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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.

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.

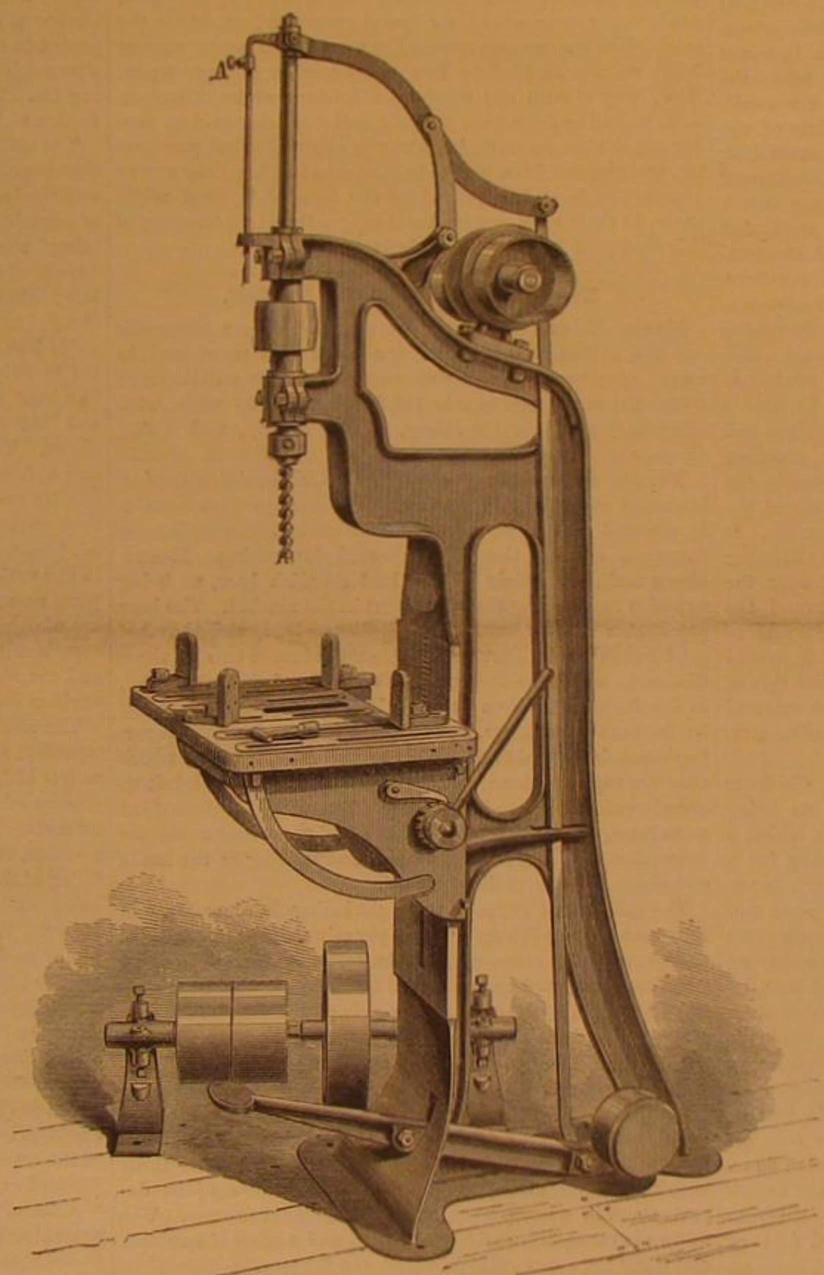
German Machinery at Vienna.

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."



UPRIGHT BORING MACHINE.

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.—*Lils 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.

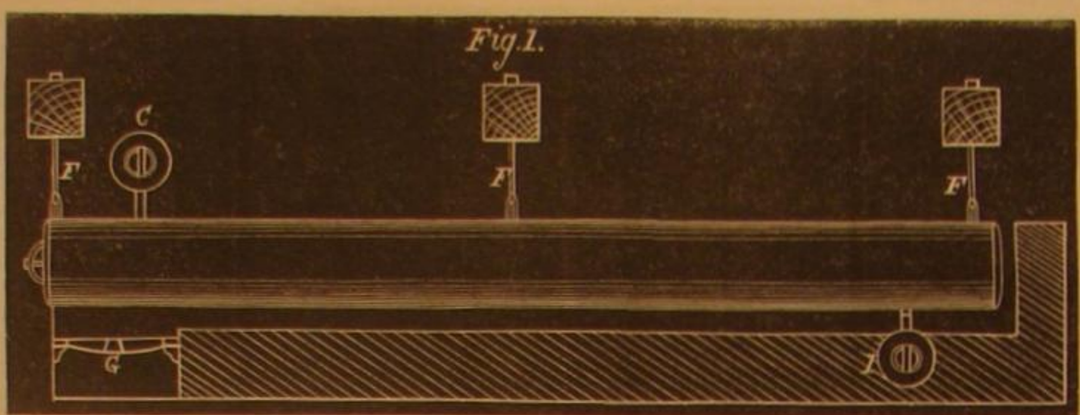
West Union, W. Va.

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.

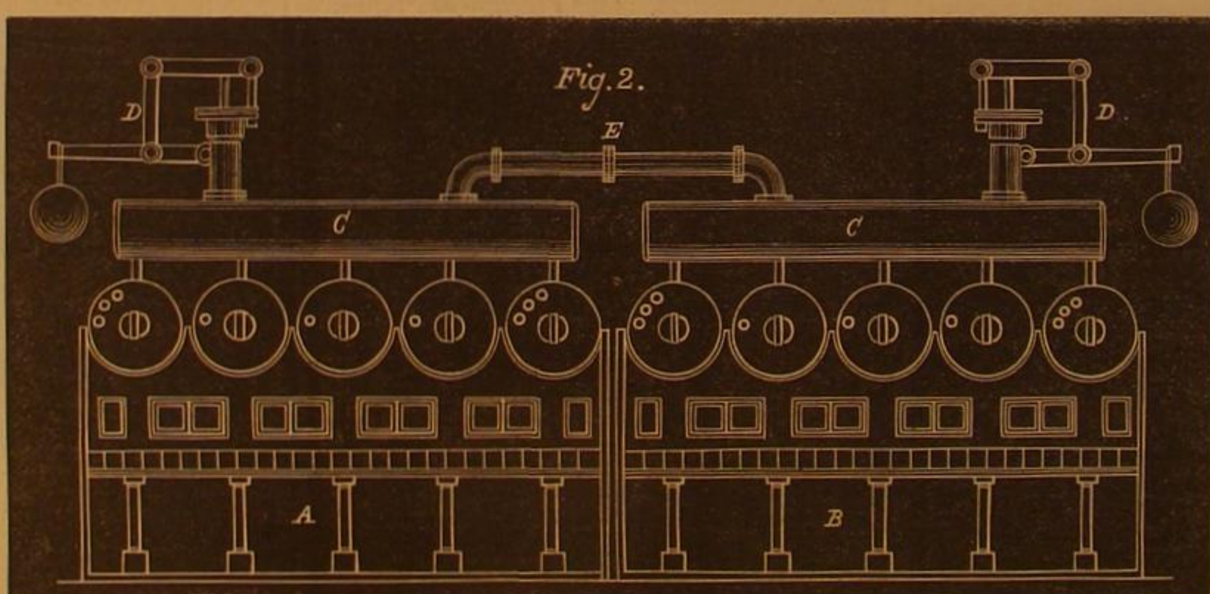
To the Editor of the Scientific American:

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.

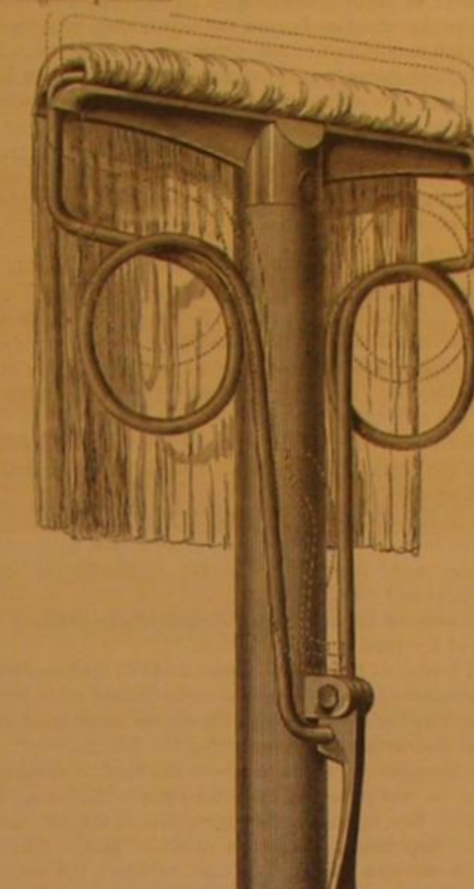
Beware of Green Wall Papers.

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.

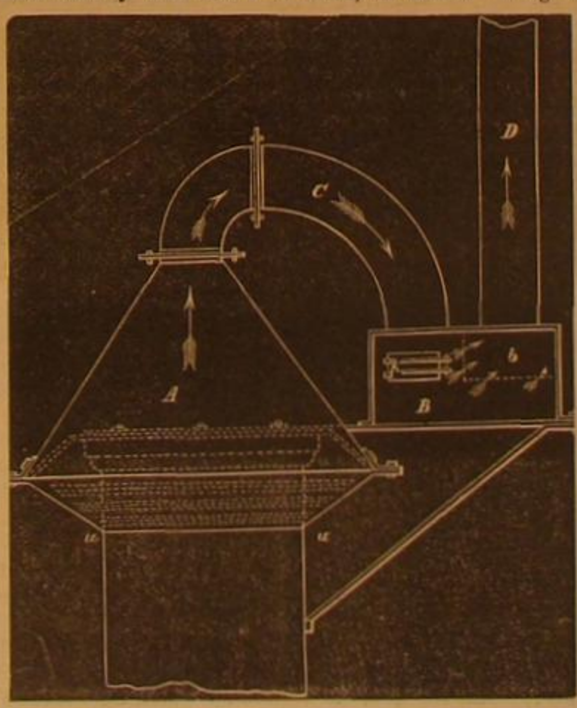


This mop head is not liable to work loose, nor to get out of order from hard usage, while it is easily and quickly adjusted to hold any thickness of mop.

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)	761½
Bargusin (Transbaikalien)	69½
Werchneoudinsk (do.)	15
Nertschinsk (do.)	154¾
Amur	172
Total	1172¾

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 light, 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.

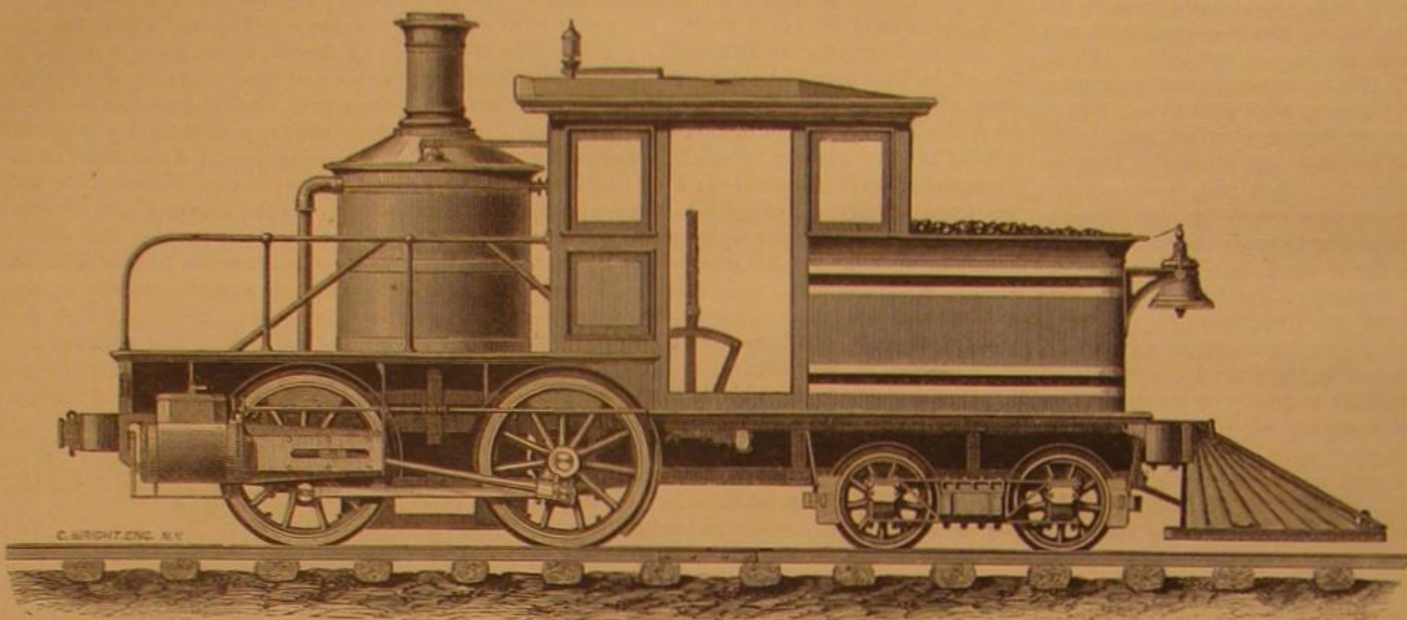
Waterspouts recently seen on Lake Erie are thus described by a newspaper correspondent: About 9.30, A.M., when about ninety miles from Erie, and nearly abreast of Cleveland, on our course to Detroit, we saw an immense waterspout, which at first looked like the heavy black smoke of a steamer. It gradually 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 tuns up to a weight of thirty or forty tuns. 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.

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.

QUARITIUS' AUTOMATIC BOAT DETACHING APPARATUS.

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.

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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.

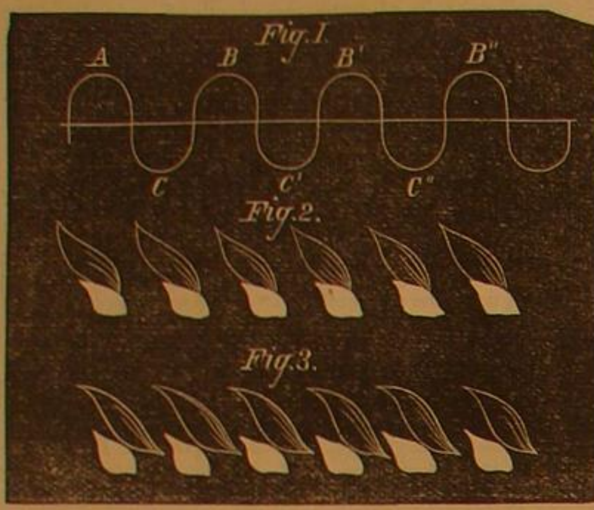
Our readers will recognize the above as confirming the views heretofore expressed by us on the subject. England, we learn, has appropriated but 6,000 pounds sterling to meet the expenses of adequate representation, but some of the papers are calling for a larger sum. It is not likely that a further amount 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

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

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, *viâ* 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 *calorifères*, 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 did 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 included 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.

Facts for the Ladies.—Mrs. M. J. Monroe, New York, has used her Wheeler & Wilson Lock-Stitch Machine since 1858 on family sewing and general manufacture; has tried others, but would rather pay $500 for it than use any other machine; it is as good now as when bought. See the new Improvements and Woods' Lock-Stitch Ripper.

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Ashcroft's Original Steam Gauge, best and cheapest in the market. Address E. H. Ashcroft, Sudbury St., Boston, Mass.

Heydrick's Traction Engine and Steam Plow, capable of ascending grades of 1 foot in 3 with perfect ease. The Patent Right for the Southern States for sale. Address W.H.H.Heydrick,Chestnut Hill,Phila.

The Berryman Steam Trap excels all others. The best is always the cheapest. Address I. B. Davis & Co., Hartford, Conn.

Wanted—Copper, Brass, Tea Lead, and Turnings from all parts of the United States and Canada. Duplaine & Reeves, 760 South Broad Street, Philadelphia, Pa.

The Berryman Heater and Regulator for Steam Boilers—No one using Steam Boilers can afford to be without them. I. B. Davis & Co.

T. R. Bailey & Vail, Lockport, N. Y., Manf. Gauge Lathes.

Brown's Pipe Tongs—Manufactured exclusively by Ashcroft, Sudbury St., Boston, Mass.

American Boiler Powder Co., Box 797, Pittsburgh, Pa., make the only safe, sure, and cheap remedy for "Scaly Boilers." Orders solicited.

Gear Wheels for Models. Illustrated Price List free. Also Materials of all kinds. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Windmills: Get the best. A.P.Brown & Co.,61 Park Place,N.Y.

Ashcroft's Self-Testing Steam Gauge can be tested without removing it from its position.

The Berryman Manuf. Co. make a specialty of the economy and safety in working Steam Boilers. I. B. Davis & Co., Hartford, Conn.

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

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

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

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

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

Better than the Best—Davis' Patent Recording Steam Gauge. Simple and cheap. New York Steam Gauge Co., 46 Cortlandt Street, N.Y.

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

For hand fire engines,address Rumsey & Co., Seneca Falls, N.Y.

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

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

Presses,Dies & all can tools.Ferracute Mch.Wks,Bridgeton,N.J. Also 2-Spindle axial Drills, for Castors, Screw and Trunk Pulleys, &c.

Perfection—Patent Ears for Elliptic Spring Heads. Address George P. Cleaves, Concord, N.H.

A party intending to engage extensively in the hose knitting business wishes to obtain full information as to the best machines, prices, etc. Address H. Hutzler, 383 Central Avenue, Cincinnati, Ohio.

India Rubber—Manufacturers of Calender rolls, and other machinery for the manufacture of India Rubber, can apply, with particulars, with a view to business, to C. E., P. O. Box 4090, New York.

To Grist Mill Machinists, &c.—Wanted a quantity of Grinding Machinery. Full particulars of any new or old process of grinding grain, or other materials, will insure business if approved. Address C. E., P. O. Box 4090, New York.

Wanted—Manufacturers for a large quantity of sewing machine attachments. Address H. & W. Bary, Detroit, Mich.

I want the best Swift. G. H. N. Cushman, Ottawa, Ill.

A New Machine for boring Pulleys, Gears, Spiders, etc. etc. No limit to capacity. T. R. Bailey & Vail, Lockport, N. Y.

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.—Jehue 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.]

Index of Inventions

For which Letters Patent of the United States were granted.

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

SCHEDULE OF PATENT FEES:

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On an application for Design (fourteen years)	$30

Arm pit shield, W. E. Beames	132,349
Barrels, machine for crozing, J. Solter	132,377
Basket, waterproof, G. M. Allerton	132,428
Bed bottom, W. H. Trissler	132,422
Bedstead, sofa, W. Farson	132,392
Boiler heads, machine for bending the flanges of, J. T. G. Piedboeuf	132,489
Boot, cloth, M. Crane	132,387
Boot and shoe soles, machine for uniting, A. A. Reed	132,493
Boot and shoe soles, machine for brushing, Briggs and Stetson	132,435
Boot and shoe taps, mode of securing, T. H. Lindley	132,474
Boot nailing machine, preparing patterns for, A. A. Reed	132,492
Boring machine, W. C. Freeman	132,393
Bricks, manufacturing, I. Gregg	132,463
Bridge, G. E. Harding	132,398
Bridge, draw, J. L. Piper	132,410
Brush, McDonel and Klock	132,479
Buckle, C. F. Moore	132,482
Building, frame, L. H. Russell	132,415
Butter tub, G. Smith	132,495
Calking ships, composition for, H. Le Grand	132,365
Camel, marine, W. P. Walker	132,506
Cane juice, apparatus for treating, Shafter and Wood	132,417
Cans, self-locking lid for, Weinel and Domer	132,507
Car coupling, H. Bale	132,429
Car coupling, W. M. Thomson	132,501
Cars, adjusting roll for loading, W. Dame	132,449
Carpenter's gage, J. A. Traut	132,421
Center board for vessels, J. Dean	132,390
Chair, tipping, A. White	132,508
Chair seat, Bjorkman and Lagergren	132,431
Chair, rocker and lounge combined, H. Haidt	132,397
Chair seats, machine for making, S. W. Cross	132,447
Chairs, extension foot rest for, J. H. Travis	132,503
Chest protector, P. Lear, (reissue)	5,110
Cigar mold press, F. Brown	132,351, 132,352
Coffin handle, N. Hayden	132,399
Collar, shirt, W. Hunt, (reissue)	5,109
Column, wrought iron, J. H. Linville	132,475
Corn planter, N. Clark	132,355
Corns, instrument for removing, J. C. Jacobsohn	132,468
Cotton seed planter, W. W. Croom	132,388
Cultivator, F. Trigalet	132,504
Curtain fixture, C. Eaton	132,453
Curtain fixture, J. Shorey	132,378
Dental forceps, J. D. Chevalier	132,354
Derrick, J. S. Clarke	132,442
Desk for school teachers, Carter and Emery, (reissue)	5,017
Desk for chairs, adjustable, S. C. Ripley	132,494
Door plate, letter box, and bell pull, combined, T. Thompson	132,379
Dust pan, W. Musgrove	132,367
Elevator, W. Elmes	132,459
Extensor, counter limb, S. H. Whittlesey	132,509
Fence, portable, A. C. Gilmore	132,461
Fertilizers, etc., treating offal so as to produce, J. J. Storer	132,498
Filter, Cooke and Watt	132,385
Fire arm, breech-loading, S. F. Van Choate	132,305
Fire arms, gas check for revolving, J. Davis	132,357
Fire engine, A. F. Allen	132,426
Fire engine and lawn sprinkler, pneumatic, H. C. Neer	132,407
Fire engines, water heater for, A. H. Perry	132,483
Fish net, C. Livaudais	132,476
Fish way, E. A. Brackett	132,349
Furnace, steam boiler, J. Howes	132,466
Furniture or cars, spring seat for, M. G. Briggs	132,350
Gas meter, liquid, D. B. Spooner	132,497
Grain binder, H. S. L. Bryan	132,436
Grate bar, revolving, G. C. Waggoner	132,423
Harness, H. T. Robbins	132,413
Harness pad, J. F. Knorr	132,472
Harvester, J. and E. Paxton	132,408
Harvesters, cutting apparatus for, Laughlin and Rice	132,513
Hay press, G. W. D. Culp	132,448
Heater, steam, Smith and Wood	132,419
Hoe, M. Cookerly	132,444
Horse rake, revolving, L. S. Edleblute	132,457
Hose, manufacture of India rubber, T. J. Mayal, (reissue)	5,111

Hydraulic piston, T. Critchlow....132,445
Hydrocarbons, burning, Chandler and Wray....132,440
Hydrocarbons, apparatus for burning, A. C. Rand....132,491
Kettle bail, J. T. Darnell....132,450
Knitting machine needle, D. Bickford....132,382
Lantern, reflecting, E. Boesch....132,433
Lard press, Pagett and Rohrer....132,486
Lard, can or bucket for transporting, J. A. Curtis....132,356
Lasting jack, J. C. Wightman....132,510
Lathes, work holder for, W. P. Hopkins....132,400
Lighting, heating, vaporizing, and drying, apparatus for, J. Kidd....132,403
Liquids on draft, apparatus for cooling and dispensing, B. M. Bastian 132,430
Lubricating compound, J. Williams....132,379
Lubricating machinery, mode of, A. P. Gross....132,395
Lubricator, J. E. Lonergan....132,477
Medical compound, L. W. Wollenweber....132,424
Medical compound, S. F. Alford....132,425
Milk cooler, C. H. Latham....132,473
Milk cooler, W. Eaton....132,454
Millstone dress, H. O'Conner....132,514
Muff, J. W. Gay (reissue)....5,108
Organ stop action, reed, J. A. Smith....132,419
Pails, etc., machine for crozing and dressing, How and Patterson....132,401
Paper box, C. T. Palmer....132,368
Paper file, J. Matthias....132,478
Paper pulp, recovering waste alkalies in treating, C. M. T. Du Motay. 132,432
Paper for telegraphic use, apparatus for perforating, T. A. Edison....132,456
Paraffin, purifying, F. X. Byerley....132,353
Pipe trap, waste, T. Smith....132,420
Piston rods, etc., metallic packing for, J. C. Furness....132,361
Plow, C. Nash....132,406
Plow and marker, corn, G. W. Meixell....132,405
Polishing marble and wood, machine for, J. C. Mateer....132,404
Polishing machine, transverse motion for, J. Miller....132,481
Potato digger, M. Johnson....132,364
Potato digger, A. Q. Allis....132,427
Preventing a person asleep from turning, apparatus, R. T. Sullivan..132,500
Pump, W. W. Green....132,462
Pump, mining, T. J. Chubb....132,384
Railroad rail, J. Downey....132,451
Railroad switch, H. Fitzsimmons....132,460
Railroad switches, locking apparatus for, Saxby and Farmer....132,416
Railway trains, apparatus for signaling between, R. K. Boyle....132,434
Range, cooking, P. N. Burke....132,437
Range, cooking and heating, J. M. Wilson....132,380
Refrigerator, S. E. Condon....132,443
Refrigerators, drip pipe trap for, C. Durant....132,391
Rolling metal, machine for, W. D. Hillis....132,465
Sad iron, Egger and Alexander....132,458
Safe, fire and burglar proof, T. Sharts (reissue)....5,112
Sash holder, W. I. Blackman....132,432
Sash holder, H. Polley....132,490
Saw mill, circular, J. B. Jones....132,4g9
Sewing machines, operating, J. Phimister....132,409
Sheet metal measures, forming, J. Coover....132,386
Show case, spool thread, J. N. Leonard....132,366
Shutter hinge, T. F. Duley....132,512
Sleigh brake, A. Derby....132,359
Smut machine, G. W. Grant....132,394
Snow from railroads, machine for removing, D. Townsend....132,502
Spring for machinery, back lash, H. W. Bachman....132,347
Steam trap, C. Schmanc....132,372
Steam hammer, W. Sellers....132,373
Steam hammer, automatic, W. Sellers....132,375
Steam hammer, automatic, C. Sellers....132,374
Steam engine, T. F. Rowland....132,414
Steam boilers, E. Neumann....132,484
Steam boilers, compound to prevent incrustations in, W. Pearson....132,369
Steam boilers, compound for removing incrustations in, J. Chandler. 132,439
Steam boilers, copper-coated iron pipe for, H. J. Newton....132,485
Steering apparatus, P. H. Jackson....132,467
Stirrer and beater for batter, eggs, etc, H. Muth....132,483
Stove, base burning, M. A. Cushing....132,389
Stove board or platform, J. S. Brooks, (reissue)....5,106
Sugar, granulating, Young and Bosson....132,511
Telegraphs, etc., paper for chemical, T. A. Edison....132,455
Tobacco press, Hardy and Peper....132,362
Traveling bags, pocket for, D. Read....132,412
Tub washer frame, B. R. Platt....132,411
Type for the blind, S. P. Ruggles....132,370
Type for the blind, map, S. P. Ruggles....132,371
Umbrella frame, A. Herzberg....132,363
Valve, balanced, T. Critchlow....132,446
Valve globe, W. Kirkup....132,471
Valve, slide, H. H. Meyer....132,480
Valve, steam engine, A. W. Fox....132,360
Valves, machine for boring and tapping, J. Gunn....132,396
Vise, W. H. Jacoby....132,402
Vise, W. H. Sullenberger....132,499
Wagon spring, J. A. Chapman....132,441
Washing machine, J. A. King....132,470
Water meter, D. B. Spooner....132,496
Water wheel, D. Bowles....132,383
Water wheels, case and gate for turbine, Denney and Mercer....132,358
Windmill, Champlin and Weeks....132,438
Windmill, J. Hall....132,464
Windmill, I. H. Palmer....132,487

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:

22,697.—Soda Water Apparatus.—E. Bigelow. January 8, 1873.
22,902.—Water Wheel.—J. Temple. January 22, 1873.
23,364.—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.

21,828.—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.

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To Make an Application for a Patent.

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

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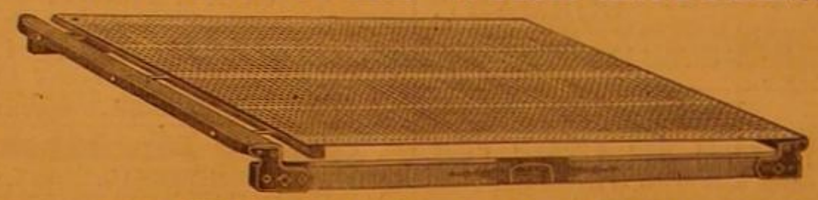

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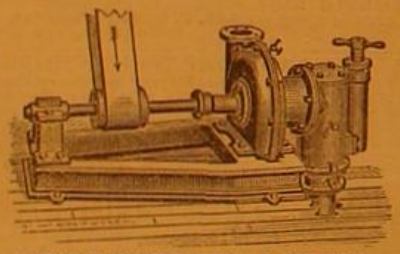

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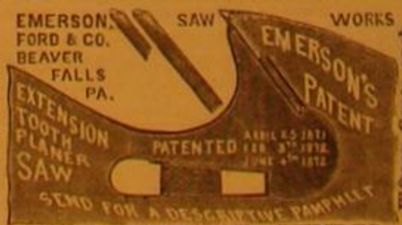

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