as fulcrums, so that the machine is raised fully half an inch, and may be easily moved from place to place. It will be noticed that the bar, Fig. 5, carrying the caster on the left, is made concave, so, that any oil, that may fall from the feeder or bearings, is caught and prevented from reaching the carpet. The treadles and the invention just described may be easily applied to all forms of sewing machines new or old.

These devices were patented through the Scientific American Patent Agency, the treadles under dates March 7, 1871, May 9, 1871, and Sept. 12, 1871, and the casters Oct. 17, 1871, by Mr. G. K. Proctor. They are now manufactured by the Salem Shade Roller Manufacturing Company, of Salem, Mass., John C. Osgood, agent, to whom further inquiries may be addressed.

The National Jubilee.

The one hundredth anniversary of American Independence is to be celebrated at Philadelphia, Pa., July 4th, 1876, in a becoming manner. One grand feature of the occasion will be the general exhibition of the products of American Industry.

The Centennial Commission has issued an address to the people of the United States, signed by President Joseph R. Hawley, for subscriptions to the fund of ten millions of dollars required to make the Centennial such a success as the patriotism and pride of every American demand. The Commission looks to the unfailing patriotism of the people of every section to see that each contributes its share of the benefits of an enterprise in which all are so deeply interested. It would further earnestly urge the formation in each State and Territory of Centennial organizations which shall in time see that county associations are formed, so that when the nations are gathered together in 1876, each Commonwealth can view with pride the contributions she has made to the national glory. "Confidently relying on the zeal and patriotism ever displayed by our people in every national undertaking, we pledge and prophesy that the centennial celebration will worthily show how greatness, wealth, and intelligence can be fostered by such institutions as those which have for 100 years blessed the people of the United States."

A Huge Snow Plow.

We see it stated that the Union Pacific Railroad is having built, at the shops in Omaha, a snow plow which, when finished, will be the largest and most powerful in the world. It is rapidly approaching completion, and in a few days will be ready for business. The trucks on which it is built are very heavy and strong, and were cast especially for this plow. The platform on the trucks is 22 feet long and 10 feet 6 inches wide, and is composed of solid oak timbers, 8 by 16 inches. These timbers are held together by 10 iron bolts 1¼ inches in diameter, which run crosswise. This solid bed is fastened to the transom beams by 40 bolts, 20 over each truck. The inclined slide, placed on the platform, is 22 feet long, and slopes at an angle of 30 degrees, and is held firmly to the bed by 40 bolts of an inch in diameter, and is supported from behind by inclined posts 5 feet long, 8 inches wide, and 16 inches thick. The entire length, from the rear of the platform end of the slide, is 32 feet. The slide is to be ironed, and an immense plow of the ordinary shape, 18 feet long, 11 feet wide, and 5 feet high, and covered with iron 3-16 of an inch thick, is to be securely placed upon it. On the point of this plow there is to be an iron plate, steel pointed, 11 feet long and 4 feet wide. This plate, of course, runs across the track, and only 1 inch above it. The rear of the platform will be boxed in, making a room twelve feet high, 11 feet wide and 10 feet long, for the purpose of keeping the snow out. It will be furnished with a door, so that, if necessary, it can be loaded with iron.

The monster will weigh fifty tuns, and will be operated by three of the heaviest engines on the road. The cost will be over $5,000. The design was gotten up by Mr. G. E. Stevens, superintendent of the car and building department, and Mr. J. H. Congden, general master mechanic of the road, who must have made it a study since last winter. There will be but very few snow drifts that this plow won't clean out; but if it ever jumps the track, it will be a pretty hard job to get it on again.

New Submarine Telegraph Cable.

Telegraph cable works have been erected on the Pacific coast, at San Francisco, and the Electrical Construction Company have completed the first section of their first job, to wit, a cable for the British Columbian Government. It is intended to be submerged under Rosario straits, to connect Vancouver's Island, at Victoria, with the continent.

The cable is 35,000 feet in length, and weighs about 30,000 pounds. The conductor is composed of seven No. 20 copper wires of 97 per cent fineness. The dielelectric consists of two coats of pure gutta percha $\frac{9}{32}$ of an inch in diameter, with intermediate coatings of Chatterton's compound. The gutta percha coil is served with two coats of machine banding, well tarred, and covered with a protecting armor of No. 9 galvanized iron wires, laid on spirally. Electrically tested, the resistance of the conductor is eight ohms, or B A units, per knot, and the resistance of the dielectric or insulating medium, 443,000,000 ohms per knot. The company has an order on hand to manufacture another cable 30,000 feet long, for the Puget Sound Telegraph Company, to establish a connection between Seattle and Port Townsend.

A PATENT called the "Electro Magnetic Motor" has, it is said, lately been tried on board the yacht Miranda, in the Birkenhead Great Float, and for the moment the result is of that nature which enables the inventors to state that at full power the motor made 1,400 to 1,500 revolutions per minute, while not connected with the screw. The yacht was worked for about five minutes, but before she could be brought up she had torn all the fastenings away from the great vibrator. The fact is, remarks the London *Daily News*, that the motor was twice too powerful for the yacht, and there is no doubt that it will take some time to bring the new invention into general use.

We have not a doubt as to the latter.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

TERMS.

One copy, one year	$3 00
One copy, six months	1 50
CLUB RATES { Ten copies, one year, each $2 50	$25 00
Over ten copies, same rate, each	2 50

TO BE HAD AT ALL THE NEWS DEPOTS.

VOL. XXVII., No. 22. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, NOVEMBER 30, 1872.

Contents:

(Illustrated articles are marked with an asterisk.)

THE VIENNA EXPOSITION.

We have had occasion of late to present to our readers a variety of evidence, showing that if the American inventor were to go to the trouble of exhibiting new improvements at the coming Exhibition, as desired by the Austrian officials, he would be simply a carrier of novel patterns to Vienna for Austrians to copy, for which they would make no acknowledgement and give him no compensation.

We have shown how fully the laws of the United States protect and encourage Austrian inventors when they come here for patents, and we have urged upon the Austrian government the propriety of simple reciprocity.

We have shown that American inventors could not be expected to take an active interest in the Exposition until the obnoxious Austrian laws are modified; and, until the change has been accomplished, we have urged that Congress ought to refuse to grant appropriations in furtherance of the Exposition undertaking. We have further indicated that there is no necessity for the office of United States Commissioner, supplemented by a host of subordinate officials; that American exhibitors, if they believe they can profit by forwarding their goods to Vienna, will need no solicitation from government employees to induce them to look after their own interests, nor should they require national assistance in pursuing their ends of private gain; and finally, that any setting aside of the public funds, to pay office-holders for services of no greater value or utility than pleasure trips to Europe, would be both unadvisable and impolitic. Such is about the substance of our hitherto expressed opinions, in answer to which the United States Commissioner, General T. B. Van Buren, sends the letter printed in another column.

Our correspondent does us an injustice in supposing that we would descend to personalities or couple the official acts with the private character of a gentleman, whose ability and patriotism we would not impugn, and to whose eloquent and forcible addresses we have listened with great pleasure and approval during the late campaign.

There are certain assertions in his letter, however, which seem to require comment at our hands. We are there stigmatized as a "show" paper, and as an illustration, reference is made to a large and handsome engraving of an improved loom, displayed on the first page of a recent issue of the SCIENTIFIC AMERICAN, of which ninety thousand copies have been printed. We admit that we are a "show" paper, and as such we take pride in presenting such fine illustrations as the one referred to. We know of no better means of laying before the public the best products of the national inventive genius, and we but perform a duty when we publish the same in the most attractive and complete manner. But the Commissioner is somewhat unfortunate in the selection of this particular device as evidence of our being a "show" paper. It happens that the loom is of remarkable and exceptional excellence and ingenuity, and has accordingly been patented in the United States and in some parts of Europe, but not in Austria. Americans avoid that country, because they can get *no proper* protection for their inventions. If the Austrian laws only offered suitable protection, doubtless the inventor of the large and splendid loom, to which the Commissioner alludes, would have made haste to apply for space at the Exposition; and we are free to say that the presence of that remarkable machine in the Vienna "show" would form a more novel and attractive feature, in the display of textile machinery, than anything of the kind that is likely to be there presented.

As the "especial champion" of inventors, a title in which we confess a pride, and which it is our aim to deserve, we consider that we advocate the cause of the entire country, and believe it to be to General Van Buren's direct personal interest, as well as that of every other American citizen, that the rights of our inventors be fostered, sustained and defended.

Special stress is laid upon a trade mark treaty, with which the Commissioner had nothing to do, and which is of little importance compared with the interests of American inventors, still open to infringement and piracy by the Austrians.

In a widely distributed circular, issued from General Van Buren's office, we find the following remarkable statement:

"The Austrian government is exceedingly desirous that the United States shall be well represented, and makes *extraordinary concessions* to American manufacturers. The Austrian patent law *is practically abrogated* for the six months of the exhibition and two months following, and inventors are protected, by a special ordinance, against piracy of their inventions." Is there not a slight discrepancy between the intimation now made to us that a treaty may at some future time be concluded, and the direct assertion to the public in the above circular, that the objects of such treaty are now absolutely accomplished?

Would it not be well for the Commission to send out a new circular to manufacturers, showing that the previous circular of the Commissioner is *incorrect*; that the Austrians have *not* granted any "extraordinary concessions;" that the Austrian law has *not* been "practically abrogated," and that all that has been done in the premises, as the result of the zealous labors of the Commissioner on that point, consists, as he now states, in the sending of a draft of a proposed treaty from 51 Chambers street, New York, to the city of Washington?

The question of personal remuneration, General Van Buren places in a rather singular light. He states that he entered upon his duties, very well knowing there was no salary attached thereto, and actuated by a laudable motive to render service to his country. In the very next sentence he forgets his patriotic desires, and says he cannot, and insinuates will not, continue his functions at his own expense. Why did he undertake them? Moreover, he says that he has no claim for past services, and wants compensation for the future. But he has already boasted that a large number of articles for exhibition have been entered. Now, surely, it will not require a very extensive assortment of machines to fill thirteen thousand feet of floor space, and consequently the Commissioner's labors must be nearly completed. Therefore, having given a fair amount of time and trouble to his duties, why does he not, as he says he is willing to do, resign? We presume there are other gentlemen of leisure and means, and possibly of equal ability, who will accept the position. Why, we further ask, does our correspondent now appoint sixty-five assistants to perform work which he was able to prosecute zealously, even when otherwise occupied in laborious political duties? Why seek to induce Congress to appropriate a large sum to pay a number of men for doing nothing, except making pleasure trips to Europe?

The word "show," and the insinuation that the Exposition is a grand advertisement, seems to wound our correspondent's sensibilities. "Show" is a plain Saxon term, and is synonymous with the high sounding "Exposition," while, as to the advertising question, we beg to refer the Commissioner to the following paragraph from a recent oration by Professor Barnard: "Since extensive advertising is admitted to be an essential condition to every industrial success, what possible expedient can be conceived better adapted to create expeditiously a demand, for any article having in it merit enough to recommend itself, than that of placing it before the world in a great international exposition?"

Since the above was written, we observe, by the daily papers, that Mr. Van Buren has made his appearance in Washington to advocate the appropriation of half a million of dollars for the expenses of himself and others to go to the Vienna show. In his remarks before some of the teachers of the District, he said that the Austrian Director of the Exposition, Baron Schwartz, had written several letters to him, urgently asking that models of American school buildings and apparatus might be sent to Vienna. But Mr. Van Buren intimated that, out of the proposed five hundred thousand dollars, only a small portion could be allotted for such purposes. We have no doubt of the latter fact. The most of the money will be required to pay for the European pleasure travels and hotel bills of the Commissioner and his superabundant retinue of assistants.

THE NOSE STRAIGHTENER.

Among the recent triumphs of mind over matter is the invention of a device for straightening crooked noses. We are not advised as to whether it will reduce the pug nose to the more elongated form, impart the stylish Grecian bend to vulgar noses, or transform the common-place idiotic nose into a thing of beauty, which is a joy forever. But we presume it will, for the patentee says so. Here is his advertisement, which we find in a London paper:

NOSE MACHINE.—This is a successful contrivance which, applied to the nose for an hour daily, so directs the soft cartilage of which the member consists, that an ill-formed nose is quickly shaped to perfection. 10s. 6d., sent free.—ALEX. ROSS, 248, High Holborn, London. Pamphlet, 2 stamps.

REMARKABLE STUPIDITY.

Through the courtesy of the Board of Management of the recent Fair of the American Institute, we have been forwarded a copy of a very singular circular lately submitted to that body. It consists in a petition, and begins by reciting the trite fact of the value of the compound marine engine, then goes on to state that the opinion of English engineers regarding the same is not conclusive, ingenuously remarks that if our merchant navy had the best engines it could compete with established rivals, and concludes with the remarkable request that tests be initiated in the machinery department of the Fair to determine the advantages of the compound system. The document bears the signatures of such firms as Williams & Guion, Pacific Mail Steamship Company, Spofford Brothers, Wm. K. Garrison, Murray, Ferris & Co., C. H. Mallory & Co., Atlantic Mail Steamship Co., H. B. Cromwell & Co., and others.

The only words which seem applicable to this astonishing composition are ignorance and effrontery. That men high in the mercantile world should not be posted in the fact that, for several years back, every new steamer that has been added to the foreign lines plying between this city and European ports has been provided with compound engines, has proved the same advantageous above all others, and has made equal speed with half the former consumption of fuel, is simply amazing. The logs of these vessels are open to their inspection, and if to this excellent evidence we add the long-since expressed opinions of not only the best European, but the first American, engineers, that the compound engine is by far the best machine extant for marine purposes, we should like to be informed what better proof these modern Rip Van Winkles require.

Were it not for the gratuitous slur upon the whole engineering profession, the concluding request would be actually funny. Here is a body of well known citizens, and among them the publishers of a scientific periodical, who at least ought to know better, deliberately asking the American Institute to require its judges to undertake experiments which are to be "of the highest value." Can anything, we ask, be more absurd? Do we understand that these gentlemen believe that the Institute, of all societies, through the medium of three civilian judges, presumably not the best talent the country can afford, backed by a mixed board of managers, the majority of whom know little or nothing on the subject, can give an opinion worthy of a moment's serious consideration, and above all of being placed superior to that of the best English and American scientific and mechanical authorities?

Were it not for the fact that this petition has been published and made the subject of comment by the daily press, we should pass it by in silence as an inconsidered emanation signed by men who were ignorant of the views it expressed; but as it has been given to the public, it is as well that its remarkable contents and purport be understood.

THE HORSE DISEASE.

The epizoötic still prevails in many places throughout the country, occasioning great inconvenience in the transaction of business, and throwing many laboring persons out of employment. In this city the distemper has abated; but a new form of disease has set in, having the character of dropsy. It has been attended with fatal results in many cases.

In respect to the epizoötic, the experience here was that the more quiet the animals could be kept, until their health and strength were fully restored, the better. In many instances, where horses were used contrary to medical advice, bad results followed. Commodore Vanderbilt has lost a twenty thousand dollar horse—Mountain Boy. The animal was so well that the Commodore drove him out. But immediately on returning, the horse sickened and died of pneumonia.

Dr. J. J. Woodward, of the United States Army, Washington, has made a careful microscopic examination of the organic forms derived from the air of stables, in that city, in which numbers of epizoötic horses are kept. He was unable to detect the presence of any germs other than those ordinarily encountered. Examination of the mucous discharge from the nostrils of the sick horses gave the same result. The popular belief that the sickness is due to the presence of certain spores of fungi, floating in the air, is not regarded as correct by Dr. Woodward and other microscopists.

OXYHYDRIC ILLUMINATION.

We have before alluded to the introduction of the oxyhydrogen light in this city, and the endeavors which are being made to supplant by it the ordinary gas now in use. In this connection the French *Bulletin du Musée* publishes a report of Mr. Felix Le Blanc, of Paris, based upon experiments made in that city and in Brussels, upon the gas of the *Société Tessié du Motay*, which is the same as that made by the New York Oxygen Gas Company. A flame of common illuminating gas is fed with a certain quantity of oxygen, by means of special burners delivering the common gas at the circumference, while the oxygen passes through the axis. The two gases, passing through distinct tubes, mix at the extremity of the burner.

The following is a brief *resumé* of the conclusions of Mr. Le Blanc, based on experiments made along one side of the Boulevards des Italiens and des Capucines, in Paris. He says: First: This illumination would not be possible over any extended surface with the gas used. Neither is the method economical, as it is notably more expensive than a quantity of ordinary gas giving equal light. The system should not be recommended for the lighting of public streets. Second: The assertions made by the society are not substantiated. It is inexact to say that, in the oxyhydric system, the combustion by the oxygen would be complete. It would require much more oxygen than could be consumed with effect, while the light would be greatly weakened. Third: If the ordinary gas be enriched by volatile hydrocarburetted vapors, previous to mixing it with oxygen, it will be necessary to surmount many difficulties in carburetting systems already well studied. The report goes on to give other reasons of the same tenor against the use of the gas, and finally considers its hygienic effect. M. Le Blanc says that without doubt such a means of illumination does not impoverish the air within circumscribed limits so rapidly of its oxygen as does ordinary gas. But to ensure complete combustion, the flame requires much more oxygen than is supplied, and consequently the light is much enfeebled; so that for this reason, he considers the healthfulness of the system to be by no means as great as is claimed. For uses in hospitals, ordinary gas with a good system of ventilation is preferred, on account of the unfavorable influences which might be exerted by a more than normal proportion of oxygen in the air. For metallurgical operations, this gas remains yet to be proved superior to air.

In spite of Mr. Le Blanc's unfavorable opinions, so far as we can judge from the results obtained by the use of oxyhydrogen gas in New York, the system seems excellently suited for a variety of purposes. In one of our largest squares (Madison), a number of burners have been placed, which illuminate brilliantly a remarkably extended area, completely paling all other lights. The expense of the system is its greatest drawback for street lighting, though it is excellently adopted therefor. For the illumination of large buildings, however, we consider it unsurpassed. In the immense hall of the American Institute, in this city, this method has been employed during the recent fair; the quantity of light given far exceeded that of the twelve hundred burners of common gas ordinarily used, while the air in the building was noticeably purer and less oppressive. The cheerful effect of the illumination in rendering objects clearer to the vision, and also in causing colors to appear in greater brilliancy, closely resembled sunlight. The whiteness of the light greatly added to the beauty of the scene presented by the profusion of tastefully arranged articles in the exhibition, and formed a marked contrast to the murky yellow glare diffused by common gas. Double pipes were laid throughout the whole edifice, one serving the street gas and the other containing the oxygen, both having their outlet at single burners. The American Institute deserves the highest commendation for the admirable way in which it has thus proved the value and utility of this new system, though opposed in its introduction by serious obstacles. The oxygen had to be transported a long distance across the city from the works of the company manufacturing it, compressed in cylinders, which were placed in position and connected with the pipes, and yet a constant and efficient supply was uniformly maintained. There is little doubt that for interior illumination this gas will be extremely beneficial, both as affording an increased supply of oxygen and not impoverishing or vitiating the air, but actually rendering it purer, while the clear white light is far less hurtful to the eyes than the yellow and heated rays emitted by the ordinary street gas flame.

OUR CONCRETE DOCKS.

The work of constructing the new docks in New York is proceeding. The foundations, up to the surface of the water, are to be of concrete, made in blocks of from 50 to 75 tuns weight each. The composition consists of seven parts broken stone, three parts sand and one part of Portland cement. The concrete is cast in wooden boxes of the desired form and size, a central aperture being made in the block. After setting for a few days the boards are removed, leaving a block having a hard and comparatively smooth surface. The block is cast with central grooves for the introduction of the lifting chains, and after the blocks are placed one upon the other, the grooves are filled with cement, which adds to the strength of the entire structure. From the surface of the water up, granite blocks are to be used.

AIR GAS LIGHT IN ENGLAND.

The "Air Gas Light Co., Limited" is the title of a new bubble in the speculative share line, now extensively puffed in the London papers and said to be having success. Several prominent names are connected with the scheme. The air gas is made by passing air through a suitable hydrocarbon liquid, such as naphtha. This method, as our readers know, has for years been in common use in this country. But in England the plan is, practically, almost unknown, and the "Air Gas Light Co., Limited," are astonishing the natives with the light, and are also unloading their stock shares as fast as they can find purchasers simple enough to buy. The air gas "epizootic" had a good run in this country; but speculation therein ceased a long time ago. A reasonable, steady and extensive branch of industry is now carried on, in this line, all over the country. For country dwellings, stores and churches, the air gas furnishes excellent illumination at a small cost.

THE GROWTH OR EVOLUTION OF STRUCTURE IN SEEDLINGS.

Professor John C. Draper has recently published a pamphlet under the above title, showing from experiments made that in plants, as in animals, growth as applied to evolution of structure or organization of material provided is inseparably connected with oxidation. Regarding the lower organisms as fungi, the uniform testimony is that these plants at all times expire carbonic acid, while it is chiefly in the higher plants and especially those that contain chlorophyll or green coloring matter, that carbonic acid is absorbed and oxygen exhaled. Regarding these plants, it is stated that they exhale oxygen in the light and carbonic acid in the dark. This change, Dr. Draper considers, arises from the fact that two essentially different operations, have been confounded, namely: the actual growth or evolution of structures in the plant and the decomposition of carbonic acid by the leaves under the influence of light, to provide the germ or other materials that are to be organized; and he proposes to show that, by adopting this proposition of two distinct operations in the higher plants, all the apparent discrepancies regarding the growth of these plants are explained.

Two series of experiments were arranged, in which growth in the dark might be studied and compared with similar growth in the light. Peas were selected as the objects of trial, and each seedling was planted in a glass cylinder one inch in diameter by six inches long, loosely closed by a cork and filled to within half an inch of the top with fine earth or vegetable mold. The cylinders were then placed erect in a covered tin box in such a manner that the lower ends dipped into water contained in the box, while the whole of the cylinder, except the top, was kept in the dark. Warmth was was supplied by the external temperature, varying from 70° to 80° F., and the supply of moisture was retained uniform. One box containing five cylinders was kept in a dark closet, and another, exactly similar, placed in a window where the direct rays of the sun fell upon it five or six hours per day. Similar means were provided for determining the growth of the plants during night and day. One seed in each set failed to germinate. From the results obtained by the experiments, Dr. Draper arranges tables which give the following conclusions: In the seedlings grown in the dark, the time with which the structures were evolved in each plant is uniform—about the 17th day. Six periods of evolution are indicated, uniform in each plant, notwithstanding the difference in the weight of the seeds. In the first period, the growth consists of the formation, close to the stem, of two partially developed pale yellow leaves; in the second, the leaves are larger; in the third, a lateral stem projects, bearing two more leaves, between which is a tendril; in the fourth, the twig and tendril elongate; in the fifth, the tendril bifurcates; and in the sixth, it trifurcates. Stems, leaves, twigs, and tendrils are therefore evolved by the force pre-existing in the germ without the assistance of light. In the case of the seedlings grown in the light, the leaves and tendrils were many times larger and of a brighter green color, but the light developed no new structure. The average weight of dry plant and the proportion of root to total weight of plant was nearly identical. It was also found that, in the pot in which the peas were grown in the dark as well as those in the light, the soil was so poisoned by the roots that a second crop failed to sprout, thus affordiug another proof that the processes in the plants must have been similar.

From careful observation, the author concludes that the act of growth or evolution of structure is independent of light, and that the manner of growth during the day is similar to that at night. He says that the whole history of the plant, from the time the seed is planted to its death, is a continuous story of oxidation, except when sunlight is falling on the leaves. The seed is put in the ground and, during germination oxygen is absorbed and carbonic acid exhaled. If kept in the dark, only carbonic acid is exhaled, oxygen never; and the plant not only grows, but all visible structures, except flowers, are formed in a rudimentary condition. In the light, the growth during the night time is attended by the evolution of carbonic acid, while during the day time the bark of the stem and branches is throwing off carbonic acid. When flowers and seeds form, the evolution of carbonic acid attending this highest act of which the plant is capable is often greater than that produced at any time by animals. The final conclusion is that all living things, whether plants or animals, absorb oxygen and evolve carbonic acid or some other oxidized substances, as an essential condition of the evolution of their structure.

PROGRESS OF AMERICAN IRON INDUSTRY.

The iron business in the United States has never been in so flourishing a condition as at the present day. In Pennsylvania more iron is now being produced than by all the combined furnaces of England and the Continent of Europe, and yet the demand is far greater than the supply. A correspondent of the *New York Times* states that in the valleys of Eastern Pennsylvania there averages a furnace for every five miles, and still millions of dollars are being invested in further extension and development of the iron industry. All the iron masters are reaping golden harvests. Pig iron can be produced at an average first cost of from $13 to $17 per tun, according to location and conveniences at hand. A clear profit of from $35 to $45 per tun is made, and when the produce ranges from one to two hundred tuns per day, the aggregate gain of a day's business can be readily calculated. This very encouraging state of affairs is considered to be due in part to the fact of the country being thrown upon its own resources, England having discontinued shipping pig metal hither altogether, because under the present state of the market in Europe she cannot afford to do so. In the cheap times of the Kingdom, ore was plentiful and labor was to be had at very little cost. Now the mines are old and well worn; native ore is rare and labor at advanced rates, so that Spanish ore is imported, which, by the time it reaches English furnaces and is smelted by English labor, is advanced fully 100 per cent over the first cost of produce. One of the most prominent operators in Pennsylvania publishes the information that for the first time in the history of this country, America has shipped iron to England with advantage.

Our supply of ore is unlimited. In nearly every State new veins are being developed, and in almost every case an accompanying discovery of coal is announced. The track of furnaces will eventually find its way to Western Virginia, thence to Texas, and in time we may look to the Territories of the great West for our valuable pig metal. This year's produce of iron, there is every reason to believe, will exceed that of last year by fully a million tuns, and if the producing capacities continue in like proportion with the present increase, the following years will swell the figure by two or three millions more.

IN Georgia, the picking of the cotton crop is rapidly going forward, and if the weather continues as fine as it now is, the whole of it will be gathered by the 15th or 20th of November. Two thirds have already been gathered, ginned, baled, and are either on the road to market or already there. So it seems that the caterpillars have not taken all of the crop.

Shoeing Oxen for Pavements.

In regard to the matter of shoeing oxen so that they can work on pavements, Mr. P. P. Sibley writes to the Boston *Journal* as follows:

"As I have worked twenty-four years at blacksmithing, and claim to be master of my trade, I will give my opinion in regard to shoeing. In the first place, turn the shoe as usual, only a little thicker at the toe, then weld together at the toe, and put a calk on the toe about an inch long and one quarter inch high; heel calk the same. In setting, care should be taken to keep each claw in its natural position, that is, spreading them as the ox would usually stand, and also fit the shoe well. Put six nails in each half of the shoe. I have always used the Vulcan No. 6 nail. I have shod cattle in this way that were driven through a river twenty times a day, and did not lose a shoe for weeks, when if shod the common way they would soon become lame."

A New Steamer.

The Victoria is the name of a new and splendid steamer, lately arrived at New York on her first voyage from Liverpool. Her burthen is 3,600 tuns. She was built on the Clyde by Messrs. Alexander Stevens and Sons, her length being 380 feet, breadth of beam 42 feet, depth of hold 30 feet, and having engines, two in number, of the compound vertical direct acting principle. The cylinders of these are 108 inches low pressure and 60 inches high pressure, with a stroke of four feet. Steam is supplied from six tubular boilers, with superheaters for each. The propeller is 18 feet in diameter and 20 feet pitch. Then there are smaller engines for pumping and deck purposes, weighing anchors, loading and unloading cargoes. Fire engines are all over the ship, and the forward part of the deck is so constructed that the seamen, in the worst of weather, may not suffer from exposure in their duty.

PATENT DECISION.

The Supreme Court of the United States in the suit of Wells *vs.* Gill, Hat Body Machine, has sustained the Wells patent. One of the allegations was that the Commissioner of Patents had, in the reissue of the Wells patent, granted claims for subject matter not contained in the original patent. The Court refused to go behind the Commissioner's action.

PROFESSOR JAMES HADLEY.

This learned and distinguished linguist died at New Haven, Conn., November 14, 1872, in the 52nd year of his age. He occupied the professorship of Greek at Yale College, was President of the Oriental Society, and enjoyed a worldwide reputation as a master of languages.

The Epizootic among Deer.

We learn from our Western exchanges that the dreadful horse disease, the "epizoötic," has now taken effect upon the wild deer, and is likely to diminish our supplies of venison and skins. Many deer are found dead in the woods. No deer is shot now, and when one is found dead the skin is removed to be made into leather. The horses used in the woods are all sick, and the men treat them to hemlock fumigations and sweats, with good results.

NEW STEAM LAUNCH.—A trial of a steam launch, built for the government of Costa Rica by Messrs. Yarrow and Hedley, of Poplar, England, recently took place on the Thames. This little steamer is 43 feet in length, and the chief feature of its construction is that it is built in three entire sections, so as to enable it to be thoroughly tested under steam in England, and can be afterwards divided into three separate pieces for shipment, each section being of such a size as to enable it to be lowered down a vessel's hatchway. At the joints there are double bulkheads, rendering each section buoyant in itself. This method of construction avoids the necessity of obtaining skilled labor to put the launch together and set to work on arrival at its destination, thereby rendering the introduction of these useful little steamers possible in many foreign parts otherwise impracticable. The launch in question maintained easily a speed of ten miles an hour on a consumption of half a hundredweight of coal.

The Boston Fire---Newspaper and Magazine Offices Burned out.

The following is the list of the newspapers, magazines, etc., which were located in the burned district:—*American Homes*, monthly, 51 Water; *American Painter*, weekly, 58 Congress; *American Railway Times*, weekly, 66 Federal; *American Union*, weekly, 63 Congress; *Ballou's Monthly Magazine*, 63 Congress; *Banner of Light*, weekly, 158 Washington street; *Boston Almanac and Business Directory*, and the *Boston Directory*, 47 Congress; *Cabinet Maker*, weekly, 50 Congress; *Christian Monthly*, 19 Lindall; *Freemason's Monthly Magazine*, 51 Water; *Gleason's Home Circle* and *Gleason's Monthly Companion*, 42 Summer; *Harness and Carriage Journal*, weekly, 40 Pearl; *Boston Journal of Chemistry*, monthly, 150 Congress; *Little Christian Monthly*, 19 Lindall; *Monthly Novellette*, 63 Congress; *New England Postal Record*, 40 Liberty square; *Saturday Evening Gazette*, weekly, 37 Congress; *Pilot*, weekly, 19 Franklin; *Shoe and Leather Record*, weekly, 40 Pearl; *Shoe and Leather Reporter*, weekly, 40 Pearl; *Shoe and Leather Trades Journal*, weekly, 3 High; *Sierra Magazine*, monthly, 100 Pearl; *Temperance press*, weekly, 46 Congress; *Transcript*, daily, 150 Washington; *Yankee Blade*, 40 Liberty square; *Waverly Magazine*, 50 Lindall; *Journal of Applied Chemistry*, monthly, 40 Pearl.

B. F. Chandler, C. E., of United States Navy Yard, Portsmouth, N. H., writes us that the large cotton mill in that place is lighted with gas made from paraffin, which proves to be far preferable and 50 per cent cheaper than coal.

A SCIENCE teaches us to know; an art to do. In art, truth is a means; in science, it is the end.

SCIENTIFIC AND PRACTICAL INFORMATION.

INOCULATION WITH DEAD BLOOD.

It is well known that surgeons are often seriously injured by accidentally cutting themselves with instruments that have been recently used for dissecting purposes. The wounded part swells, and mortification often ensues, necessitating amputation and sometimes causing death. In order to determine the poisonous properties of this putrid blood, M. Davaine communicates to *Les Mondes* the result of several experiments made upon rabbits. The liquid used was the blood of an ox that had been ten days slaughtered. This, by subcutaneous injection, he administered to his subjects in varying quantities, obtaining by successive dilutions with water the most infinitesimal attenuations. Killing one animal, he would take its infected blood and force the same into the veins of another, and so on until he reached what he terms the twenty-fifth generation. On this last experiment he says: "Four rabbits received respectively one trillionth, one ten-trillionth, one hundred-trillionth, and one quadrillionth of a drop of blood from a rabbit belonging to the preceding generation that had died from the effects of a one trillionth dose. Of the four, but one animal died—that which received the one ten-trillionth. It appears, then, that the limit of the transmissibility of the poison in the rabbit reaches the one trillionth part of a drop of decayed (*septique*) blood."

INDEPENDENT CAR WHEELS.

In the Polytechnic Exhibition of Moscow is now exhibited a new method of arranging the axletrees of railroad cars or other vehicles, in order to facilitate the passage around curves of very short radius. The axle is cut in the middle and the two portions are reunited by means of a long metallic sleeve. The extremities of the axle consist of a pivot and socket, so that their only point of contact is directly in the center of their junction. Shoulders or flanges are arranged which retain the halves within the sleeve. The two portions of the axle are thus allowed to work at different velocities, by which it is believed that the successive shocks occasioned by the sliding of the wheels on the rails in rounding short curves will be avoided. This system is being applied to a tramway between Petrofsky Park and the gardens of the exposition, on which there are curves of from 30 to 50 meters radius.

The invention is very old and has long been known in this country. One of the most approved examples is the "Doty-Miltimore Compound Car-axle," which is now used on several of our railroads. It is stated that 104 patents have already been granted in this country upon car axles and wheels having the above idea in view, to wit, making car wheels to run independently.

COLORING THE EYE.

Dr. R. J. Levis, of the Pennsylvania Hospital, has devised a means of coloring opacities in the cornea of the eye. He says: "The disfigurement of the glaring white opaque spaces of the cornea can be cured by indelibly tinting, so that if central, they shall show the blackness of the natural pupil, or if peripheral in location, the color of the underlying iris may be most deceptively imitated. Should even the entire cornea be opaque, a very natural imitation of the appearance of the whole circle of the iris and the pupil can be accomplished." The instrument used is a bundle of from three to six very fine sewing needles inserted into a handle. For coloring matter, ordinary water pigments are used, rubbed to a pasty consistence and mixed with a little glycerin. For the black of the pupil, Indian ink is employed. The surface of the opaque spot being wiped clear from moisture, the paint is applied thickly over it with a small pencil. The needle points are made to penetrate repeatedly and rapidly in varying directions, until much of the opaque surface is gone over with the pigment. Two or more repetitions of the process are required. The operation is said to be painless, and as the coloring matter is regularly tattooed into the tissues, it cannot be washed out by tears.

THE OSCILLATIONS OF SHIPS MADE USEFUL.

M. Guzman, of France, has lately published in the *Annales du Génie Civil* an elaborate essay, proposing to utilize the inertia of a suitably suspended and freely oscillating body, such, for instance, as a heavy pendulum so placed on a vessel as to be swayed by the action of pitching and rolling, and, by suitable mechanism connected with the pendulum, to apply the power to working pumps, etc. This is a very old idea, and is, we believe, an American invention. At any rate it is the basis of several different patents in which the idea is embodied. One would almost suppose that Mr. Guzman must have had before him, in preparing his essay, a copy of United States patent No 18,192, of September 15, 1857.

This invention consists simply in a heavy weight attached to a swinging shaft. As the former sways to and fro, by the movement of the vessel, it actuates gearing which communicates motion to a shaft which operates a pump and keeps the ship dry. In the back numbers of the SCIENTIFIC AMERICAN will be found several other forms of the same idea illustrated and explained.

The essay of Mr. Guzman is only one of hundreds of examples in which Europeans, having hit upon some old American invention, have put it out in a new dress and passed it around through the press as a novelty.

NEW BOOKS AND PUBLICATIONS.

HOW TO PAINT: A complete Compendium of the Art. Designed for the Use of the Tradesman, Mechanic, Merchant and Farmer. By F. B. Gardner, Author of "The Carriage Painter's Manual." Price $1.00. New York: Samuel R. Wells, No. 389 Broadway.

A neatly printed, convenient little book, thoroughly practical in all its instruction. Many excellent recipes are contained in it.

Business and Personal.

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

Notes & Queries

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

1.—How can I best stop small leaks in a rubber gas bag?—B. S. P.

2.—Will some one please inform me whether black ink writing, faded by age, can be restored so as to be read; and if it can be what is the process?—H. E. C.

3.—How can I best prepare lime cylinders for use in producing the oxyhydrogen or calcium light? Can air-slaked lime be utilized for the purpose?—B. S. P.

4.—Can any one of the readers of the SCIENTIFIC AMERICAN give me a recipe for making a cheap and permanent silver plating for brass ware? I have tried several patent preparations, but the coating does not last long.—J. W. C.

5.—What is the best and cheapest way to remove old paint or varnish from carriages, preparatory to repainting and varnishing?—M. M. H.

6.—How can I galvanize cast iron? I wish to have your way of doing it, as all the recipes from your paper I have tried came nearer the mark than any others.—C. I.

7.—I am experimenting in photozincography and collotypy; can any of your numerous readers inform me what kind of a press I should use, whether platen or roller, and whether an ordinary copper plate could be successfully printed with from the same press? What is the composition of the ink to be used?—A. G., Jr.

8.—Can any one give me information concerning the manufacture of flour starch? Would it pay a farmer to make it on a small scale? How many pounds of starch can be extracted from a bushel of ground wheat?—J. S.

9.—I am using a copper and tin composition for a sliding box, and find it wears out rapidly. I have thought of using *lignum vitæ*, or some other hard wood, instead of metal. Will some one inform me whether any kind of wood would wear longer than the above named metal for such a place? I have noticed that some manufacturers of steam fire engines use *lignum vitæ*, but do not know the reason why they use it. Can any one inform me?—J. M.

Answers to Correspondents

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·50 a line, under the head of "Business and Personal."

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

P. H. A. enquired in our paper of November 16 whether there was any danger of bursting the barrel of a rifle in case the ball is not rammed down to the powder. The answer was that the fact that the ball was not rammed down does not increase the liability of bursting the barrel. It should have read "does increase" the liability of bursting. The theory of gun men is that, when there is any considerable space between the powder and ball, the gas engendered by the charge strikes the ball a more sudden blow than when the ball is rammed home to the powder. Accidents from bursting, due to insufficient ramming, or placing two charges or balls in the gun, with air space between, or placing wads or other plugs in the barrel, not in proximity to the powder, are of frequent occurrence. Shot guns, which have light, thin barrels, especially near the muzzle, have been known to burst on firing if the muzzle was simply plugged with snow.

C. M. B. says: I am about to have a particular kind of muzzle loading rifle made, and there are some points that I wish to be informed upon before giving the order. The following are the points: How thick ought a steel rifle barrel be to carry a two ounce concave-conical bullet with perfect safety, allowing as much powder as would burn in the chamber? What would be the proper charge of powder to use for such a bullet in order to shoot it with all the force that the barrel would stand? What would the weight of such a barrel be, allowing it to be as light as possible and perfectly safe, that is, as safe as the ordinary rifle? I have tried hard to find this matter out here, but with poor success. I have consulted some gunsmiths, but they could give me no definite answer, and guess work won't do in this case. You may be sure I shall anxiously look through your column of answers to correspondents for the time to come. Answer: In thickness the barrel should be twice the diameter of the bore at the breech, and one and three fourths the diameter of the bore at the muzzle, and the barrel should not be less than thirty inches long in order to burn all the powder. The barrel should be made of decarbonized steel of good quality. The weight of the barrel will depend upon its length, which is not stated by you. But you can easily settle the weight. The quantity of the powder should be equal in weight to about one sixth the weight of the bullet.

G. L. H.—What will be the best practical method to decompose water into oxygen and hydrogen, filling separate vessels respectively? Answer: The most convenient method of decomposing water is by means of the galvanic battery. Place the ends of the two wires in water, near each other, and over each wire a collecting jar or tube. The two gases will then rise, hydrogen in one, oxygen in the other.

R. H. D. says: You might add to your article on paper hanging: Cover your table with newspapers and renew when soiled, instead of cleaning the table so often, and use sizing of vinegar and water before pasting the walls.

A Subscriber asks if tea made of burdock root will purify the blood without thinning it too much? Answer: This root is considered excellent for disorders of the blood, but we advise you to consult a physician in respect to its use.

W. C. Van N. says: I am troubled with rheumatism in my feet. Will some one state a remedy? I have heard that lemons are good. How many must I eat a day, and at what hours? Answer: Fifteen lemons a day, eating one every hour, will probably quiet your rheumatism, and all other troubles, in a short time. But if you wish to live for a while longer, let the lemons alone and consult a firstrate physician.

W. D., of N. C., sends us a mineral specimen, asks what it is, and says he has leased for ten years the land where it is found. Answer: The mineral is quartz rock, colored red by oxide of iron. The silvery particles in it are mica, and of no value.

F. D. H. asks: Can iron be plated with copper by the means employed to plate metals with silver, using a solution of sulphate of copper instead of the silver solution? Answer: Yes.

F. D. H. asks: How can I remove mercury from the surface of brass, which has become coated by accident, without injury to the same? Answer: By heating the article. Look out that you do not inhale the mercurial fumes.

E. H. asks in what way galvanized iron can be treated to resist the action of salt. Answer: You can protect the iron by means of varnish. You do not state, however, the circumstances under which the iron is used.

F. H. N. requests us to inform him whether the report of one gun can be heard as far as the report of two, fired simultaneously, the guns to be of the same size, charged the same, etc. The question arose thus: A. claimed that the solos sung at the Boston Jubilee could be heard just as far as the choruses, provided the voices were all of the same power. Certainly the report of two guns will make a louder noise, then it consequently would transmit the sound farther. Answer: Your conclusion is correct. The report of two guns will be louder than one, and will consequently be heard further. A. is wrong about the Jubilee singers. One voice could not be heard at so great a distance as several voices of the same power.

Professor Ott writes as follows: In your issue of November 9, I find it stated among the answers to correspondents that the process of Mallet for manufacturing oxygen has not as yet come into practical use. Permit me to inform you that the same has been in use in Frankfort-on-Main for about two years, the oxygen being employed for Philipps' new system of illumination, which has also been patented in the United States. The experiments made with the first apparatus of Mallet yielded a gas consisting of 97·3 volumes of oxygen and 2·7 of nitrogen, an amount which for all technical purposes is of no consequence whatever.

In answer to A. F. S., asking how to clean stove pipes of soot, I would recommend the following: Place a piece of newspaper with a spoonful of gunpowder enclosed, beneath the entrance to the stove pipe, removing the tops on the back near the pipe. Let the paper have a long end; light it and then retire after replacing the tops. The explosion of the powder will bring the soot down.—H. B.

W. K. L., query 2, page 281, will find that silicate of soda is soluble in water after becoming hard. The trouble is that people generally do not understand the difference between silicate of soda and water glass. The makers of this useful article decline to sell it at retail; where can it be procured in small quantities?—T. E. L.

In a recent issue you suggest to artists and draftsmen the use of "ordinary collodion, sold by all dealers in photographic materials" as a protection to pencil and crayon drawings. Would it not be best to use plain or unsensitized collodion, as the free iodine in ordinary collodion, for photographic use, would seriously stain or tint a delicate drawing? The solution should contain less cotton than for ordinary use. The following is a good formula; Sulphuric ether, 1 oz., alcohol (95 per cent), 1 oz., soluble gun cotton, 4 grains. I have used it with excellent results.—G. G. B., of N. Y.

To A. T. M., query 6, page 314. Dissolve about 60 grains of carbonate of ammonia in the water used for mixing with 1 pound of flour. Knead well, and bake immediately; all the ammonia will volatilize. Or mix dry, with each pound of flour, about 36 grains tartaric acid and 42 grains carbonate of soda, add water, etc. Knead quickly, place in tins and bake. Bread also used to be made by using carbonate of soda and muriatic acid; but the introduction of the large quantity of common salt so formed was was considered injurious to the health.—E. H. H., of Mass.

To O. S., query 11, page 314. Ozone papers are made by dipping unsized paper into a solution of 1 part iodide of potassium, 10 parts wheat starch and 100 parts distilled water. Dry rapidly, cut into slips, and keep in a well stoppered bottle in the dark. To use: moisten a slip and hang in a cage of wire gauze, when the effect of any ozone will be indicated by the depth of color produced.—E. H. H., of Mass.

To D. R. W., query 12, page 314. There is nothing dangerous about the processes named for silvering glass.—E. H. H., of Mass.

To O. S., query 21, page 314. Saturate the outside of your vats—especially the bottoms—with a solution of corrosive sublimate, and, when dry, coat well with paint. You need not fear any ill effect from the sublimate on the contents. It will be also well for you to see that there is some ventilation underneath. The corrosive sublimate is about the best preservative of wood against decay known.—E. H. H., of Mass.

To T. J. S., query 26, page 314. Steep, for a while, in a dilute solution of permanganate of potash; the broom corn will become brown. Place then in a hot dilute mixture of muriatic acid, and it will be quite white.—E. H. H. of Mass.

To O. S., query 11, page 314. Boil common starch into a weak solution of iodide of potassium, to make a solution of any convenient consistency. Brush this evenly over any good paper; druggists' white wrapping is good. Dry and preserve. To use it, moisten the slips and expose. Free ozone will, if present, decompose the iodide of potassium, coloring the starch a deep blue, forming iodide of starch.—S., of N. Y.

To E. E., of R., India, query 5, page 314. Such a machine as an ordinary hay cutter answers very well for cutting leaves. Have four or more blades, instead of two, and so cut the leaves to the width you want.—E. H. H., of Mass.

To E. E., of R., India, query 9, page 314. The senna leaves after drying on sieves by currents of air or in a stove, are prepared for the market by picking out the leaflets, stalks, pods, and the leaves of weeds or other herbs, etc., thus being sure that it is free from argel leaves, with which it frequently is largely adulterated.—E. H. H., of Mass.

W. B. N., query 5, page 298, will want 40 horse power to drive sixteen 30 inch 12 gage circular saws through 6 inch to 10 inch stocks, and he will require two rubber belts, 13 inches wide, 8 ply thick.—J. H. M., of P. Q.

To J. H. L., page 314. A very good way to imitate ground glass is to take a ball of fresh putty, as large as a small apple, and press it to the inside of the glass, repeating the operation until the whole is sufficiently coated. It will require a practical eye to distinguish the result from ground glass.—A. B., of U. S.

To A. P. C., query 23, page 314. All parts of the circumference of a locomotive wheel travel around the axle at the same rate. But one point rests upon the rail, not moving forward for the time being. All the other points are moving forward with varying rates, the top point moving most rapidly. Thus every point of the wheel describes a cycloid but, being in different parts of the cycloid at the same time, advance accordingly.—Le R. F. G., of Mass.

To E. E., of R., India, query 28, page 314. There is no plan so reliable as the tasting of an infusion made of definite strength, by weighing the quantity of tea and measuring the quantity of water. An extract of tea can be made, but the result would be useless, as the fine aroma would be dissipated during the necessary evaporation. Tea contains the principle called theine, similar to caffeine in coffee, and possessed of the same therapeutic properties. Heat, if too great, will volatilize it, as is done daily in the roasting of coffee. Tea can be analyzed and its constituents separated.—E. H. H., of Mass.

J. F. S., query 29, page 314, can prepare litmus paper by taking druggist's white wrapping paper and brushing over one side with a solution of 1 part litmus to 4 parts water. This will make blue paper, to detect acids. For red paper, redden the above solution, carefully, with an acid and use as above. I prefer to take blue litmus paper and hold it over the fumes of nitric or acetic acids, and thus redden it. This avoids all excess of acid, and the paper is more delicate. Any vegetable blue will answer in place of litmus, if you can get a color deep enough.—S., of N. Y.

To J. F. S., query 29, page 314. Make an infusion of litmus in water and a very little alcohol. Use unsized paper. Put the infusion in a flat dish or saucer, and draw slips of the paper through it. If common blotting paper is used, it probably will be an advantage to add a few drops of ammonia to the litmus solution. This will make the blue papers. For red: proceed as before, but add a drop or two of acetic, or dilute sulphuric acid.—E. H. H., of Mass.

COMMUNICATIONS RECEIVED.

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

On the Dangers of Car Couplings.—By J. E. S.
On the Force of Steam and the Theory of Heat.—By J. C.
On the August Meteors.—By W. L. D.
On Methods of Ascertaining the Dew Point.—By R. H. A.
Experiments and Suggestions Concerning Automatic Fire Alarm Devices.—By H. M. S.
On the Prognostication of the Weather by Animals.—By J. P. H.
On Sheet Lightning.—By J. H. P.
On a Recent Boiler Explosion.—By J. A. W.
On the Rotation of Movable Wheels.—By J. H. P.
On the Properties of the Concentrated Solar Rays.—By G. R.
On Milk Sickness.—By A. G. P.
On Canal Boat Propulsion.—By L. M. H.
On Car Couplings.—By T. E. B.
On Cylindrical Steam Boilers.—By L. C. S.
On Thunder and Lightning.—By A. E. D.
On Scientific and Mechanical Possibilities.—By J. E. E.

Recent American and Foreign Patents.

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

ROTARY STEAM ENGINE.—Andrew Philp, New York city.—In this invention the cylinder has two long circular recesses in the inner periphery, at opposite sides of the axis, with inclined abutments, said recesses being as wide as the length of the cylinder, and as deep as it is designed that the piston plates, that the steam acts upon, shall project from the disk, which fits in the cylinder as close as it can and revolve freely, and carries the said piston plates in radial slots. The said plates are fitted therein so as to slide out and in and yet not allow steam to escape by passing around them in the slots. The said disk is provided with steam way grooves on one side, and on the other in the corners between the plates, by which live steam is admitted to the recesses behind the plates for propelling the disks. The steam is admitted to these steam ways by the ports on one side and on the other, from the annular steam chests in the disks, attached to the plates which inclose the cylinder at the ends, and to which said chests the steam is admitted by a cock which can be shifted to admit it to either, as required. Steam is also admitted from these steam chambers through the small ports on one side and on the other to the radial slots behind the plates for throwing them out against the walls of recesses. The arrangement of the ports, relative to the recesses, is reversed for the different sides of the engine, the object being to run the engine in opposite directions thereby. There is an exhaust port at each end of the recesses, with a cock for opening and closing them, as required. All discharge into an annular space. The steam, admitted to the radial notches for forcing the plates out into recesses for taking steam therein, exhausts through the small ports, which are arranged equidistant between the ends of recesses, so that they exhaust the said notches, whether the engine runs one way or the other. The inner ends of the plates have little grooves to admit the steam, although the said ends rest on the bottom of the notches. The ports are arranged so that the steam will always enter the notches and recesses when they come to the ports, which are always open and will be cut off when they pass beyond said ports. The steam ways are so arranged, relatively to said recesses, that steam is admitted behind the plates as soon as the said rear corners have arrived at the bottoms of said inclines; and the steam ways will be made any length short of the exhausts, according to the extent it may be desired to work the steam expansively. The exhausts will be alternately opened and closed, according to the direction in which the engine is required to run.

CARPENTER'S WORK BENCH.—Edward Andre and William H. Andre, of Tiffin, Ohio.—The object of this invention is to construct a work bench for joiners, house finishers, and others, which can be much more easily moved and transported from place to place than work benches of ordinary construction; and it consists in a bench that folds up.

FIRE KINDLING COMPOUND.—John S. Carroll, of Covington, Ga, assignor to himself and J. W. Rogers, of same place.—This invention relates to a new composition which is to be applied to wood, coal, or other devices to be ignited, and which can also be used for illuminating purposes on torches or similar articles. The invention consists in combining the following ingredients: plaster of Paris, lard or swine oil, kerosene oil, and Spanish brown or other coloring matter.

CHURN.—Roger Williams, of Yonkers, N. Y.—The invention consists in operating two open frame dashers in the same direction in an oval churn. The two dashers stand with their faces at right angles and always remain so during operation, as they revolve in the same direction with equal velocity. They thereby prevent a continuous current of the cream along the walls of the churn. A faucet for the discharge of milk is applied to the lower part of the churn.

FLYING APPARATUS.—Watson F. Quinby, Wilmington, Del.—This invention relates to a new apparatus for enabling men to fly with the use of side and dorsal wings, which are connected with the extremities for operation. The chief object of the present invention is to support the flying apparatus entirely on the body of the operator, and remove all weight from the arms and legs, so that they will be free to give their entire strength to the operation. The invention consists in a new arrangement of belt and rigid braces for supporting the apparatus on the body; in a new system of stay cords in the several wings; novel method of uniting the wings in front and making them adjustable, and in a new arrangement of cords for connecting the wings with the extremities or exposing them to the action of the same. By grasping certain cords with the hands, and pushing forward and upward, the wings are raised, not fully at once, but gradually, the forward part first, and thence backward, the same as can be observed in the movement of winged animals. By means of the feet, the operator can draw the wings exactly in a reverse to the effect on the same by the hands. The system of upper and lower cords on each side wing is divided into two parts, whence branched cords extend to the uniting rings, thus forming two points of attachment whereby the canting or rolling of the wings will be prevented and a steady motion insured. The rods and branches are principally strained in the direction of their lengths, and can, therefore, be comparatively light. The apparatus is easy to put on, and can, when not in use, be folded together into a comparatively small compass. The weight of the whole machine need not exceed fifteen pounds. The points are the same as those of the bat's wing, except that in the bat the three rods projecting backward are not branched. The rods are then secured in position and the stay cords and covering attached to them. The waist ring may be composed of fellies, like a light wheel, or of thin metal curved so as to combine strength with lightness. The main rods may be composed of bamboo, branches of reeds, or wood, not exceeding an inch and a half in the thickest part, and tapering to a half inch. The small rods are in proportion. The covering (which may be composed of oiled silk or gummed cloth) is secured to the cord which extends all around and connects the points of the rods and stay cords. It is intended to start from the ground. In order to make a beginning, one foot is disengaged from the stirrup, when, by raising the other foot and pushing the hands upward and forward, as in swimming, the wings are raised. Then, by suddenly depressing the wings, by means of the elevated leg, the former are intended to elevate the body by their action on the air. This alternate elevation and depression of the wings is continued as long as flight is desired. After rising from the ground, the other foot may be inserted in its stirrup and both legs used. The actions are intended to be natural, resembling those of swimming in water.

COMBINED WARDROBE AND BEDSTEAD.—Robert M. Austin, of Philadelphia, Pa.—This invention has for its object to improve the construction of the combined wardrobe and bedstead patented June 4, 1872. Suitable appliances hold the side boards from rocking or turning when extended, and at the same time, allow the said side boards to be turned up into a vertical position. To the outer side of the inner end of each of the side boards is pivoted a grooved pulley, which rolls up and down in a groove formed for that purpose upon the inner surface of the sides of the case, the said groove being made dovetailed to keep the said pulley in place while moving up and down. To the inner end of each side board is attached the end of a rope or cord which passes up and is attached to a drum, attached to a shaft, which is pivoted to the upper part of the case. One of the drums is made double, and to its other part is attached a cord, which is weighted, and passes over a guide pulley or pulleys, to bring it into such a position that it may be conveniently reached and operated to raise the side boards To the inner ends of the side boards are attached the ends of another pair of ropes, which pass over guide pulleys to bring them into such a position as to be easily reached and operated to draw the side boards downward, and thus extend the bedstead. When it is desired to close the bedstead the spring slats are pushed along into grooves, and when the bedstead is opened the said spring slats are drawn out of one set of grooves and into others.

ICE CUTTER.—Louis Townsend, of Terre Haute, Ind.—This invention has for its object to furnish an improved machine for cutting ice for packing and for opening a passage for vessels. The frame work which carries the saws is made in T form. A set of circular saws, attached to a shaft, is intended to take the place of ice plows in crossmarking the ice, but they are not intended to cut through the ice. The ends of the shaft revolve in bearings in bars and may be raised out of contact with the ice, or lowered to cut the ice to any required depth, by moving the rear ends of the bars up or down upon screws. The saws for cutting the ice are held forward against the ice by weights connected with the upper parts of the saw by cords. To the under side of the bars of the frame, that run in the direction in which the cutter moves, are attached runners, some of which may be grooved longitudinally to enable them to take a firm hold upon the ice and prevent lateral slip. The cutter frame may be connected with either end of the frame to enable the return cuts to be made without turning the power. To the under side of the longitudinal bars of the frame are attached runners upon which the power moves. Cross runners are pivoted eccentrically to the side bars of the frame so that, when turned in one direction, the said runners may be held free from the ice, and when turned in another direction their faces may project below the runners to support the frame and enable it to be moved laterally to adjust it to make a return trip. The construction enables the power to be placed at a considerable distance from the edge of the ice, and at any desired distance in front of the cutters, so that there may be no danger of breaking through.

MACHINE FOR CROZING AND DRESSING THE INSIDES OF PAILS, ETC.—Richard W. How and Clarence E. Patterson, Brooklyn, N. Y.—This invention has for its object to furnish an improved turning out slide of pail and keg lathe, which shall be easily adjusted for different sized pails and kegs. By turning a shaft in one direction, the crozing heads will both be moved forward into a working position; and by turning the said shaft in the other direction, the said crozing heads will both be drawn back to allow the slide to be withdrawn from the pail or keg. A stop arm projects into such a position that the ends of the staves of the pail or keg, when the slide is moved forward into the said pail or keg, will strike against it and stop the said slide in the proper position for the crozing knives to operate upon the staves, the adjustable crozing heads having been previously adjusted in proper position.

TUB WASHER FRAME.—Butler R. Platt, Plainwell, Mich.—The invention consists in the tub washer frames, which rest upon the top of the tub, to allow of which the tub is grooved to admit the crank shaft. Pins in the bottom of the frame, four inches, more or less, in length, are so arranged that they bear against the outside of the tub to hold it in place. The side and end pieces of the frame are turned, to allow the water to drain off from the frame, and give the same a finished and workmanlike appearance. By means of the pins arranged to inclose the tub, the machine is kept steady and in its proper position when in operation.

PNEUMATIC FIRE ENGINE AND LAWN SPRINKLER.—Henry C. Neer, Park Ridge, N. J.—This invention consists of a stationary or portable tank of sheet metal, adapted to bear great internal pressure, with two pumps arranged within it, and adapted for compressing air, also for injecting water in some cases; the pumps being worked by a foot treadle connection, which is also adapted for the application of a hand crank. The tank is also provided with a funnel with a stop cock for being filled by pouring water in when the air pressure is off, in case it is not convenient to introduce the water by the pumps. The object is to provide a machine which may be kept charged with water and compressed air for use in shops, factories, etc., ready for instantaneous use for extinguishing fires in their early stages, when a small quantity of water will suffice if quickly applied. It is also designed to afford a apparatus, to be moved about on wheels, much better and more convenient for sprinkling lawns than those in which the water is expelled by a pump.

CHAIR, ROCKER, AND LOUNGE, COMBINED.—Henry Haldt, New York city.—This invention consists of a chair in which the back and seat are arranged on a stand or frame so as to rock, or be made fast for either a rocker or easy chair, and the back turns down and unfolds by a joint at the top to form the body of a lounge while the seat turns up to form the head, constituting an easy chair, rocker, and lounge.

COFFIN HANDLE.—Nehemiah Hayden, Essex, Conn.—This invention has for its object to furnish an improved coffin handle, neat, tasteful, and beautiful in appearance, that can be manufactured at small expense; and it consists in the joint formed by the combination of the tube and tips with the ear and end of the arm that supports the hand piece.

POCKET FOR TRAVELING BAG.—Daniel Bead, of New York city.—This invention has for its object to furnish traveling bags provided with an improved outside pocket, designed especially for small traveling or belt bags for ladies' use, but which may be applied with advantage to other styles of bags, and which will add greatly to the beauty of the bag; and it consists in the outside pocket provided with an elastic mouth applied to the outer surface of the bag.

DRIP PIPE TRAP FOR REFRIGERATORS.—Charles Durant, of Jersey City, N. J.—This invention has for its object to furnish an improved trap for the drip or drain pipe of a refrigerator, which shall be so constructed that it may be tilted to clear it of any sediment or other matter that may collect in it, and unless removed obstruct it; and it consists in the combination of a tilting trap with the drain pipe; in the construction of the trap; in the combination, with the drain pipe, of a U-shaped supporting and stop bar; in the combination with the trap of a cross bar or plate; in the combination of a trip rod with the tilting trap; and in the combination of hook hinges with the trap and its supporting bar.

STEAM HEATER.—James J. Smith and Samuel B. Wood, of Cleveland, O.—This invention has for its object to improve the construction of steam heaters. It consists in rectangular cast iron boxes, into which the steam is introduced, and by contact with which the air is heated. In the lower part of the opposite sides of the boxes, near one end, are formed holes, in which are inserted short pipes having a screw thread cut in their inner surfaces. Any desired number of the boxes are placed side by side and at a short distance apart, and are connected together by short pipes, which are screwed into the small first mentioned pipes of two adjacent boxes. The space between each two boxes is inclosed with a case, which has an opening in its bottom near the pipes for the entrance of the air, and an opening in its top, directly over the other orifice, for the escape of the air. A horizontal partition extends longitudinally through the middle part of the space between each two boxes, from the end of the case at or near which the openings are formed nearly to the other end of said box, thus forming a flue and compelling the air to pass twice along the sides of the steam boxes before it escapes. The heater should be surrounded with a box or case fitting closely to it at the sides and ends, but leaving spaces or compartments at the bottom and top. The steam is introduced into the pipe at one side of the boxes, and it and the water of condensation escape through the pipe at the other side.

BACK LASH SPRING FOR MACHINERY.—Hiram W. Bachman, of McLean, Ill.—This invention consists in the employment of two back lash springs for connecting the spindle and pinion of mill gearing or other gearing. The said springs are connected to the collar on the spindle and to the pinion on opposite sides, so as to equalize the bearing of the collar and pinion on the spindle. They thus prevent the wearing of the parts in the localities where the bearings come when one spring is used, which very soon makes such looseness as to cause the pinion and collar to wobble, thus creating back lash even with a spring connection, and making it necessary to frequently refit the spindle pinion and collar.

MODE OF LUBRICATING MACHINERY.—Alexander P. Gross, of Vallejo, Cal.—This invention relates to the application of the principle of the hydrostatic press in the lubrication of journal or shaft bearings of every description. A suction and force pump of ordinary or suitable construction, is connected with the bearings, and its piston rod is curved inward at its outer end so as to enter and work in a cam groove in a circular collar, which is secured on the shaft. The lubricant is contained in a chamber, from which a pipe leads to the pump. To operate the apparatus, the chamber is supplied with oil or other preferred lubricant and the shaft set in motion, which causes the reciprocation of the pump piston through the medium of the grooved collar and the piston rod. By this means the oil is received into the pump cylinder and forced out, whence it spreads laterally beneath the shaft into grooves and returns to the reservoir or passes directly into the said reservoir, according as the shaft is horizontal or vertical.

METHOD OF FORMING SHEET METAL MEASURES.—Jacob Coover, of Chambersburg, Pa.—This invention relates to a "new way" of constructing dies so as to graduate the form of a standard measure, not only to an aggregate cubical quantity, but also to aliquot parts thereof, and it consists in a conical male die, having a lower section of a cone, the solid contents of which equal one gill; then a horizontal projecting shoulder formed by another sectional cone resting thereon, whose solid contents also equal one gill, but together with the preceding are equal to one half pint; the next section of a cone is equal in solid contents to one pint: and so on, according to the desired aggregate size of the vessel. A female die, correspondingly constructed, allows it to fit nicely therein. A conical tube is then formed of suitable size, placed the female die, and staved up. The bottom is then applied thereto and the top finished in the usual manner.

WASTE PIPE TRAP.—Thomas Smith, New York city.—This invention is an improvement on the waste pipe trap for which a patent was granted to the above inventor June 18, 1872, No. 128,077, which said trap consists of a box with a hinged valve or gate in it, introduced between two sections of the pipe, so that the waste passes under the free end of the valve to the escape pipe, the said valve being to stop the wind gusts which sometimes blow up from the sewers and blow the water out of the water traps above, so that the gases from the sewers escape into the houses. The said trap is designed to be used as auxiliary to the water trap. The inventor now proposes by having the waste pipe leading into the trap enter at the bottom instead of the top, as heretofore, so that its mouth will always be submerged, which was not so before, to make this a water trap, also to effectually shut off the gases from the sewers, as well as a gate or valve trap, to stop the aforesaid wind blasts, which gases leak or escape through the joints of the valve above the water in the trap.

WROUGHT IRON PIER FOR BRIDGES.—Theodore B. Mills, Iola, Kansas.—This invention consists in the construction of piers, columns, or abutments of iron for bridge supports, etc., of four double T bars stepped in metal pockets or foot rests on the foundation, at suitable distances apart at the bottom, and converging upward toward a common center for bracing properly with a metal cap, to which all are connected at the top; said cap being also a seat for the bridge shoe, to which cap the posts or bars are connected in a novel manner. They are also braced at suitable intervals between the top and bottom with horizontal and diagonal braces. The posts are arranged with their greatest transverse diameter in lines radiating from the center, toward which they converge in the upper part for having the greatest strength in the direction of the greatest pressure. Two of these columns or piers are used for one abutment, being placed side by side at a suitable distance for supporting the sides of the bridge, and connected together at the top. The sides are covered with planks extending horizontally between the posts or bars, fitted into the grooves between the flanges, and secured binding plates or bars running lengthwise of the posts and bolts.

CASTER FOR TABLES.—Henry A. Hiestand, Hellam, Pa.—This invention consists of a pair of bars for each side of the table or other article, on which two of the casters with long shanks are mounted, so as to have an ascending and descending motion. The bars have hooks with adjusting nuts, so arranged as to be readily detachably connected to the legs of the table. On the upper bar a pair of levers is pivoted and arranged for lifting the table by bearing on the caster spindles at one end when the other end is raised. The latter ends of each pair are connected with a yoke, pivoted to a crank or eccentric disk on a shaft mounted on the under side of the table top and extending from one side to the other for operating the levers at both sides at once. When the table is raised off its legs and thrown on the casters, the point of connection of the yoke with the disk passes beyond the vertical line of the axis of the shaft and brings the yoke to bear against the shaft in such manner as to be self fastening. The table is thus held on the casters, so that no time or labor is lost in fastening and unfastening the apparatus.

SHEARS.—Charles Gudehus, of Hoboken, N. J.—This invention consists of a lever and spring combined with a shears in such manner that, as the blades close in cutting and the point of resistance shifts toward the points of the blades and increases by moving from the fulcrum, the force will be transmitted from the handle directly to or nearly to the point of the upper blade through the said lever and spring, so as to greatly lessen the labor of cutting through several layers of cloth. The arrangement is also such that, as soon as the force of the hand by the blades are forced together is relaxed at the handles, the spring will throw the blades open again, and thus greatly relieve the hand of the operator of a difficult part of the labor.

[OFFICIAL.]

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On each Trade-Mark	$25
On filing each application for a Patent (seventeen years)	$15
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On appeal to Examiners-in-Chief	$10
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APPLICATIONS FOR EXTENSIONS.

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

22,775.—COTTON PRESS.—Z. Atkinson. January 15, 1873.
22,786.—HARVESTER.—C. G. Dickinson. January 15, 1873.
22,787.—STOVE.—P. Dodge. January 15, 1873.
22,792.—MACHINE FOR MAKING WOODEN TROUGHS.—S. T. Field. Jan. 15, 1873
22,802.—MILL FOR GRINDING CANE, ETC.—I. A. Hedges. January 15, 1873.
22,809.—BAKER'S OVEN.—G. C. Jennison. January 15, 1873.
22,841.—HARNESS SADDLE TREE.—S. E. Tompkins, J. Maclure. January 15, 1873
23,001.—ELASTIC TOY.—L. P. Porter. January 29, 1873.

EXTENSIONS GRANTED.

13,897.—GIMLET.—C. C. Tolman.
16,814.—CIRCULAR SAWING MACHINE.—C. P. S. Wardwell.
21,828.—FURNACE FOR TEMPERING STEEL.—P. G. Gardiner.
21,917—HULL OF STEAM VESSEL.—R. and T. Winans.

DISCLAIMER.

16,814.—CIRCULAR SAW MACHINE.—C. P. S. Wardwell. 1872.

DESIGNS PATENTED.

6,220 & 6,221.—CARPETS.—T. Barclay, Lowell, Mass.
6,222 to 6,225.—CARPETS.—R. R. Campbell, Lowell, Mass.
6,226.—CARPETS.—J. M. Christie, Brooklyn, N. Y.
6,227.—CARPETS.—J. Hamer, Lowell, Mass.
6,228.—COFFIN HANDLE EARS.—N. Hayden, Essex, Conn.
6,229.—PENCIL CASE.—E. S. Johnson, Jersey City, N. J.
6,230.—CARPETS.—D. McNair, Lowell, Mass.
6,231 to 6,234.—CARPETS.—E. Perrin, Kidderminster, England.

TRADEMARKS REGISTERED.

1,040.—MEDICINE.—J. S. Coleman, San Francisco, Cal.
1,041.—SMOKING TOBACCO.—C. R. Messinger, Toledo, O.
1,042.—PREPARED PLUMBAGO.—Morse Brothers, Canton, Mass.
1,043 to 1,045.—CORSETS.—Ottenheimer, Rothschild & Co., New York city
1,046.—TAGS AND LABELS.—C. S. Schenck, New York city.
1,047.—EMERY WHEELS, ETC.—The Tanite Company, Stroudsburg, Pa.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

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

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

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

How Can I Best Secure My Invention?

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

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

Preliminary Examination.

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

To Make an Application for a Patent.

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

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

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On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee or $20) for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish full instruction.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row

Copies of Patents.

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

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