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## IMPROVED PATENT SECTIONAL BOILER.

The essential features of the boiler represented in our engraving consist in its construction in sectional form, and in the sections being of cast iron, of a shape calculated to economize space, to afford a large proportion of heating surface, to be durable, and to be readily cleaned. The inventor considers that cast iron, owing to its granular formation, allows of the passage of heat through it more readily than does wrought iron, which is fibrous; and, at the same time, it affords a means of building the boiler at a much decreased expense. Two forms of the generator are represented.

Each section in Fig. 1 consists of the curved tube, A, and of one or more smaller tubes, B, which are made on arcs of concentric circles and are cast in one piece with the larger pipe. The lower extremity of the tube, A, in each section, is, by means of a suitable screw connection, attached to a horizontal base pipe, C, two of which pipes extend longitudinally through the lower portion of the generator on each side, and are connected at the back by a transverse pipe, not shown. On the exterior of the main tubes, A, at D, and opposite to the orifices of the smaller tubes, are made apertures, closed by screw plugs, which are accessible through the outer casing, for removal, in order to insert the necessary instruments for cleaning. The upper extremities of tubes, A, are closed, and meet to form the arch, as represented. On the upper side, however, and near these ends are also screw connections, which communicate with the steam drum, E. It is hardly necessary to point out that a large amount of heating surface is secured, while the construction is such that an explosion is confined to the single section, which, through the two screw connections mentioned, is readily taken out and replaced. It is claimed that a perfect circulation is always maintained. The greatest heat is generated in the top of the furnace, through the rising of the light gases, and there is a ready escape of steam into the drum, preventing priming or lifting of the water from the hot surfaces.

In Fig. 2 the boiler is represented somewhat differently constructed. A bridge wall, F, passes longitudinally through the fire box, along which extends the pipe, G, from which rise vertical tubes, H, which connect directly with the steam drum. To flanged projections on tubes, H, are connected the curved tubes, as shown. To the base pipes, I, are fastened large tubes, J, which line the arch of the furnace, having closed upper ends and abutting against the vertical pipes. These tubes have each a screw connection with the drum at K, and, with the various portions, are so joined as to admit of free circulation throughout the generator.

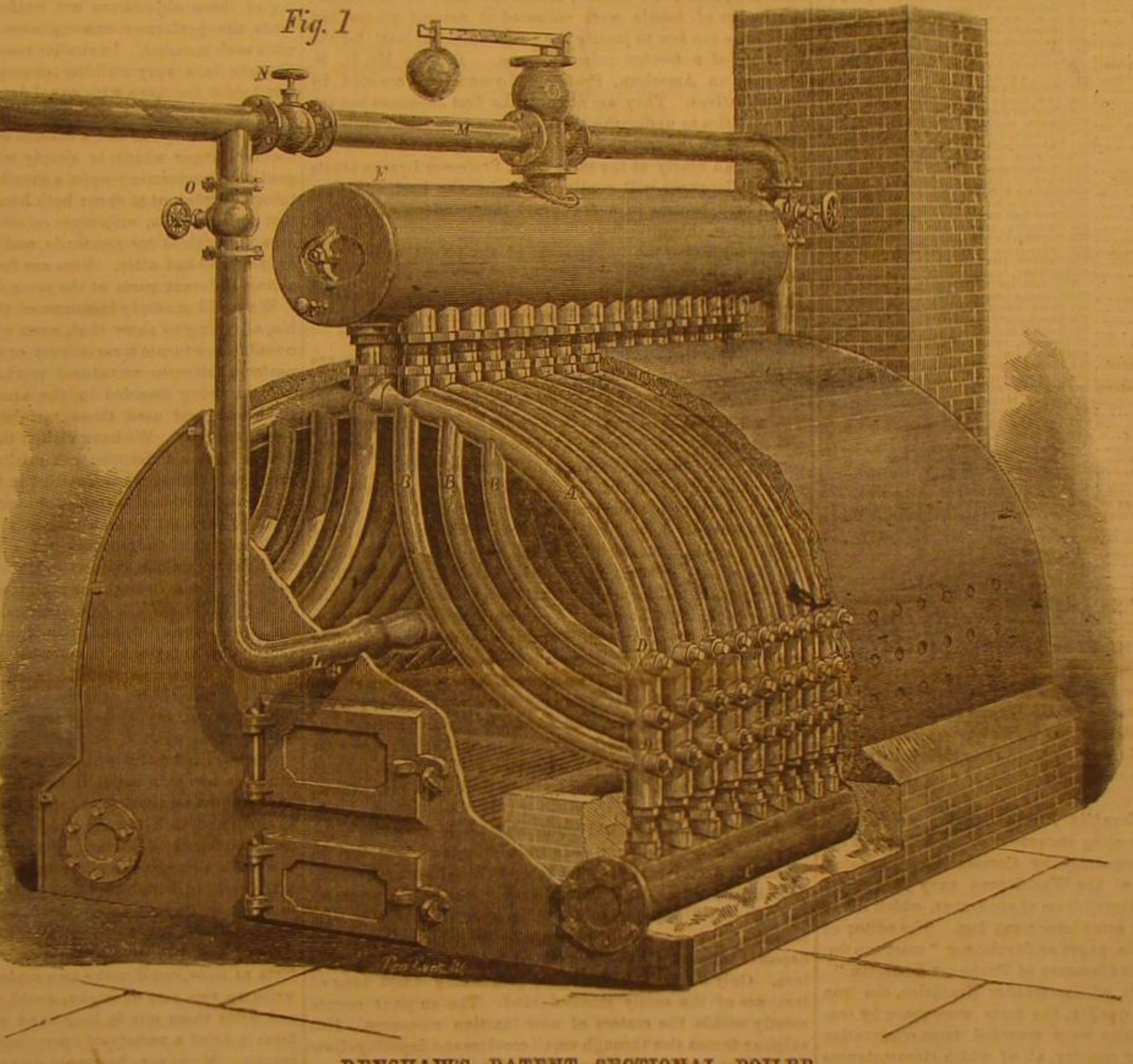
It will be noticed that both forms offer ready means for blowing out the sediment which may accumulate, as the same will sink naturally to the base pipes, where it may be ejected or removed. In Fig. 2 the feed water is admitted to the base pipes.

In connection with the boiler, in Fig. 1, a simple superheater is shown, consisting of a pipe, L, which extends down through the fire box, completing a parallelogram, of which the steam pipe, M, forms the upper side. By closing the valve, N, the steam passes down through this pipe, and thus becomes superheated. In case this is not desired, communication with the attachment is cut off by means of the valves, O, on the vertical branches.

We are informed that the castings are tested at not less than 250 lbs. to the square inch in hydrostatic pressure, and their peculiar form in curves, concentric as above noted, obviates greatly the dangers due to unequal contraction and expansion. The manufacturers, Messrs. Dougherty & Broome, of Nos. 143 to 147 Bank street, New York city, state that they use one of these boilers in their foundery, and that, in a small 15 horse generator, an average of one pound of coal erves to evaporate eleven and a half pounds of water. Larger boilers, it is said, show even better results.

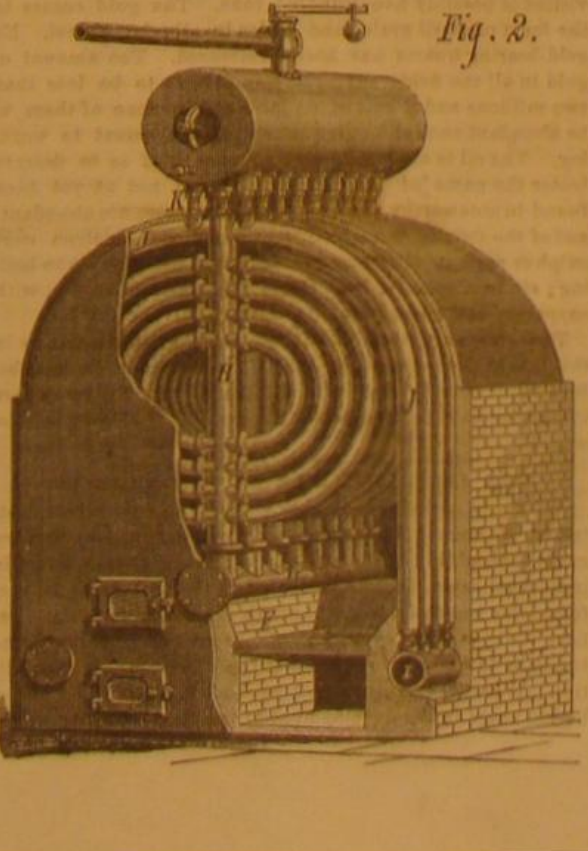
The device is covered by ten patents, the most recent of which are dated October 21, 1873. Further information may be obtained by addressing the manufacturers as above.

Fig. 1



RENSHAW'S PATENT SECTIONAL BOILER.

Fig. 2.



### Gas Pressure Alarm.

When two neighboring buildings are illuminated by gas derived from the same source, it frequently happens that the extinction of the lights in one building causes the pressure of gas in the other to become greatly increased, and sometimes to result in accident. M. Launay proposes, as an alarm to give warning of this over pressure, a bisulphate of mercury battery, in which the liquid is in communication with the gas by means of a siphon, so that the pressure of the gas in varying, raises or lowers its level.

If the pressure is above a certain fixed limit, the liquid is raised so as to come in contact with the metallic portion of the battery, establishing a current which sounds an electric alarm. M. Launay also suggests that a simple method of determining leaks in gas pipes throughout a building is to force some strongly odorous smoke into the supply pipe. The fumes of incense, for example, escaping in any room, would be readily distinguished from gas, and the locality of the leak quickly found.

### Old Hats' Paradise.

The grotesque fancy of savages for the cast-off habiliments of civilized races is a source of amusement to travellers the world over. It is rare, however, that the fancy rises to such a passion for a single article as is exhibited among the Nicobar islanders. Young and old, chiefs and subjects, in these "Summer Isles of Eden," alike endeavor to outvie each other in the accumulation of old hats, priding themselves on the extent and variety of their collections as other people do on their wealth of gold or jewels or works of art. Curiously, second hand hats are most in request, new ones being looked upon with suspicion and disfavor.

The singular passion is taken advantage of by the traders of Calcutta, who make annual excursions to the Nicobars with cargoes of old hats which they barter for cocoanuts, the principal production of the islands. A good tall white hat with a black band fetches from fifty five to sixty-five prime cocoanuts, sometimes more, as, during the intense excitement which pervades the islands while the trade is going on, fancy prices are often asked and obtained. When the market closes, by the exhaustion of the stock of hats for sale or cocoanuts to buy them with, the traders usually land with a cask or two of rum, and the entire population, clad in their new possessions, with perhaps a rag about the loins in addition, celebrate the occasion by getting thoroughly drunk.

WHAT is believed to be the longest rope in the world has been recently on view at Messrs. Frost's walk, Shadwell, England. It is a grapnel rope, 10,000 fathoms long without a splice, and has been made for the Siemens Telegraph Company. It is made of three strands, the diameter of the completed rope being 2 inches.

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Contents:

(Illustrated articles are marked with an asterisk.)



## ELEVATION OF THE ELASTIC LIMIT BY STRESS.

The Scientific American first published, on page 336, volume XXIX, the novel and unexpected discovery by Professor Thurston of the "Elevation of the Elastic Limit by Stress," as the discoverer has since called it, which was communicated to the American Society of Civil Engineers, in a note published in the transactions of the Society for November, 1873.

The *Journal of the Franklin Institute*, in the last month's issue, contains an interesting statement of the results of experiments made subsequently by Commander Beardslee, United States Navy, at the Washington navy yard, independently and by a different form of apparatus, which led to the re-discovery of the same important fact. The editor of the *Journal* presents the paper as furnishing "most conclusive confirmation of the discovery of Professor Thurston."

In these experiments of Commander Beardslee, the iron was generally of poor quality, the tests were made by tensile strain, and the results were recorded from observation instead of by automatic registry, all of which circumstances differ from those of the earlier researches, and the confirmation which is given of the phenomenon referred to is thus rendered the more conclusive. Samples were taken in pairs and subjected to a strain which exceeded the elastic limit. One was removed from the machine and laid aside; the companion specimen was left under the load in the testing machine. In the former case, four tests gave an average increase, in sixteen hours, of 10·00 per cent. The latter method, with six specimens, gave an average of 11·30 per cent, or, leaving out one exceptional result, 12·20 per cent. These specimens were of ½ square inch section. With smaller pieces of ¼ square inch section, the same treatment gave, by the two methods, 8·20 and 13·40 per cent, respectively.

The (at first sight) very singular fact, that an increase of resistance should be developed when the specimen is taken out of the machine after giving a set, is, we presume, readily explained by the fact that the set, produced by the refusal of some of the particles to return to their original positions, holds other groups of particles separated, and, as explained by the discoverer, allows a flow to take place, relieving internal strain, and permitting nearly all portions of the piece to act together in resisting external force. The set thus holds the piece under strain somewhat as does the machine.

The subject loses neither interest nor importance by investigation, and we shall hope to learn more of its practical bearings. We have already given much of our space to the discussion of these new facts relating to the strength of materials, and shall from time to time endeavor to present our readers with the latest results of research in this field. There is no subject which is of more direct importance to every mechanic and engineer than that of the strength of the materials upon which he is compelled to rely in all his constructions.

There are many facts still unknown to the public, or to the engineering profession even, and of which no knowledge can be gained by reference to books. For example, one of these is the resistance of iron to compression at different temperatures.

Many of our readers can undoubtedly furnish facts of interest and importance; and we hope that those who find themselves in possession of such facts, which have evidently escaped the observation of acknowledged authorities, will assist their brother workmen by sending them to us for publication.

## THE GEOLOGICAL SURVEY OF JAPAN.

We have received from our countryman, Mr. B. S. Lyman, who was appointed, by the government of Japan, Director of the Survey, a preliminary report containing some of the results of the first season's work in Yesso.

It is a pamphlet of 46 pages, excellent in typography and appearance, published and printed in English by the *Kaitakushi* at Tokei. The work, according to the instructions of the Hon. K. Kuroda, Jikuwan of the Kaitakushi, was confined to the four southwesternmost provinces, Oshima, Shiribets, Iburi, and Ishcari, about one third of the island. A number of fossils were collected at several places, but they were too few to justify the employment, at least for the present, of a foreign palæontologist. Besides Mr. H. S. Munroe, an American, Professor Lyman was assisted by eleven natives. They are not only the first Japanese but the first Asiatics to undertake the study and practice of geology; and although the training of native geologists in India has been begun nearly at the same time, Professor Lyman trusts that the Japanese will continue to take the lead, and that Japan will become in a few years independent of foreign countries in this direction.

In determining the importance of the points to be more carefully surveyed, regard was had chiefly to their mining value, and many places were visited where valuable minerals had been supposed to exist, but where they proved to be deficient either in quantity or quality.

Along the principal and many of the smaller rivers are rich alluvial plains, which would be admirable farming sites, were it not for the lack of roads at the present time. The soil indeed seems to be very good, even on the uplands, and supports a rich growth of wild plants. The chief exception is in the neighborhood of Tarumai volcano, which so recently as the first of March, 1867, was in active eruption; and where for many miles around, even the low plains by the seashore have been so covered with pumice as very much to lessen their fertility. Yet even here a rich black soil, in some places six feet thick, exists at the depth of only about a foot below the surface of the ground. The volcanoes that still have active sulphur vapors seems to be mostly along the shores of Volcano Bay and the adjoining coast. Besides these, there are many more that seem to have long been quite extinct. The highest, most symmetrical, and beautiful of them all, is Shiribets Mountain, perhaps 6,000 feet high above the sea, and almost a regular cone. The useful minerals of chief importance in the field gone over are: Coal, iron sand, sulphur, limestone, gold, and rock tar and mineral springs; and traces of silver, lead, zinc, manganese, and copper.

The Kayanoma coal field covers about half a square mile, and has six workable coal beds from three to eight feet in thickness. The coal is what is strictly called brown coal, probably of tertiary age, though closely resembling bituminous coal in its appearance and in many of its qualities. Of iron, the whole amount of pure ore in the principal workable deposits is perhaps 125,500 tuns, containing 91,000 tuns of iron. Only 5,500 tuns of the ore (containing 4,000 tuns of iron) are of the easily smelted kind. The sulphur occurs mostly within the craters of now inactive volcanoes. Hot sulphur fumes rise through small crevices and deposit yellow sulphur on the cold surface of the ground, forming a crust more or less impure, with a mixture of partially decomposed rocks. The shape of such deposits is extremely irregular and often inaccessible in many parts; so that the precise extent can hardly be measured except very roughly. The whole quantity of sulphur to be got from the places thus far visited is possibly five hundred tuns. The gold occurs in the form of small grains and scales in alluvial gravel. No gold-bearing quartz has been discovered. The amount of gold in all the fields surveyed would seem to be less than two millions and a half of dollars, and in none of them to be abundant enough to give much encouragement to working. The oil is all black, and so very thick as to deserve better the name of tar; moreover it has not as yet been found in noteworthy amount. Mineral springs are abundant; and of the twenty-one which were examined, thirteen were sulphur springs with temperature from coldness up to boiling; six iron springs, from 27° to 91°; one cold spring, with copperas; and two nearly pure springs, 30° and 50° hot.

Though scanty, these details are sufficient to interest us in the future development of Japan, and it cannot be long before representatives of our commerce will follow where those who have represented our Science have already led the way.

A. R. L.

## THE INCREASED USES OF THE MEMBERS.

We doubt if the human body has ever in any instance attained the acme of its possible development; and by this we mean that while certain sets of muscles or organs have, in individual cases, become subjected to the will so as to perform feats impossible save through education, we do not believe that the being ever lived who could control every member so as to cause it to operate to the extent of its capabilities. Whether in future ages such a condition will mark a higher stage in the development of the race: whether, as the human mind expands, or, as the saying is, the "world grows wiser," it is reserved for physical culture to keep pace with such mental growth: is a subject for speculation, which, in view of the doctrines of evolution and the constant approach of organic species toward more perfect individualism, is by no means devoid of present interest.

We have discussed at some length the question of the use of the left hand, and we have pointed out that, by a mistaken notion, children are taught to discard the use of the member, and hence to lose half the powers which Nature intended they should have when she formed the body as it is. We have also suggested that, so far from restraining the infant from using its left hand, its tendency to employ both members indiscriminately should be encouraged. Now, we propose to advance a step further, and to ask why should not a child be taught to utilize both hands at once, and at different occupations. The idea may seem somewhat chimerical at first, but it is not without the bounds of possibility. The reader has doubtless seen jugglers who, in performing their dexterous tricks, become so expert that, without any apparent difficulty, they can keep half a dozen knives or balls constantly in the air or in each hand. The falling and rising of these objects are not uniform, and hence to all intents the performer accomplishes a totally different result with each member. In similar manner great pianists—Rubinstein is a very striking example in point—use either hand upon the keys with equal dexterity and both together, in playing music of tremendous difficulty which requires a power of perception and a control of the muscles of each individual finger which is simply wonderful. Again, an organist, in performing upon a grand instrument, has several things to think of at once: both hands on the keyboard, both feet on the pedals, with stops on either side, couplers and the separate devices for *crescendo* and other accidental effects are to be looked after. Here are four members of the body acting different parts at the same time.

We could multiply instances of this kind with little trouble, all going to show that, even when advanced in life, it is possible to educate a certain set or even sets of muscles to perform hitherto unnatural work. Cases there are where men, on being disabled in the arms, have had recourse to their toes, and used those members for writing and even handling tools. We have visited the studio of quite a celebrated French artist whose exquisite paintings were entirely produced with brushes handled in the above manner. But while an individual member, or even the body, may be educated to perform feats apparently impossible, it requires a higher order of training to compel the members to perform different operations at once—a training, we think, only to be fully imparted in beginning at the earliest years, but still fully possible. With our dual brains, the right lobe is now the most developed, and with it the dexter side of the body. Let means be taken to develop the left side equally, and the body is symmetrical in its powers. Each side, governed by both brains, will be capable of work for which now, when controlled by, say, three quarters of the brain power, it is inadequate.

We need not point out the advantages to a person who can thus use both hands in connection with the brain. We have known an artist who could draw two different pictures at once; and in a former article, we alluded to a very eminent professor of natural history who, while watching a specimen through the microscope, sketches with one hand while writing with the other. Now, if a person advanced in life can become so educated, how much easier it would be to impress the same on the plastic mind of a child! Once taught, the person could write upon two different subjects at once, could make two copies at the same time, could write up two sets of books, could make stenographic notes and write them out in long hand simultaneously, and perform in brief a variety of operations productive of lucrative results. Moreover, he would do each understandingly, and not semi-automatically with one hand. Nine tenths of ordinary pianists who have to "learn a piece" play the treble with their brains and the bass with their muscles. The left hand learns certain fixed skips and jumps by practice, and performs them automatically at certain times, while the right hand carries the expression as well as the air of the composition, and is much more directly under the control of the performer.

We began by speaking of a possible future of the race. Is it then improbable that at some time man may have every faculty educated to its utmost, and thus become raised to a creature mentally and physically infinitely the superior of such as we now are, as much beyond us as we are beyond the monkey? Traits developed in the parent may be transmitted to the child and there intensified, and thus an approach to human perfection ultimately attained. But meanwhile, who is to begin? To whom among the scores of thousands who will peruse these lines—who may perchance give them a second thought—will it occur that the idea may be carried into practice with the very yellow-haired youngster, perhaps at this moment clambering upon his knee?

## THE NEW THEORY OF QUANTIVALENCE.

The theory of quantivalence, by which the modern chemistry differs so radically from the science laid down in the old text books, thus far used and still taught in most of our scientific institutions, is based on close comparisons concerning the nature of divers chemical combinations; and these have taught that each elementary atom possesses a certain definite number of bonds, by which alone it can combine with other atoms.

There are two material conceptions by which we may assist our imagination to realize this abstract idea: One is to imagine the bonds as hooks attached to the atoms, by which the combinations are held together, so that, for instance, the hydrogen has one hook, oxygen two, nitrogen three, carbon four, phosphorus five, manganese six, etc. A combination of two or more atoms is called a molecule; and in the molecule of a compound, every atomic hook is attached to another hook, either of another atom or of itself. The other material conception realizing this idea is that of regarding these atomic bonds as poles of a magnet, with the difference that, unlike a magnet, which has only two poles, the different elementary atoms possess one, two, three, four, or more attracting poles, by which they have the capacity of uniting other atoms to themselves, so forming the compound molecule, having totally different properties from the component atoms: so different, indeed, that every chemical compound is to all intents and purposes a body totally different from the elements of which it is made up.

Chemists have agreed to distinguish the elementary substances (by their capacities for combining with one, two, three, four, five, six, or more atoms of other elements) as univalent, bivalent, trivalent, quadrivalent, quinquivalent, sexivalent, etc., or otherwise as monads, diads, triads, tetrads, pentads, hexads, etc., and to accept a modification of the existing chemical symbols by representing the bonds, hooks, or poles, by as many dashes. After this idea, the univalent elementary atoms are written with one dash, in front, over, or under the symbol, thus: H—, Cl—, F—, K—, Na—, Ag—, meaning that hydrogen, chlorine, fluorine, potassium, sodium and silver, are univalent; in other words that, when each is combined with a single atom of another element, its chemical affinities will be satisfied. The bivalent atoms are written thus: —O—, —S—, —Ca—, —Mg—, —Hg—, —Zn—; or O=, S=, Ca=, Mg=, Hg=, Zn=, meaning that oxygen, sulphur, calcium, magnesium, mercury, and zinc are bivalent, and thus will combine with two univalent atoms, or one bivalent atom. So oxygen will combine with two hydrogen atoms to form water. This is expressed in the ordinary way by $H_2O$, but after the new method by H—O—H, indicating how the oxygen atom has two bonds, while each hydrogen atom is only attached by one bond. On the other hand, one atom of oxygen will combine with one of zinc, thus: Zn=O, both being bivalent, having two bonds, and in the same manner one atom of hydrogen will combine with only one of chlorine, thus: H—Cl, both being univalent.

Among the principal trivalent atoms, we will mention nitrogen, phosphorus, arsenic, antimony, boron, and gold, and their symbols may be written:

—N—, —P—, —As—, —Sb—, —B—, —Au— (each with a third bond above); or —N=, —P=, =As—, Sb≡, ≡B, —Au— (with a third bond below).

In each of these elements, every atom will combine with three of hydrogen, chlorine, or three other univalent atoms, or one bivalent and one univalent, or one trivalent atom. For instance: H—N<H—H, or Cl—N=O, or Au≡P.

Finally we will mention a few quadrivalent substances: Carbon, silicon, tin, platinum, of which the atoms are represented thus: =C=, =Si=, =Sn=, =Pt=, or,

—C—, —Si—, —Sn—, —Pt— (each with a bond above and below);

and the quadrivalent elements will combine with four univalent or two bivalent atoms, or with one trivalent and one univalent; so we have the combinations $CH_4$, $CO_2$ and Sn Si, expressed thus:

H—C—H (with H— above and H— below), O=C=O, and Sn≡Si.

It is especially in the organic compounds, in which carbon plays the most essential part (in fact so much that this element has been called the great organizer), that the law of quantivalence finds the most extensive application. It ought to be stated here that this quantivalence of the atoms is not totally invariable; but it is remarkable that, if variations take place, they are according to a law which allows a quadrivalent atom to become bivalent or sexivalent, so that a quantivalence expressed by an even number will always be even, and one expressed by an odd number will always be odd. Atoms of the first class are called artiads, of the the second (with odd numbers), perissads; and this classification appears to rest on a fundamental law.

This is a short explanation of the fact that a definite quantivalence of the atoms of each elementary substance is one of its most important inherent properties; and it is therefore the most distinctive feature in which the new school differs from the old. It is the chief cause of the recent revolution in chemical science. The old fashioned authors and teachers did not question how the elementary substances were united in a compound; but now it is considered of the utmost importance to investigate and determine the exact manner in which the atoms are united in order to build a molecular structure. It has long since been suspected that the quality of a chemical compound depends as much on the manner of structure of its molecules from the atoms as in the nature of the atoms themselves; and now it has been proved that a compound may be totally changed by simply changing the relative position of the atoms in regard to the nucleus of the molecule, which itself may change without any alteration in the number or quality of the individual atoms.

It ought to be considered that the above is not merely the expression of an hypothesis, but is the result of actual experiment. Not a shade of doubt clings to it, notwithstanding that the actual view of the atoms constituting a molecule is far beyond the range of the most powerful microscope. Nevertheless, although it has been proved that the molecule of nitro-glycerin, consisting of 20 atoms, $C_3H_5N_3O_9$, cannot be larger than the twenty-five millionth part of an inch, we are now almost as positive about the internal structure, position, and arrangement of its atoms as we are of the structure, position, and arrangement of the bodies in our planetary system.

The theory that heat is a mere mode of motion, residing in the molecules or atoms of bodies, may be considered to be as firmly established as any in the field of Science; and the theories that rise and descent of temperature are nothing but increase and decrease of this molecular motion, and that the absolute zero point of temperature, that of 460° below the zero of Fahrenheit, corresponds with absolute molecular rest, are necessary consequences of this theory. Every substance must be composed of moving molecules, of which the atoms themselves are in constant motion; every complex molecule therefore resembles a planetary system, not only in the arrangement of its different members, but even in the motion of its atoms, which is rotary as well as progressive. It is, indeed, a grand idea that the same force which, on the infinitesimally small scale is called chemical affinity, and holds the different constituent atoms of matter in well balanced and unalterable groups, so securing the stability of compounds, prevails also throughout the immense distances of the heavenly bodies, wherein we call it gravitation, which secures the stability of the systems of worlds which make up constellations and galaxies.

## FARMERS' HEALTH.

The State Board of Health of Massachusetts are doing admirable work. Their fourth annual rep rt, published last year, was a model volume of its kind, and copious reproductions from its pages found place in our columns. Its successor, now before us, is every whit as valuable. It is not a dry mass of undigested statistics, nor a bundle of official platitudes which nobody understands and no one takes the trouble to read; but a series of papers, plain, practical, and full of common sense on sanitary questions which are of the nearest importance to every one. We commend the work as exemplifying what a report addressed to the people should be; and it seems to us that an immense amount of good would be done if the general government, among the tuns of documents supplied to our representatives for distribution to their constituents, would provide similar volumes on similar subjects, and compiled in a similar manner.

Some papers in the book before us, we have already embodied in articles on these topics. At the present time we desire to direct attention to the very important subject of the sanitary condition of farmers, who, though popularly considered the healthiest people in the world, have, it appears, yet something to learn tending towara their improvement and to the prevention of dangers incidental to their calling.

The basis of the views presented is the opinions of the country doctors all over Massachusetts, and no better foundation could be obtained. A paper based upon their combined experience cannot be otherwise than instructive. The farmers in the above State constitute one eighth of the industrial population, a less proportion than in the Western States, as in Illinois the farmers with the farm laborers make up one half of all persons having occupations; so that no further argument is necessary to prove that their sanitary welfare is that of a very large proportion of the entire population of the country.

The first question considered is that of longevity. A table collated over twenty-eight years shows the average age of farmers at death to be 65·13 years, figures far in advance of all other callings, and greatly exceeding the lifetime of active mechanics (not in shops), who, averaging 52·62 years, appear next on the list. The opinions of the physicians consulted also go to show that the farmer's chances of long life are somewhat greater than those of any other class. As regards general health, there appear to be divided views, the large majority of doctors, however, holding that farmers and their families enjoy better health than most people, while a respectable minority advocate the reverse. This leads to a more direct examination of the causes which tend to impair the health and shorten the lives of the agricultural classes. First of these is overwork, that is, not the nature but the amount of labor performed, combined with exposure to the weather. Labor carried too far exhausts and enfeebles the frame. During a short season, however, when the year's operations are crowded into a space of five months, and when wages are high, overwork on the part of the farmer is too common. In spring he works at the plow from morning until night, to hurry through the planting; in summer, prodigies of mowing and pitching of hay are done, which too frequently tend to cause serious rupture or other physical injury. In winter, there is a continual series of hard work in hauling wood and doing similar exhausting labor, causing sudden changes of temperature in the body. The result of the whole is that rheumatism becomes by far the most prevalent disease. Again, farmers' wives work even harder than their husbands, and, it is said, are the most likely to be overburdened. The remedy for such excess of labor on the part of farmers and their families is a better comprehension of sanitary laws. It should be understood that it is not true economy to lay up money when the process of accumulating it makes the farmer's wife an invalid, and necessitates the expenditure of a much larger sum for sickness. More labor-saving machinery should be introduced. For small farms, where the more expensive machinery is not available, cheaper substitutes would doubtless be invented, were inventive genius turned that way through the liberality of agricultural societies.

It is a somewhat singular fact that farmers live so little upon their own productions. They send their fresh vegetables, fruits, eggs, and poultry to the market, and live themselves upon salt pork, pies, and saleratus bread. The result is dyspepsia and a train of kindred diseases. It is important that good cooking should be cultivated. It is actually easier to cook well than badly, provided the work is not done in a hurry. In the bad cookery, the overwork is again traceable, and it is the very pressure of labor which causes the preparation of the food to be done in any way so long as the materials are rendered eatable. A pork diet is not healthy. The meat is slow of digestion; it contains an excess of fat; it may, if improperly cooked, produce trichiniasis and tapeworm, and it increases the liability to consumption and scrofula. Farmers should live on plenty of fresh meat, use less tea, avoid frying as a means of preparation, eschew pies and cake in excess, and provide for their own tables an abundance of vegetables and fruits, with wholesome, well kneaded, yeast bread.

As a rule, it is said, farm houses are very badly located, worse so than city residences. Farmers should comprehend the necessity of choosing a dry and airy locality, and the dangers resulting from living on damp soil or in a low, shut-in situation. Where the house is placed low, house drains are sluggish and imperfect, and fogs are frequent; when shut in by higher ground, the air is stagnant, and the effluvia from the house and outbuildings are not blown away. Too many trees conduce to dampness and shut out the sunlight.

Uncleanliness of surroundings is a prolific cause of disease. Typhoid fever and summer bowel diseases abound in the vicinity of putrescent animal matters, which poison both air and waters. Faulty drains and neglected privies are the most dangerous, while foul cellars and barnyards are also deleterious. No farmhouse should be without a commodious covered cesspool several rods from the house, on lower ground, if possible, and connected with the kitchen sink by a well constructed covered drain. In default of a brick cesspool, an inverted hogshead will do, if the soil be porous, but a barrel never; it is too small to be of any use. The drain should then be kept free, so that the cesspool can be so used that not a drop of dishwater, slops, or any kitchen refuse whatever shall find its way out upon the surface of the ground from the back door or window. Everything should go into the cesspool, except what the pigs can consume, and the back of the house should rival the front in cleanliness and tidiness. Privies should be thoroughly disinfected by the combined use of earth and copperas. The latter can be bought for from two to five cents a pound, and it should be kept constantly on hand. The place should be perfectly inodorous, otherwise the disinfection is not accomplished. In winter the earth closet should be used indoors, and the waste will be found a most valuable addition to the compost heap.

Bad drinking water is another cause of sickness. As a rule, a well receives drainage from a superficial area, whose diameter is from one to three times the depth of the well, varying with the character of the soil. To keep the latter area in a thoroughly purified condition is a good and safe rule to follow. A well, for example, twenty feet deep should have no privy, pig pen, barnyard, drain, nor should slops or garbage be thrown upon the surface, within thirty feet of it in any direction.

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MR. SALEM H. WALES, after a connection with this paper of more than twenty years, withdrew some three years ago, and was appointed by the mayor one of the Commissioners of Public Parks in this city. Mr. Wales was subsequently chosen President of the Board by his colleagues, which office he held to the satisfaction of the public until a few days ago. In a pithy letter to the mayor, resigning his office, Mr. Wales animadverts very pointedly to the acts of our city comptroller, for interfering with the Park Commission in the appointment of its employees. On Wednesday evening, the 26th ult., a score and more of Mr. Wales' friends gave him a complimentary dinner at the Union League Club; and on the following Saturday he sailed, with a member of his family, for Europe, for a few months' rest and recreation on the continent. His friends everywhere will join us in wishing him a pleasant voyage, improved health, and a safe return.

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ISOLATING MATERIAL FOR STEAM PIPES.—The committee for the trial and inspection of boilers of the State of Saxe-Anhalt, Germany, recommend the following composition for the above purpose: 182 pounds limestone, 385 pounds coal, 275 pounds clay, and 330 pounds sifted coal ashes. This is finely pulverized and mixed with 660 pounds of water, 11 pounds sulphuric acid at 50° B., and 160 pounds of calves' hair or hog bristles. The compound is applied to the pipes in coats of 0·4 inch thickness, repeated until a thickness of an inch and a half is obtained, when a light covering of oil is given.

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THE spring or summer season opened with unusually hot weather in Europe, but soon afterwards severe cold seems to have set in. The sudden change is accounted for by M. De Fonvielle, a French savant, by the fact that the earth is passing behind a ring of asteroids, which absorb a portion of the sun's warmth, due to us while it remains above the horizon. The temperature will not resume its ascensional movement until the annual rotation shall have carried our sphere from the shadow of the multitude of small planets which is always projected on the same point of our orb.

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M. PASTEUR, the distinguished French chemist, has recently been awarded the sum of $2,400 by the National Assembly of France in recognition of his eminent services and discoveries.

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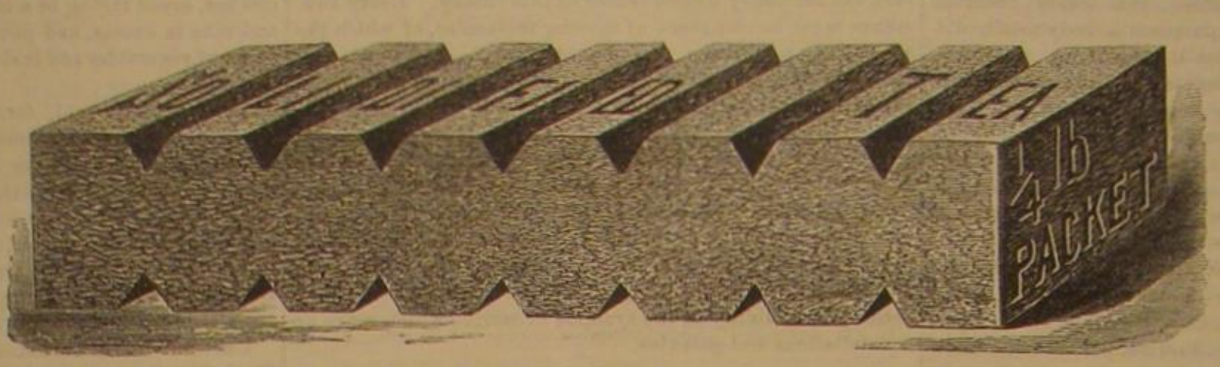
THE man who has thoroughly mastered a scientific principle holds a key which opens many locks.—*Tyndall.*

### SOLIDIFIED TEA.

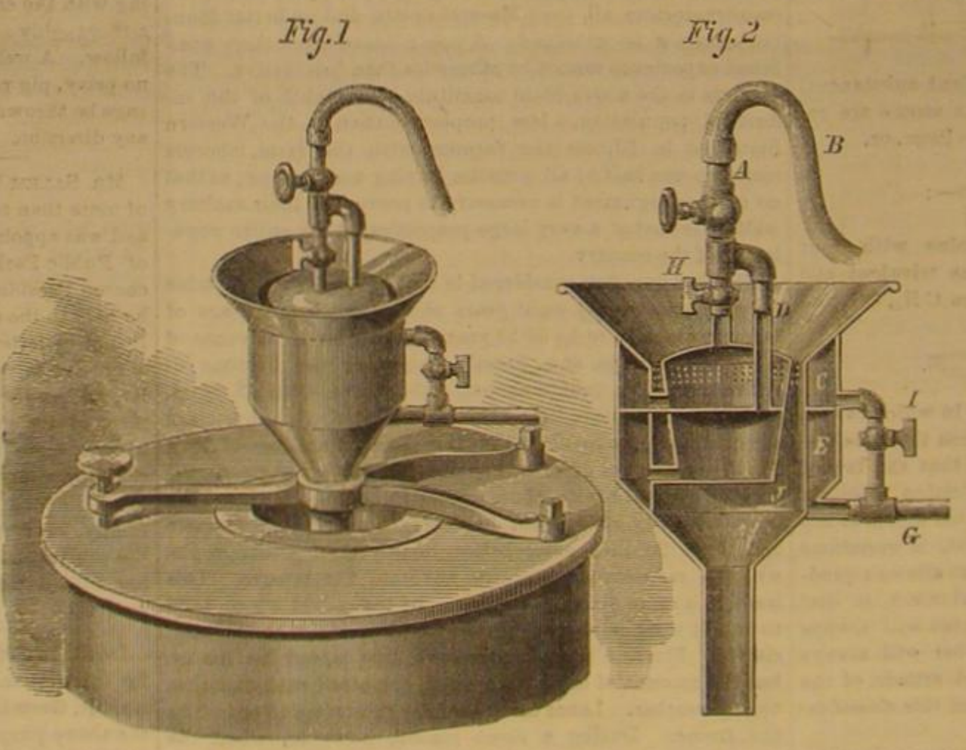
A novel mode of preparing tea for the retail trade, consisting in compressing the leaf into blocks of the size and shape represented in the annexed engraving, has been patented February 24, 1874, through the Scientific American Patent Agency. The advantages of the solidified tea, as it is termed, consists in a gain, claimed to be from 30 to 40 per cent, in the process of solidifying, both in strength and flavor. The reason ascribed is that the enormous pressure brought to bear on the leaf crushes the small cells, which contain the essential strength and real flavor of the tea, which is, to a great extent, wasted in using tea not so treated. Theine, the essential property in tea, has a tendency to prevent the decay of bone, hence the natural craving after tea by most elderly persons. Now the inventor considers that the process of solidifying thoroughly brings to the surface the theine in tea, thus rendering it medicinally superior to the article not so treated. The many properties thus set free, also insures, it is believed, an efficacious antidote to nervousness. As much strength is obtained in five minutes from the solidified tea, it is claimed, as can be drawn out of the same tea, not solidified, in five hours. The tablet, weighing four ounces, is divided into half ounces, so that the consumer can calculate how much should be used in a week or a month. Thus prepared, the tea is necessarily genuine, and cannot be adulterated. It is sold in a form that makes waste, deterioration, or loss of aroma, it is claimed, impossible. To travelers going abroad, its advantages are plain, as it occupies only one third the space of ordinary tea; and to families, hotel keepers, and institutions, the saving effected by the invention will probably be large.




State and county rights for sale. Address James Spratt, 54 Knowle Road, Brixton, London, S. W., England. Samples of the solidified tea may be seen at this office.

### IMPROVED WHEAT STEAMER AND DRYER.

Many millers, after having tried various improvements for steaming wheat, have been compelled to abandon them in consequence of the grain passages clogging up with dampened wheat. The feed of the burrs being thereby altered, the constant watching of the miller is required to keep his mill grinding evenly, and to prevent the result of the wheat not being uniformly steamed. By reference to the illustration, it will be noticed that, in the device represented, the grain passage widens downwardly, to afford a greater space for the grain as it swells by the effect of the steam. This is very important for a wheat-steaming apparatus, and the patentee proposes to employ such form, whether the passage be annular, as shown, or otherwise. This apparatus may be placed between the stock hopper and burrs, if more convenient, or may be used as a silent feed, as shown. The tube, A, passes through the feed lever and is raised and lowered in regulating the feed of the stones with perfect facility. The steam connection is made by means of the flexible rubber steam hose, B, which connects with the steam pipe. The latter conducts the steam into the upper or steaming chambers, C, the walls of which are perforated. D is a branch pipe which conducts the steam into the lower or drying chambers, E. G is an escape pipe for condensed steam from both upper and lower chambers. The walls of the inner and outer chambers, C, are perforated, so that the steam may pass into the grain for steaming it from both sides as it descends in its passage. Below these perforations, the grain is subjected to the hot walls of its conduit, by which the surface dampness is dried off, after it has been sufficiently moistened to toughen the bran. H and I are stopcocks, to shut off the steam entirely from the upper or steaming chambers. J represents the grain passage, which widens downwardly, and in this example is of annular form. Above the passage is the hopper from which the wheat flows into the former. If the apparatus is to be used for drying grain which is too damp for grinding or does not require steaming, the steam will be shut off from the upper or steaming compartments; or by closing the globe valve shown, the steam is shut off altogether.




HUNT'S IMPROVED WHEAT STEAMER AND DRYER.

Patented through the Scientific American Patent Agency, March 24, 1874. For further particulars address the inventor, Mr. Pardon B. Hunt, Council Bluffs, Iowa.

### The Gas Wells of New York.--- New Plan of Heating the Canals in Winter.

The novel proposition of Mr. R. A. Cheseborough to keep the Erie canal open in winter by means of steam pipes laid in the canal, at a cost of $1,500,000 per annum, is now seconded by Professor Charles Plagge. The latter suggests the possibility of greatly reducing the cost for fuel by making use of the immense national supplies of gas which this State contains.

According to Professor Henry Wurtz, there are at least three belts of gas wells running across the State of New York, from east to west. Professor Wurtz assumes the average tension of compression of the gas contained in the three gas charged horizons (the Salina, Marcellus, and Genesee), at 20 atmospheres. Estimating the porosity of the rock at only 5 per cent of its volume, the whole gas contained in the rock will assume at the surface the volume of the rock itself. If, therefore, the three New York belts are 200 miles long, and equal in mass to ten miles wide, and of 100 feet thickness (a moderate allowance), they will supply more than three thousand wells, each discharging 500,000 cubic feet of gas per 24 hours, for over 100 years. As, practically, 20,000 cubic feet of marsh gas (the principal constituent of the gas of natural gas wells) may be assumed to be equal in heating capacity to one tun of anthracite, the amount of heat which could be drawn through out the middle tier of counties in Western New York is equal to 75,000 tuns of anthracite per day, or to 27,375,000 tuns per year. Although the line of outcrop of the Marcellus formation, from which the West Bloomfield gas comes, lies south of the line of the Erie canal, Professor Wurtz has also shown, in the same memoir, that the gas found in boring at Buffalo comes from strata lying far deeper and cropping out many miles further north than the Marcellus; and that on the general line of the canal, the Hamilton and Salina will be found for great distances, so situated as to be reached by borings not far therefrom, and at depths which will ensure their having retained their original gaseous contents unimpaired by outcrop leakage. It may therefore be accepted, with implicit confidence, that there are throughout that part of the State large districts within which, by judicious explorations, an immense number of natural gas wells may be developed, furnishing a fuel which raises itself out of the mine, and which may be made to transport itself to any point required. This almost inexhaustible source of fuel is the more valuable for the warming of the water in the canals, as the apparatus required can be constructed at a comparatively small expense and in such a way as not to need any extra hands for its attendance; so that the expence of keeping navigation open all winter will be confined to little more than the interest on first cost of plant, which will probably not be greater than that as estimated above for artesian wells.

### The Samoan Islands.

Colonel A. B. Steinberger, late United States special agent to the Samoan or Navigator's Islands in the South Pacific Ocean, has recently submitted a report embodying much interesting information concerning that little known section of the globe. The entire group over which his examinations extended is between 13° 27′ and 14° 18′ south latitude, and reaches from 169° 28′ to 172° 48′ west longitude. The islands are of volcanic formation, which everywhere gives evidence of great antiquity, and seem to have been lifted from the ocean bed by a mighty convulsion of Nature.

With the political character of Colonel Steinberger's mission, we have nothing to deal. In scientific intelligence, however, and notably with reference to the structure, climate, etc., of the islands and their inhabitants, the report offers profitable reading. In the writer's graphic description of this remarkable land, we read of strange structures, apparently the ancient works of man, regarding which not even tradition is extant. The smoothness of the stones, and their erection in pillars and slabs of circular form, show past human labor, a fact further proved by the discovery of a large quarry of laminated lava which had evidently been worked once, though it is now buried in a dense forest. Along the coast great lava walls, some fifty feet above the sea level, extend, pierced with caverns which at certain times are the conduits of huge water spouts.

There are caves, we are told, unknown even to the missionaries, forming an arterial system, beneath a heavily timbered stretch of country, for miles. In some places the roof is a perfect arch, and quite as symmetrical as the finest railway tunnel. The various tropical trees indigenous to southern latitudes exist in great profusion, while others, comparatively unknown and of curious properties, abound. The anauli is a tree of excellent hard wood, which is a vegetable caustic not less positive in its action than nitrate of silver. The fau has a peculiar inner fibrous bark, from which fishing nets and fine lines are made, and also a beautiful white mat which resembles dressed sheepskin. The tensile strength of the fiber is greater than that of silk or hemp. The ava yields an intoxicating drink, which is prepared from the dried root by a disgusting process of mastication by young girls, and strained through cocoanut fibers into a large bowl hewn from the trunk of a tree, the inner side of which, from constant use, attains a beautiful pigeon blue-colored enameled surface of high polish.

The report, we notice, puts forward as a strong point the discovery of a living dodo, a fact which, if true, would be of the highest scientific importance. But, unfortunately, both the writer, as well as several of our cotemporaries who have commented upon the fact, are mistaken. The *didunculus strigirostris*, or three toothed pigeon, is not an extinct bird, and never has been considered as such. It constitutes the first subdivision of the *columbæ*, and is allied, it is true, to the real dodo (*didus ineptus*), which is actually extinct, and is the type of the second division. Professor Richard Owen, F.R.S., describes the *didunculidæ* with considerable minuteness and classifies them as above. He states that they exist only upon the Navigator's Islands, and that they are trained and kept as pets by the natives. The bird is of interest as showing the living connection of the pigeons with the dodo, a question at one time a matter of considerable dispute among naturalists, but it is far from even closely resembling the true fowl. The three toothed pigeon, for instance, is about the size of a partridge, while the dodo was as big as a swan; besides, there are a variety of other positive and distinct differences which it would be idle to particularize. If Colonel Steinberger had ever consulted Appleton's "Cyclopedia," he would have been spared the mistake of confounding the *d. strigirostris* with its larger relative.

The flying fox, which is abundant, enters into the structure of the native religion. Specimens of this strange animal have been found measuring four feet from tip to tip of the wings.

The temperature of the islands is remarkably uniform, averaging for four months about 80°. The equability of the climate, rarely varying over more than 7° from sun to shade, renders the body extremely sensitive to its changes. The people are Polynesian Malay, symmetrical in form, and simple in their habits. They are readily taught, and few, it is said, cannot read and write their own language. The population is about 35,000. *Ie*, the Samoan "fine mat," enters more largely into their political organization than any creed or custom they have ever held. Families count their wealth, and all real and personal estate is counted, by mats, and the sacredness of the cloth is everywhere venerated.

The trade of the country consists in cotton and copia, or dried cocoa nut, that in the former being insignificant, and in the latter amounting to a home value of over three million dollars.

### A Golden Chicken.

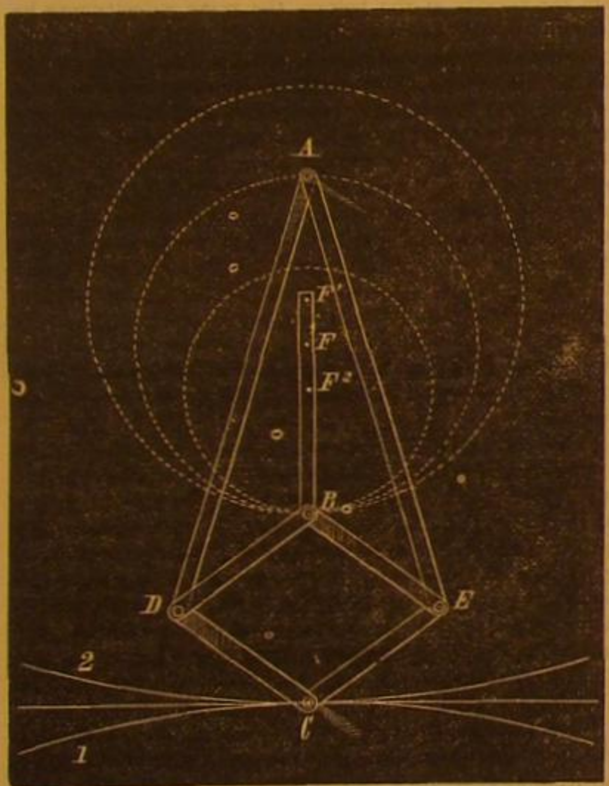
The Vallejo (Cal.) *Independent* describes the following singular search for a gold mine: A short time ago Smith and Barr sold a chicken to a customer. A day or two ago the customer returned and was anxious to learn from whom Smith & Barr had purchased that chicken. At first he declined to tell why he wished to know, but finally told that he had found pieces of coarse gold in the chicken's crop, and was satisfied that there must be plenty of it where the chicken came from. The chicken was traced to a man and his wife who brought down a lot from Lake County, and the gold hunter started off in quest of the chicken raisers. He is going to scour the country until he finds them, and then he expects to see gold lying around on the ground loose and in great abundance.

RED COLORING MATTER OF THE BLOOD.—M. Béchamp has isolated the red coloring matter of blood, which shows the presence of iron.

### A NEW PARALLEL MOTION.

Parallel motion is the conversion of circular motion into rectilinear or the contrary, the best if not the most familiar example of which is found in the action of the beam and piston of the ordinary steam engine. Watt's parallel motion is to be found, in principle, embodied in almost every device of the kind; but that it is not mathematically exact, has long since been proved.

Professor Sylvester, in a recent lecture, a report of which we find in *Iron*, states that an absolutely perfect parallel motion has been discovered by M. Peaucellier, a young French officer of engineers, who gave to it the name of compound compass. The invention is illustrated in the annexed engraving, from which the reader can readily construct a model for himself in order to verify its action. It consists simply of six pieces jointed together, and A is the fulcrum around which the entire apparatus moves. B is the power point, and C the weight point. The figure formed by the four short arms, between B, C, D, and E, is the rhomb, and A D and D E, the connections. The form of the rhomb and the actual length of the connectors is immaterial, the only conditions being that the latter are equal, and that the three points, A B C, lie always in the same line, no matter what the position of the machine may be. A moment's consideration will show that if the near point, B, be brought to A, the further point, C, will recede, so that the path followed by C, when it is moved, will be inverse to that of B in respect to A. If by any means the point, B, be made to travel in a determinate course, the curve described by C will be equally definite and invariable. At B, the bar, B F, is added, forming the radius of a circle, which B will describe about F F¹ F², as centers. If now the center of this circle be fixed at F², so that the circumference falls inside the point, A, then C will describe the external or convex circle, marked 1. If the radius be lengthened so as to reach F¹, and to be greater than half the distance, A B, then the orbit of B will contain A within it, and C will move in an arc of a circle concave to A, marked 2. It requires no mathematical reasoning to show,




for it is self-evident, that the curves thus described will grow flatter and flatter the nearer the center of the circle of B is to the actual center of the line, A B; and as Nature never acts *per saltum*, there must be a point in the process of change from one kind of curve to the other where the inverse path of C ceases to be a curve, when it theoretically describes two arcs of infinite radius, each looking to a center infinitely distant: in other words, a straight line. This clearly cannot happen when the radius, B, is either greater or less than half of A B, and therefore it can only be when F actually coincides with the center of A B. But in this case B, in its orbit, will evidently pass through A, and, by geometrical laws, the inverse, described by C, will be a straight line, so that the result is not merely practically but theoretically a perfect parallel motion. It gives us the means of converting circular into rectilinear motion with perfect accuracy, without friction and without any necessity of packing or any other faulty contrivances which have been inseparable from every system hitherto desired for the purpose of producing the same result.

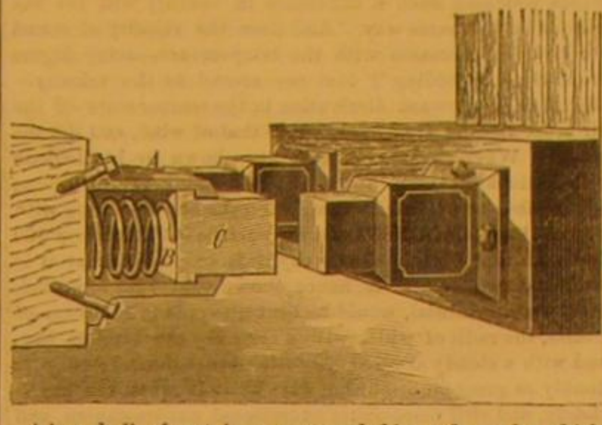
#### Absorption of Hydrogen by Gray Pig Iron.

Mr. John Parry lately read a paper before the Iron and Steel Institute on the above subject, also on the probable absorption of zinc, cobalt, cadmium, bismuth, and magnesium, by gray pig iron heated in vacuo, in vapors of the same. This was exclusively a chemical paper; and so far as the experiments detailed can be as yet considered conclusive, it adds, to our previous knowledge of the strange absorbent and occluding power of iron for gases, that it possesses the like power in reference to a number of metallic vapors, among which that of metallic arsenic is remarkable from the circumstance stated by the author, that its vapor when once absorbed is not again evolved upon heating the iron.

By the new postal treaty, letters of half an ounce may be sent from the United States to France for 9 cents.

### IMPROVED CAR BUMPER.

Mr. Richard Lloyd, 265 Walker street, Cleveland, Ohio, has patented, April 28, 1874, through the Scientific American Patent Agency, a novel bumper for railroad cars, which is claimed to be more durable and elastic than those now in use. Our engraving exhibits the device in perspective and also in section.

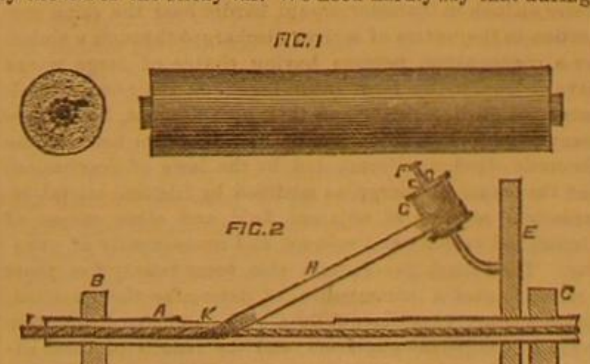



A is a shell of cast iron, surrounded by a flange by which it is bolted to the timber of the car truck. Within the shell is a spiral or rubber spring, B, and on the interior of the former is a shoulder, with which the head of the bumper block, C, projects sufficiently to engage. The head and shoulder are held in contact with each other by the spring except when the cars come together; then the spring is compressed. The two bumpers, thus coming in contact, prevent the violent concussion and jar, alike disagreeable to passengers and destructive to the vehicles. The shell and block may be of any form and size. The device is stated to be cheap and durable, and may be easily applied to any car. Further information may be obtained by addressing the inventor as above.

### THE NEW ATLANTIC TELEGRAPH CABLE—HOW IT WAS MADE.

As the new Atlantic telegraphic cable, which is to extend from Ireland direct to the United States, landing on the New Hampshire coast, is nearly completed and is soon to be laid, we have thought that our readers would be interested in knowing just how the great conductor was manufactured. We take the following description from the *Engineer*. The cable was made at the works of Messrs. Siemens Brothers, Charlton (near London), England.

The new cable is rather peculiar in construction, and we append a full sized section and elevation of a portion of the core, Fig. 1. It will be seen that it consists of one thick central wire, round which are spun eleven fine copper wires, the core passing first through a peculiar composition, which, when cold, serves to bind the whole copper rope, as we may call it, strongly together. By this arrangement the largest available sectional area of copper is got with a given diameter. It is evident, however, that all elasticity, except that due to the stretching of the internal wire, is lost; whereas in an ordinary stranded wire rope, there is always a small amount of resilience due to the spiral lay of the strands. The wire, having been coated with gutta percha, is then "served" with manilla fiber to a diameter of ½ inch, and this is in turn covered with ten iron wires spun on, each wire being itself first covered with hemp; after this the rope passes through two tar troughs, tar being continually poured on it by an endless chain. It is then wound with twine in a very open spiral, to hold the main strands in close contact till the tar is cold; and the rope then passes to one of three or four enormous tanks on the premises until it is wanted on board ship, the only further preparation it goes through being to coat it with powdered chalk to prevent the coils from adhering to each other by the aid of the sticky tar. We need hardly say that during




the whole process of manufacture testing is carried on almost continuously, so that a fault cannot escape detection.

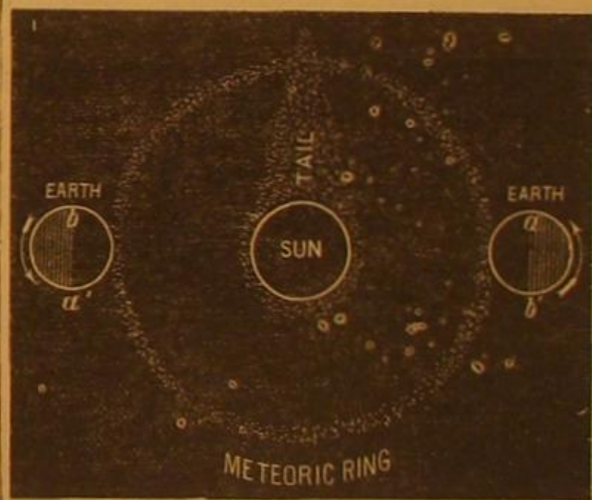
We cannot leave the subject, however, without describing the way in which India rubber is used to cover cables, as the process is exquisite and totally different from that employed when gutta percha is used. At the time of our visit some cable was being made, for what locality we do not know. The core consisted of six thin copper wires, spun together with a long twist; all the wires were tinned separately before spinning. The India rubber, which comes over to this country in large lumps or bottles, is masticated and washed, and worked between rollers, in a way too well known now to need description. It is finally reduced to a thin sheet, a little thicker than the air balls sold as children's toys in the streets. Strips of this, about ½ inch wide, are cut out and wound on a reel or bobbin; this is mounted on a spindle on a disk, as in the annexed sketch: A is a piece of iron tubing about 3 feet long, revolving on bearings at B and C, and fitted with a disk, F, which carries the inclined stud, which can be shifted on F. This supports the bobbin, G, round which is wound the strip of India rubber, H, a thumb screw adjusting the resistance of G. The wire is shown at I, and passes from one reel to another down the tube, A; at K a long slot is made in the tube, through which the strip of India rubber passes. It is obvious that if the wire is prevented from rotating, and proceeds from coil to coil, while A and F rotate round it, that the strip of India rubber will be wound off G and on the core. In this way the core receives its first coat. For the second, it passes through an elegant little machine, the principle of which is sketched in Figs. 3 and 4. Here C is the core, with its first coat of India rubber put on as just described; B B are two small rollers through which it passes, and D D are two strips of thin India rubber about ½ inch wide, one over, the other under, the wire. These are drawn in with the wire, which next passes between the edges of the grooved disks, A A. These compress the edges of the rubber and coat the wire equally. If there were nothing more the wire would appear as in Fig. 5, two fins of rubber, A A, sticking out at each side. It will be seen, however, from Fig. 4, that the lower disk has a thick edge, against which rotates the sharp cutting disk, *x*; this shears off the superabundant fin, A A, Fig. 5, and so the wire comes out coated with three coatings—for it passes through two machines like Fig. 3—pink, round, and smooth, and ready to be served with canvas for use.

## Correspondence.

#### The Zodiacal Light.

*To the Editor of the Scientific American:*

On page 320 of your current volume, Professor Wright is credited with being the discoverer of the cause of the zodia-




cal light. It seems that he has satisfied himself of the fact that the said light is "derived from the sun" and reflected to us from solid or meteoric material, "small bodies," as he calls them. Now I told your readers all that, and much more, over five years ago, as can be seen in your issue of January 8, 1869. Then I stated substantially what I say now: That the zodiacal light is not on two sides of the sun, neither is it all around the sun, nor is it a solar atmosphere, nor a nebulous vapor; but, on the contrary, it is ever on one side of the sun only, his hinder side, if you will, and is purely meteoric.

I said, further, that the said light was and is a longitudinal appendage or tail of the sun, and is so long that it stretches some 37,000,000 miles beyond the earth's orbit. I said also that the earth either passes through it or by it, on about the 14th of every November. In addition to that, I say now that the earth passes through it every 33 years, and by it, at more or less distance from it, in the intervening years, the cause being that the plane of the terrestrial orbit is but slightly out of the plane of the solar orbit.

Professor Wright is doing for me, in his practical way, in reference to the zodiacal light theory, what Professor Agassiz did in reference to my glacial epoch theory: he is proving my theory to be true; but that he is the discoverer of the theory, I claim, is not the fact.

That the zodiacal light is solar light reflected to the earth from meteorites, is undoubtedly the fact. But one thing remains to be settled; it is this: Is the zodiacal light a ring or a longitudinal tail of meteors?

The zodiacal light is seen after sundown, in this latitude in April and May; and before sunrise in October and November. If it were a ring, it could be seen at evening and morning of both periods. Any person can prove the fact by a diagram such as the one annexed.

In the figure, *a a'* represents morning, *b b'*, evening. From which it may be seen that, at *a*, a person could see the tail, but while at *a'*, he could not see it. So while at *b* he could see it, but at *b'* he could not see it. At the same time, if the said light were a ring, he could see it evening and morning, at *a a'* and *b b'* of both seasons. It cannot so be seen, and therefore it is not a ring, as is supposed by Professor Wright and others. JOHN HEPBURN.

Gloucester, N. J.

### The Recent Boiler Explosion in Philadelphia.

*To the Editor of the Scientific American:*

We have read, in your issue of May 30, the article of W. Barnet Le Van on the boiler explosion at the mills of Mr. Henry Hoppen, Philadelphia. In his allusion to the work of the Hartford Steam Boiler Inspection and Insurance Company, the impression is carried that it was carelessly and inefficiently done. The facts are these: We formerly had charge of Mr. Hoppen's boilers; but at the inspection which was made in June last, we pronounced the boiler which exploded unsafe until repaired, and declined to assume any risk or responsibility, either pecuniarily or morally, until such repairs were made and the boiler re-inspected. The repairs were not made under our supervision, nor were we called to make an inspection after they were made. We had issued no certificate, and had no responsibility whatever in the matter. The intimation that the boiler was under our care and considered safe by us is entirely gratuitous.

Hartford, Conn. J. W. ALLEN, President of the Hartford Steam Boiler Inspection and Insurance Company.

### A Curious Freak of Nature.

*To the Editor of the Scientific American:*

A few days since there was hatched under one of my hens a double bodied chicken, having but one head. The two bodies were perfectly developed up to the point where the vertebræ of the neck began. There was but one breast bone, which ramified towards each body. There mere two complete backbones, four perfect feet, and four wings. Unfortunately this curiosity was accidentally killed. A dissection showed but one heart, one liver, and one gizzard. There was but one bowel leading from the gizzard. This extended about one inch from the gizzard and there ramified, giving the two bodies each a full set of bowels. The specimen is now preserved in spirits in one of our physician's offices.

Louisville, Ill. C. H. MURRAY.

### Refraction of Sound.

Professor Osborne Reynolds, in a recent paper read before the Royal Society, shows that sound, instead of proceeding along the ground, is lifted or refracted upwards by the atmosphere in direct proportion to the upward diminution of the temperature.

The lifting of the sound is shown to be due to the different velocities with which the air moves at the ground and at an elevation above it. Owing to friction and obstructions the air moves slower below than above, and the bottom of the sound waves will thus get in advance of the upper part, and the effect of this will be to refract or turn the sound upwards: so that the rays of sound which would otherwise move horizontally along the ground actually move upwards in circular or more hyperbolic paths, and may thus, if there be sufficient distance, pass over the observer's head.

It was found (as indeed it was expected) that the condition of the surface of the ground very materially modified the results in two ways. In the first place, a smooth surface like snow obstructs the wind less than grass; hence over snow the wind has less effect in lifting the sound moving against it than over grass; and it is inferred that a still greater difference would be found to exist in the case of smooth water. Under ordinary circumstances, the sounds which pass above us are more intense than those we hear. The general conclusions drawn from experiments are:

1. The velocity of wind over grass differs by ½ at elevations of 1 and 8 feet, and by somewhat less over snow.

2. That when there is no wind, sound proceeding over a rough surface is destroyed at the surface, and is thus less intense below than above; owing to this cause, the same sound would be heard at more than double the distance over snow at which it could be heard over grass.

3. That sounds proceeding with the wind are brought down to the ground in such a manner as to counterbalance the effect of the rough surface (2), and hence, contrary to the experiments of Delaroche, the range of sound over rough ground is greater with the wind than at right angles to its direction or than when there is no wind. When the wind is very strong, it would bring the sound down too fast in its own direction, and then the sound would be heard farthest in some direction inclined to that of the wind, though not at right angles.

4. That sounds proceeding against the wind are lifted off the ground, and hence the range is diminished at low elevations. But that the sound is not destroyed and may be heard from positions sufficiently high (or if the source of sound be raised) with even greater distinctness than at the same distances with the wind.

5. In all cases where the sound was lifted, there was evidence of diverging rays. Thus, although on one occasion the full intensity was lost when standing up at 40 yards, the sound could be faintly and discontinuously heard up to 70 yards. And on raising the head, the sound did not at once strike the ear with its full intensity nor yet increase quite gradually; but by a series of steps and fluctuations in which the different notes of sound were variously represented, showing that the diverging sound proceeds in rays separated by rays of interference.

On one occasion it was found that, with the wind, sound could be heard at 360 yards from the bell at all elevations, whereas at right angles it could be only heard for 200 yards standing up, and not so far at the ground; and against the wind, it was lost at 30 yards at the ground, at 70 yards standing up, and 160 yards at an elevation of 30 feet, although it could be distinctly heard at this latter point at a few feet higher.

It is argued that, since wind raised the sound simply by causing it to move faster below than above, any other cause which produces such a difference in velocity will lift the sounds in the same way. And since the velocity of sound through air increases with the temperature—every degree from 32 to 70 adding 1 foot per second to the velocity—therefore an upward diminution in the temperature of the air must produce a similar effect to that of wind, and lift the sound. Whereas Mr. Glaisher has shown by his balloon observations that such a diminution of temperature exists; and further he has shown that, when the sun is shining with a clear sky, the variation from the surface is 1° for every 100 feet, and that with a cloudy sky it is only half what it is with a clear sky. It is hence shown that rays of sound, otherwise horizontal, would be bent upwards in the form of circles, the radii of which with a clear sky are 110,000 feet, and with a cloudy sky 220,000 feet, so that the refraction is doubly as great on bright hot days as it is when the sky is cloudy, and still more under exceptional circumstances, and comparing day with night.

It is then shown by calculation that the greatest refraction—110,000 feet radius—is sufficient to render sound from a cliff 235 feet high inaudible on a ship's deck 20 feet high at 1½ miles, except such sound as might reach the observer by divergence from the waves above; whereas when therefraction is least—220,000 feet radius—or where the sky is cloudy, the range would be extended at 2¼ miles with a similar extension for the diverging waves. It is hence inferred that the phenomenon which Professor Tyndall observed on July 3, and other days—namely that, when the air was still and the sun hot, he could not hear guns and sounds from the cliffs of South Foreland, 235 feet high, for more than two miles, whereas, when the sky clouded, the range immediately extended to three miles, and as evening approached, much farther,—was due, not so much to stoppage or to reflection of the sound by invisible vapor, as Professor Tyndall has supposed, but to the sounds being lifted over his head in the manner described.

There are many other phenomena connected with sound, of which this refraction affords an explanation, such as the very great distances to which the sound of meteors has been heard, as well as the distinctness of distant thunder. When near, guns make a louder and more distinctive sound than thunder, although thunder is usually heard to much greater distances. In hilly countries, or under exceptional circumstances, sounds are sometimes heard at surprising distances. When the Naval Review was at Portsmouth, the volleys of artillery were very generally heard in Suffolk, a distance of 150 miles; the explanation being that, owing to refraction, as well as to the other causes, it is only under exceptional circumstances that distant sounds originating low down are heard near the ground with anything like their full distinctness, and that any elevation either of the observer or of the source of sound above the intervening ground causes a corresponding increase in the distance at which the sound can be heard.

### The Measurement of Flowing Water.

There is probably no point which has occasioned more dispute and litigation than the conflicting rights of persons entitled to take water power, in certain proportions, from a common source, where the demand exceeds the supply. The experiments, conducted by mathematicians and philosophers, have been, many of them, conducted on a small scale, and the results are not regarded as entirely conclusive, as the causes of contraction and other phenomena in a vein of water an inch in diameter would hardly bear the same proportion to the waters of a river discharged through a sluice. As a consequence, persons having charge of large works have endeavored to form rules based on their own experience. English engineers, on their own account, have made many experiments to determine the difference between the theoretic discharge (computed by the laws of gravitation) and the actual discharge, as modified by friction, lateral retardation, reaction of adjacent fluid, and other causes of diminished velocity and volume, and consequently of quantity. The French government also, some twenty-five years ago, appointed a commission to determine the question, and elaborate experiments on a very extensive scale were made by competent engineers, and the results of these experiments have brought the question within narrow limits.

In the "Philosophical Transactions" of the Royal Society of London, we have the following conclusions, which have been deduced from the experiments just referred to: 1. That the quantities. discharged in equal times, are as the areas' orifices. 2. That the quantities, discharged in equal times under different hights, are to each other nearly in the compound ratio of the areas of the apertures and of the square roots of the hights. The hights are measured from the centers of the apertures. The mean result, also, of several experiments, all the openings being formed in brass plates 1-20 of an inch thick, showing that, for round, triangular, and rectangular holes, the average of the numbers showing the proportion, between the theoretic discharge of the water calculated as a falling body, and the actual discharge as measured, was 6·1, and for the rectangular holes it was 6. It has also been found that the effect of gravity may be represented by 64 feet 4 inches, or 64·3—that is, the hight in feet through which the body falls, being multiplied by 64·3, will give the square of its velocity in feet per second. For the actual discharge per second in cubic feet, multiply the product of the altitude or head of water in feet, the area of the orifice in square feet, and the time in seconds, by 64·3, then extract the square root, and multiply by 6. It is found also, that with small orifices the effect of a high head is to contract the vein and to diminish the discharge, so that the nearer the orifice can be brought to the surface, and yet the water be kept running with a full stream and without causing any eddy or depression of the surface, the greater will be the discharge. But with larger apertures, as, for instance, one with 3¼ feet in length by 1⅝ feet in width, or 5⅜ square feet of area, the discharge increases with the increase of head.

As to the discharge of water from open notches in dams it is found to be equal to ⅔ of the discharge from an orifice of the same size with a full stream under the same head. The proportion between the theoretic and the actual discharge from the open notches varies with the depths, the factors used being less with the greater depths. An English handbook of tables gives 214 cubic feet per minute as the quantity which would run over every foot in width of a regular notch 1 foot in depth from the water's surface. The amount discharged depends very much on the form of the notch or aperture. A plain rectangular notch, cut with square edges in a three inch plank, will discharge very much less than one which has its inner edges beveled or rounded off in the parabolic form of the contracted stream or vein of water. If the aperture be small, the difference may amount to a fourth of the whole quantity. Care should also be taken to form the wing-walls to sluices with curved or trumpet-shaped approaches, conformed to the natural contraction which may be produced by the overflow or sluice way.

To obtain the quantity which passes through a parallel channel in a given time, the sectional areas should be multiplied by the mean velocity, the latter element being obtained by adding the velocity of the water at the surface and that at the bottom of the current and dividing the sum by two. As it may not be convenient, in every case, to ascertain the velocity at the bottom, the mean velocity may be determined, with accuracy sufficient for practical purposes, by ascertaining the surface velocity in inches per second in the middle of the stream, and the mean velocity will be equal to this velocity less the square root of this velocity *minus* five. If, for example, the surface velocity in the stream is equal to 36 inches per second, the mean velocity will be found by subtracting 5 from 36, leaving 31, then extracting the square root of 31, which is 5·5, and subtracting this last figure from 36, giving 30·5 inches per second for the mean velocity. Multiplying this number by 60 and dividing by 12, or, which is the same thing, multiplying it by 5, will give the velocity in feet per minute. In the case just supposed the velocity per minute will be 152·5 feet. If, then, the water course be 4 feet wide and 2 deep, the amount of water discharged per minute would be 152·5x8 or 1,220 cubic feet.

When the overfall is a thin plate, it will discharge a greater proportionate quantity when the stream is only one inch deep than with greater depths. When the overfall is of two inch plank, the flow of water is more retarded, a greater head is requisite, and the maximum discharge is given by a head of seven inches. When the length of the overflow plank is ten feet, the coefficient is greater with a depth of five inches; and when wing boards are added, causing the stream to converge toward the overfall at an angle of 64°, the coefficient is greater even when the head is less, showing the utility of proper wing walls on sluices.

To determine the hight of the waterfall in a running stream, a small temporary dam, unless one exists, must be made, so as to secure a still surface. Take two poles sufficiently long to reach from the bottom of the water to the required line level. Make a plain mark or notch on both sticks, at a distance from the upper end equal to the distance of the intended line level above the water, marking that distance in feet and inches. Push the poles down through the water into the earth at the bottom until the notches are both at the level surface of the water, care being taken to have the poles plumb and at a convenient distance apart. Sight across the tops of these two, and set as many more as may be desired to run the line of level to the desired point, and the tops, being ranged accurately by the first two, will show a water level so many feet above that of the water. It is estimated that this is a more accurate way than the use of the ordinary spirit level.—*Boston Lumber Trade.*

### Comparative Economy and Intensity of Electric Light and Gas.

The London *Daily News* says: Some curious and useful information about the lights displayed from the Clock Tower of the Houses of Parliament is given in a report just made to the House of Commons. It appears that the two semi-lanterns, which a spectator at Westminster sees 250 feet above him in the Clock Tower, are in the hands of two rivals—one of whom employs gas, and the other electricity, as the source of illuminating power. The Wigham light has three burners, each composed of 108 jets, placed one above another on the same axis. The electric light is produced by an electromagnetic machine, worked by steam power, the currents being conducted from the machine to the lantern along 1,700 feet of copper wires. The report is decidedly favorable to the electromagnetic process. Thus Mr. Douglas states that the electric light has a superior intensity of 65 per cent when one 108 jet burner is used, and of 27 per cent when three are employed. So, again, as to cost: the electric method produced a saving of 162 per cent, measured in cost per candle per hour, when a 108 jet gas burner is used, and of 133 per cent when three burners are used."

## PRACTICAL MECHANISM.

NUMBER I.

BY JOSHUA ROSE.

### Introduction.

The education of the machinist in the science governing the daily practice of his art has not received its proper share of attention at the hands of those authors who have written books upon mechanical subjects: and the artizan is, in consequence, deprived of the aid derivable from the experience of the thousands who have trodden the same path before him. Hence it takes years of practice and observation to acquire knowledge which could be gained in a comparatively short space of time by the aid of a little book learning.

To converse intelligently with the artizan, it is necessary to employ language and terms with which he is familiar; and in cases where calculations are required, they should be of as simple a nature as possible, because the practical machinist is not usually versed in algebra; and if he finds that the information of which he is in pursuit is treated only in formulas whose meanings are a mystery to him, he becomes discouraged and abandons the task of their elucidation. When, on the other hand, the mechanic is encouraged by the easy acquirement of the desired knowledge, it proves an incentive which leads him to higher paths of study, into the pursuit of which he had at first no idea of entering.

Practical workmanship is not a mere matter of accustoming the fingers to perform mechanical movements; but is governed by a series of distinct principles, simple and complex, the employment of which depends at all times upon the perception and judgment of the artizan. Nearly the whole distinction between an expert and an indifferent workman consists in their relative capability to perceive the principles applicable to particular work, and in their readiness in overcoming the innumerable little obstacles which present themselves, rendering a deviation, at times, from a common rule either highly advantageous or absolutely necessary.

The inexperienced or unobservant mechanic frequently fails to recognize the very principles he applies to his work, although conscious of a large class of conditions under which he would proceed by the same method; because experience has forced it upon him as indispensable in such cases. Being dependent upon the information which he may be able to gather from the particular pieces of work which chance to fall to his lot, and to such scraps of disjointed instruction as a fellow workman may feel disposed to impart, it often occurs that, when he encounters a difficulty, the more experienced hand who helps him out of it neglects to explain the principle governing the means by which the difficulty was overcome, so that the uninitiated gains nothing by the experience, and fails to perceive the numerous applications of similar remedies to parallel obstacles.

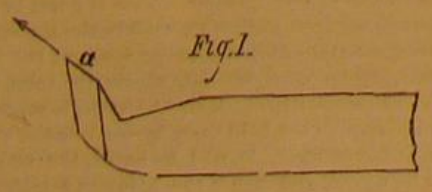
The machinist is to iron what the carpenter, joiner, cabinet maker, wheelwright, etc., are to wood, with the disadvantage that he has to design and determine the shapes and temper of his tools, which vary so much (to suit the work) that the tool suitable for one piece may be totally inadequate to perform the same service upon another, although the proportions, the texture, and the metals may be alike in both instances. We cannot, therefore, tell a good machinist by his tools, unless we know for what particular piece of work those tools were used. Nor can a machinist be judged from his shavings, because there are many kinds of work for which a tool keen enough to cut a thick and clean shaving cannot be used to advantage. Even the speeds, given in mechanical books, at which to cut metals tend to mislead, because the nature and size of the work, the depth and nature of the cut, and numerous other influences render the variation of the cutting speed at times one third greater or less than the given speed. A knowledge, however, of the general rules, together with an intelligent understanding of the principles governing the exceptions and deviations, will enable the artizan, when a difficulty arises, to at once perceive its precise cause, and to apply an adequate remedy, the conditions only requiring to be understood to render the application of the principles governing them palpably necessary and easy of accomplishment; thus rendering the learning of the trade more a matter of understanding and less a matter of unintelligent labor.

The aim, therefore, of the author of these papers is to develop from the promiscuous practice of the workshop its inherent science, and to present it to the mechanic so arranged that he will find each formula the natural sequence to its predecessor; and while explaining its positive conditions, to so present its negative ones that the mind will instinctively seek the remedy which its successor will supply.

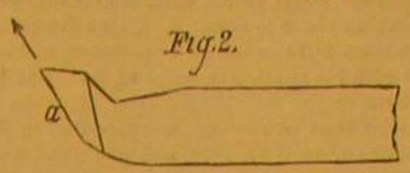
### Machine Tools.

FRONT OR TOP RAKE.

The principal consideration in determining the proper shape of a cutting tool for a machine is where it should have the rake necessary to make it keen enough to cut well, and this is governed by the nature of the work on which it is to be used. It is always desirable, when practicable, to place nearly all the rake on the top face of the tool, as shown in Fig. 1



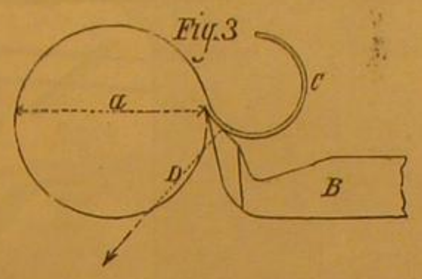

The line *a* represents the top face, the rake being its incline in the direction of the arrow. In those cases (to be hereafter specified) in which top rake is, from the nature of the work to be cut, impracticable, it must be taken off and given proportionately to the bottom face, as shown in Fig. 2,




in which the line *a* represents the bottom or side face of the tool, the rake being its incline in the direction of the arrow.

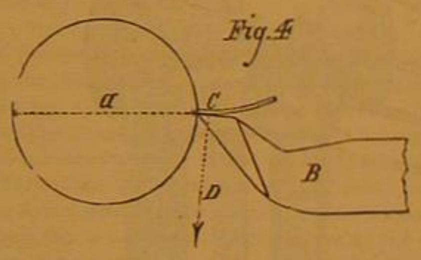
The tool possessing the maximum of top rake, as shown in Fig. 1, is the strongest, because its cutting edge is the best supported by the metal beneath it, and is so presented to the metal to be cut that the tool edge cuts freely, having no tendency to scrape.

The shaving, as it is cut off, exerts a pressure upon the top face of the tool, the line of force of this pressure being at about a right angle to the face. If, therefore, the top face of the tool possesses much rake, this line of pressure will be in a direction to force the tool into its cut (causing it to spring into the cut and break), as shown in Fig. 3.




A represents a shaft, B the tool, C the shaving being cut off and the dotted line D the line of force of the strain placed upon the tool by the shaving, from which it will be seen that, if the tool springs in consequence of this pressure, it will enter the cut deeper than it is intended to do. A plain cut (either inside or outside) admits of the application of a maxi mum of front or top rake, and of a minimum of bottom or side rake; but a tool of this description, if used upon work having a break in the cut (such as a keyway or slot), would run in and break off from the following causes:

If the strain upon the tool were equal in force at all times during the cut, the spring would also be equal, and the cut, therefore, a smooth one; but in taking a first cut, there may be, and usually is, more metal to be cut off the work in one place than in another; besides which there are inequalities in the texture of the metal, so that, when the harder parts come into contact with the tool, it springs more and cuts deeper than it does when cutting the softer parts, and therefore leaves the face of the work uneven. If less rake be given to the tool on its top and more on its side or bottom face, as is represented in Fig. 4,



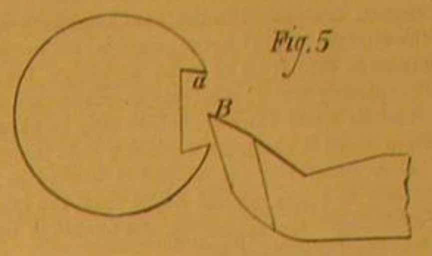

*a* being the shaft as before, B the tool, and C the shaving, the dotted line D is the direction of the strain put upon the tool by the shaving, which has but very little, if any, tendency to spring the tool into its cut.

STRAINS ON TOOLS.

The strain referred to is not alone that due to the severing of the metal, but that, in addition, which is exerted to break or curl the shaving, which would come off, if permitted, in a straight line, like a piece of cord being unrolled from a cylinder; but on coming into contact with the face of the tool (immediately after it has left the cutting edge), it is forced, by that face, out of the straight line and takes circular form of more or less diameter according to the amount of top rake possessed by the tool. A glance at Fig. 3 will show that the shaving comes off the tool there represented at such an acute angle that but little force is required to bend it out of the straight line into circular form. An inspection of Fig. 4 demonstrates that the shaving comes off the tool there described at almost a right angle to the straight line, and the grain of the metal (already disintegrated in the cutting) fragments from the force necessary to bend it to such a degree.

It follows, then, that, if two tools are placed in position to take an equal cut off similar work, that which possesses the most top rake, while receiving the least strain from the shaving, receives it in a direction the most likely to spring it into its cut. It must not, therefore, be used upon any work having a tendency to draw the tool in, nor upon work to perform which the tool must stand far out from the tool post, for in either case it will spring into its cut.

Especially is this likely to occur if the cut has a break in it with a sharply defined edge, for example, when turning a shaft with a dovetail groove in, as presented in Fig. 5. For when the edge, *a*, of the dovetail strikes the point of the tool, B, it will spring it into the cut and break it, more particularly if the point, B, of the tool is placed above the center, in which position it cuts, in ordinary cases, to the best advantage. It is apparent, then, that tools for the above description of work must be given the form described in Fig.




4, not because it is the best tool to cut the metal, but because it is the least liable to spring into its cut.

### Petroleum Fires Extinguished by Chloroform.

Some of the fiercest and most destructive conflagrations on record have been occasioned by the burning of large quantities of petroleum. It is hardly necessary to recall instances; the frequent fires in the large oil works in Brooklyn, the great conflagration in Philadelphia some years ago, and the fearful disaster on the Hudson River Railroad, due to the ignition of an oil train through collision, are within every ones recollection. Various processes have been suggested for rendering the petroleum incombustible, principally, however, based on the admixture with the oil of foreign substances and their subsequent removal before using the material. Abbé Moigno, the editor of *Les Mondes*, suggests in that journal a new means, which, he states, renders the oil absolutely proof against fire. He states that petroleum mixed in proportion of five to one with chloroform cannot be ignited; it becomes not only uninflammable but incombustible so long as the major part of the chloroform remains unvolatilized.

It is a remarkable fact, that if a quart of petroleum be poured upon a large shallow dish so that its depth will be about 0·3 of an inch, and in surfaces about three inches square, and then ignited and allowed to become well kindled, about one tenth of a gill of chloroform will extinguish the flames; and if attempts be made to relight the petroleum, the liquid will put out the match. Another experiment tried on a larger quantity of oil, though retaining the same superficial area, showed that the same amount of chloroform sufficed to repeat the result. Mixtures of explosive gases mingled with the vapors of chloroform also lose, it is stated, in a great measure their inflammability.

The chloroform must be pure and free from alcohol. If, however, the vapor of boiling chloroform or the liquid in a pure spray be introduced into the flame of burning alcohol, the latter becomes extinguished.

The composition of chloroform gives an explanation of these facts, which, however, are nevertheless very remarkable, inasmuch as most chemical treatises admit the inflammability of the substance. The formula $CH,Cl^3$ leads to the decomposition by heat with the formation of $Cl^2H$, and Cl and C become free. An æolipile, covered externally with alcohol and internally with chloroform, gives off clouds of carbon accompanied with intense fumes of hydrochloric acid.

From the preceding it would seem that, for use aboard vessels or in large storehouses where great quantities of petroleum are massed, a reservoir of chloroform would furnish a means of keeping down conflagrations, the ravages of which at the present time it is almost impossible to check. This reservoir, Abbé Moigno suggests, might be so arranged that, in case of a fire occurring in the oil at a certain point, its contents would there be conducted and discharged.

We should imagine that a system of tubes, one leading to each tank, could be connected with some electromagnetic or other fire annunciator, the action of which, caused by the heat, would open a valve and so admit the chloroform. It is true that the high cost of the latter would be worthy of consideration, but a suitable provision once made, at an expense of few hundred dollars, would, if properly enclosed, last indefinitely; and besides, the expense would be trivial beside the saving effected, of a ship and her cargo or of a large warehouse.

The author says that if his experiments, conducted on a still larger scale, prove equally successful, as he confidently expects them to do, the resources of chemistry should furnish a means of making one or the other chloride of carbon very cheaply. In fact, already the tetrachloride of carbon, $CCl^3$, may be easily produced through the sulphide. The difference between the tetrachloride and chloroform is that the latter, $CH,Cl^3$, boils at 140° Fah., and its density is 1·48. $CCl^4$ boils at 172·4 Fah. and has a density of 1·6. The tetrachloride is transformed partially into chloroform by reactions indicated in chemical works.

THE LARGEST GAS METER IN THE WORLD.—The Gas Meter Company, Limited, have lately erected, at the Independent Gaslight Company's Works, Haggerstone, London, a station meter which is the largest yet made. Its capacity is 150,000 cubic feet of gas per hour, and its measuring drum delivers for each revolution 1,600 cubic feet. The cast iron tank, with its pilasters, cornices, etc., is of the Grecian order and of the following dimensions, namely: 19 feet 8 inches square, and the total hight from floor line to the top of pediment is 20 feet 2 inches, and when filled to the working waterline contains 21,000 gallons of water. The inlet and outlet connections are 30 inches diameter. The meter works well at three tenths of an inch pressure.

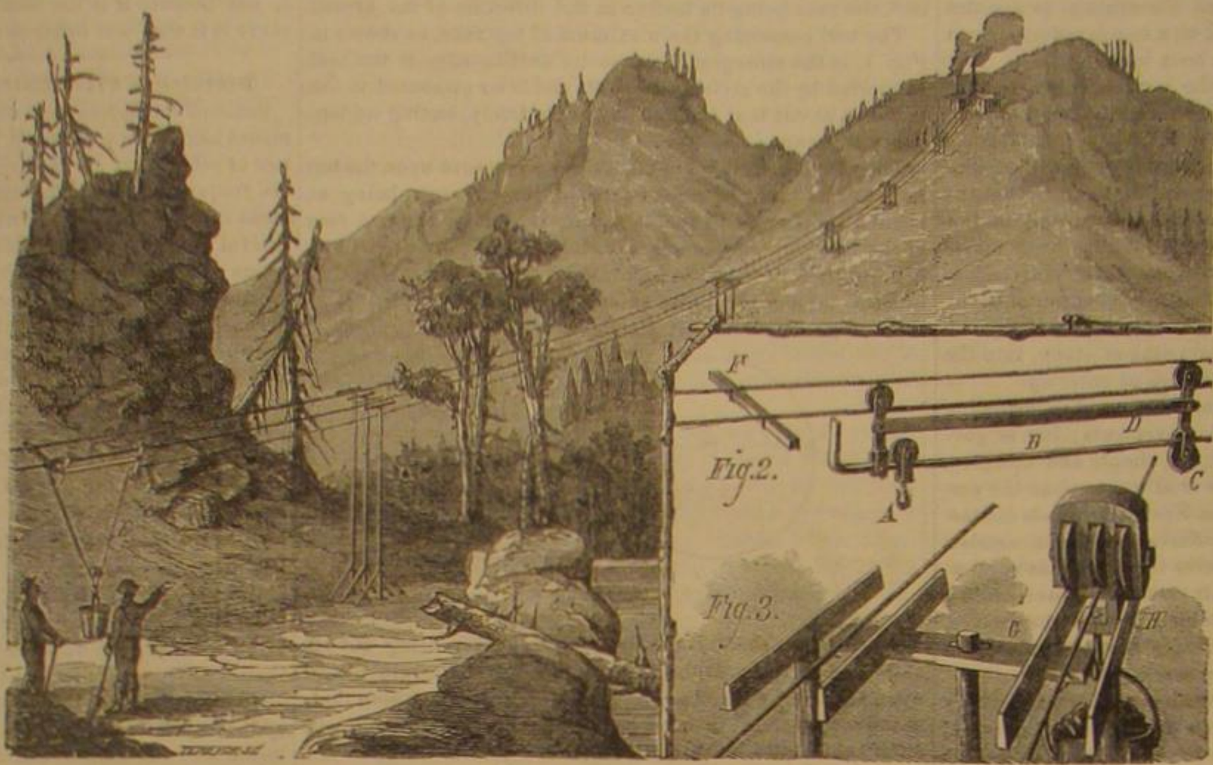
A NEW process for heliographic engraving is given in the *L'Année Scientifique*. A photographic proof is applied to a sheet of zinc, when the silver, transferred from the paper to the plate, produces a metallic layer which enables the zinc to be attacked by very dilute acids.

## WIRE WAY FOR TRANSPORTING ORES, ETC.

The invention illustrated in the annexed engraving is another of the modern useful arrangements for lowering and raising buckets or cars from or to an elevation, for the purpose of transporting water, minerals, merchandize, etc. The receptacle travels down the way, which may be at any angle to the horizon until it reaches a desired point; there, by mechanism below described, the bucket is caused to descend perpendicularly to a convenient hight from the ground for emptying or filling. On returning, the bucket is first lifted up to the way, and then hauled to the elevated point from which it started. This is all done automatically by a motor stationed on the eminence.

In our engraving is shown a general view of the invention, and in Figs. 2 and 3 the principal portions in detail. The bucket ready to descend is affixed to the hook, A, which is attached to a pulley which slides freely on the rod, B. The forward portion of the latter is hook shaped, and is pivoted to a suitable support. The rear end rests upon a pulley, C, in a similar arm. Both supporting arms are provided with wheels above to run on the wire, as shown, and are connected by a rod, D, pivoted to both. The lowering and hoisting rope, E, in the large view is, as represented in Fig. 2, attached to the rear end of rod B.

An empty bucket, starting on its downward course, is lowered by the rope, E, until the point at which the filling is to take place is reached. On the way, and directly at such point, is secured a crossbar, F, which the hook end of rod, B, strikes against. The effect of this is to disengage the rear end of rod, B, from the pulley, C, through the action of rod, D, and to allow said extremity to descend. The bucket of course slides down by its own gravity, leaves the rod, and reaches the rope, being finally lowered as represented to the left in the large engraving.




WIRE WAY FOR TRANSPORTING ORES, ETC.

As soon as the receptacle is filled, the motor commences to pull on the rope, and in so doing would naturally drag the car along the ground. This tendency, however, is immediately prevented by resistance of the hook end of rod, B, which, having caught over the crossbar, F, as the opposite extremity descended, retains its hold until the ascending bucket has reached the rod, B. The gravity of the receptacle causing it to descend to the hook end of rod, B, its weight disengages the hook from the crossbar, leaving the car free to be pulled up the incline.

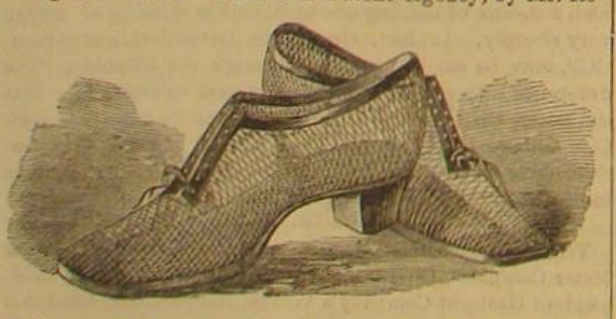
In Fig. 3 is shown the mode of holding up the wire, G being the support. Adjacent to this, in order to allow of the passage of the car, is a short railway, on which the outer wheels of the traveling pulleys, which are threefold, revolve. These being a trifle larger than the middle wheel, the wire will be relieved of the weight of the buckets while the same are passing the supports, and the opening, H, permits the parts which form it to pass with their pendent burden.

The apparatus is adaptable to various uses, and may, it is suggested, be profitably employed when obstacles of any kind exist between localities from one to the other of which the transportation of materials is necessary.

Patented June 24, 1873. For further particulars address J. Whitson Rogers, manufacturer and proprietor, Peekskill, N. Y. [See advertisement on another page.]

### A WIRE CLOTH BOOT.

Quite a novel form of shoe or boot has been patented through the Scientific American Patent Agency, by Mr. Robert Sommerville, of Sandusky, Ohio. Instead of making the whole covering of leather or other material in common use, the inventor proposes to employ wire cloth or gauze for the upper. The sole and heel are of course of leather, and the wire portion is secured to the former by means of a strip of thin metal fastened to the top of the sole by screws, and to which the upper is soldered. The principal advantage claimed is that the shoe thus constructed gives the foot free ventilation, while the pliability of the material is such as not to interfere with the free action of the member. We presume that the inventor designs it specially for Southern latitudes or for summer wear.

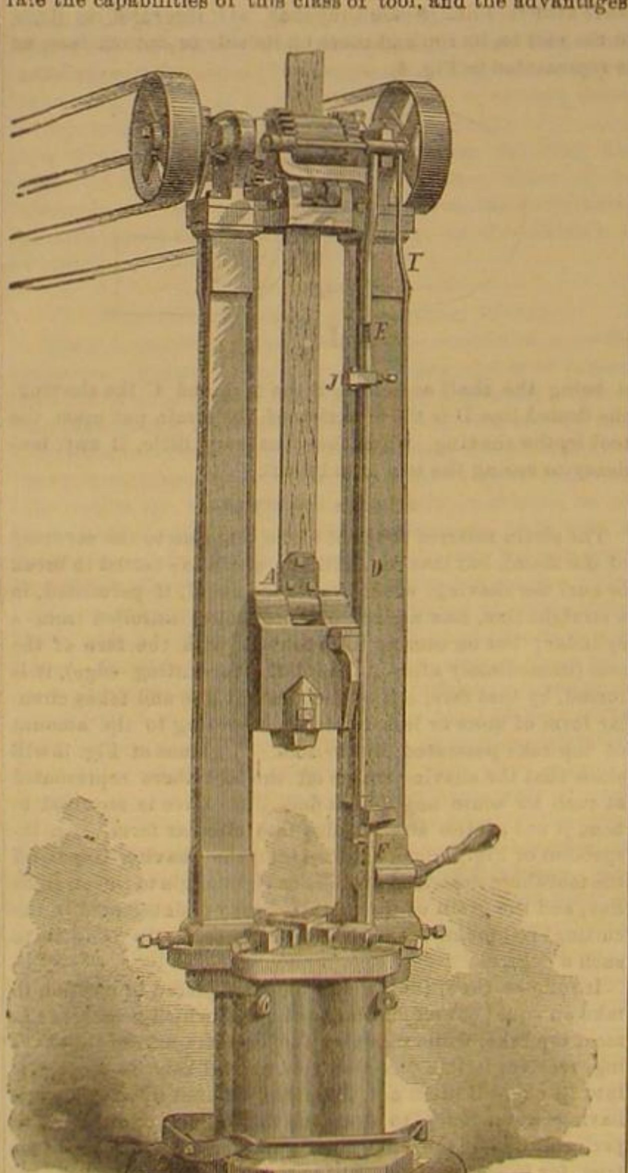


### Iceberg Alarm.

M. Michel lately presented a paper before the Academy of Sciences, Paris, describing as new an apparatus for vessels, to be used for giving notice of the proximity of icebergs. It consists of a metallic thermometer placed outside the vessel. The moment the vessel enters water that is below a certain limit of heat, an alarm is sounded. This alleged French improvement is set forth as one of importance, and as having originated with the gentleman referred to. But the device is of American origin, well known here. It is the invention of Mr. Charles Dion of this city, was described in the SCIENTIFIC AMERICAN, April 23, 1870, and was published in various papers throughout the country about that time. This is only one of many examples in which descriptions of new American inventions are translated from our papers by foreigners, presented and read to some continental society, and credit for the origination claimed on behalf of the translator.

### THE HOTCHKISS OR FRICTION ROLL DROP HAMMER.

As we have already directed our readers' attention at some length to the value of the drop hammer as a means of forging small articles in dies, it is hardly necessary to enumerate the capabilities of this class of tool, and the advantages




which it offers to the machinist. It possesses an accuracy and rapidity in operation hardly attainable by other means, and in its special work is, in many respects, more desirable, especially in point of economy, than the forms of hammer operated by the direct action of steam.

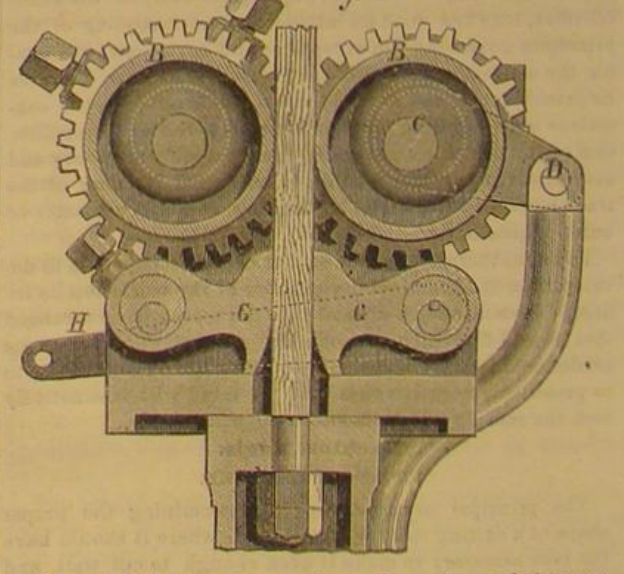
The machine represented in our engravings possesses certain improvements, covered by the patents of Messrs. Hotchkiss & Stiles, which are claimed to add materially to its efficiency. It will be noted that the device belongs to the class of tools in which the hammer is raised by a stiff belt or board passing up between two friction rolls. The hammer, instead of being attached to the board by a rigid connection, has an elastic or flexible one, as shown at A, the object being to prevent the sudden jar and probable destruction of the same, owing to the repeated shocks.

Referring to the sectional view, Fig. 2, motion is communicated between the rolls, B, by means of the two cog wheels shown. The teeth of this gearing are always engaged, and hence the revolution is constant; but in order to cause a griping of the board, the shaft of one wheel, and consequently the roll, which also works thereon, is moved up closer to the other. The teeth of the cogs are of sufficient length to allow of this movement, which need be but very slight. The sliding motion of the movable roll is effected by an eccentric, C, connected with a lever and rod, D, the action of which is clear from our illustration. The rod, D, which, by the screw connection at E, Fig. 1, is adjustable as to length, is shown in Fig. 1 at the right, and its lower extremity rests upon the top of a vibrating arm, F, which is pivoted, as shown, to the frame. On the hammer, at the same side, will be noticed a wedge-shaped projection and on the vibrating piece, a short pin, which may be located in either of the holes shown.

Referring again to Fig. 2, G G are two clamps, up through which the board passes, and which are so arranged that as the hammer ascends they will freely open of themselves, but on descending they will close and hold the hammer; how this is done is obvious from their shape. Connected with one of the clamps is a lever, H, which, passing to the rear of the machine, is attached to a rod and thus communicates with the treadle. It will be readily understood that, by pressing down the latter, the operator raises the lever, H, and hence the clamps, holding the same in such position as long as he chooses and thus either freeing the board from their gripe or preventing the pair of clamps acting for any desired time. To the right of the machine (Fig. 1) is shown a handle connecting with and moving a rod, I. This acts in addition to the rod, D, to open or close the rolls at will. The lower end of rod, I, has a slot, so that the action of the hammer will not disturb the hand lever, thereby preventing the hand being injured as otherwise might be the case.

We can now, before proceeding with further detail, follow the operation of the working parts. The hammer, we will suppose, as represented in our Fig. 1, is in the act of rising. This it will continue to do until it strikes an adjustable collar, J, on the rod, D, raising the latter up. As soon as its lower end is lifted above the vibratory arm, F, a spring on the latter pulls it under, and thus the rod, D, is supported in the position to which it is lifted. The consequence of raising the rod, D, however, as we have above shown, is to open the rolls; hence the hammer falls, to be caught, however, instantly by the clamps, G. These are held open by the pressure of the foot of the operator on the treadle, and therefore the hammer is free to deliver its blow. This it does, but on doing so its wedge-shaped projection strikes the pin on arm, F, and pushes the latter out from under the rod, D. The rod falling again, by its own weight, closes the rolls, and the hammer is once more lifted. This operation is repeated just as long as the clamps are held open by the treadle, by releasing which, at any moment, it will be noted, the clamps will be thrown in action, and hence the hammer arrested at any point on its down stroke. It will be clear, from the above, that a continuous series of blows may be maintained by simply keeping the treadle down; and the force of these strokes

Fig. 2



depending upon the fall of the hammer, is regulated by adjusting the collar, J, to cause the opening of the rolls sooner or later. For governing the motion of the head more accurately, delivering longer or shorter blows or drops of varying hight, the hand lever provides a simple means. By this the rolls can be brought together or separated at any moment. The hammer can be held up at any point below the collar by simply bringing the lever into action when the head attains the desired hight, so that the next blow can be given from a state of rest of less hight than that for which the collar is set. A gentle pressure upon the treadle, slightly relaxing the grip of the clamps, will allow the hammer to descend slowly; and by removing the pressure, an instant stoppage and suspension of the head is effected. The clamps, in holding up the hammer, keep the board from touching either roll, and prevent the same from being worn. By means of the set screws, shown on the back roll and on the clamp in Fig. 2, these portions are made nicely adjustable to different thicknesses of board or belt.

The machine, we learn from parties using it, is reliable and efficient in practical operation, and its construction, while simple, is of durable and strong material. It needs no explanation to show that the entire apparatus is completely under the control of the operator, as much so, in fact, as the steam hammer, and hence the blows may be graduated in force and rapidity, to an extent, it is claimed, unattainable by other devices. It is manufactured only by the Stiles and Parker Press Company, of Middletown, Conn., to whom letters for further information may be addressed.

### Coffee as a Disinfectant.

Roasted coffee, says the *Homœopathic World*, is one of the most powerful means, not only of rendering animal and vegetable effluvia innocuous, but of actually destroying them. In proof of this, the statement is made that a room, in which meat in an advanced degree of decomposition had been kept for some time, was instantly deprived of all smell on an open coffee roaster being carried through it, containing one pound of newly roasted coffee; and in another room, the effluvium occasioned by the cleaning out of a cesspool, so that sulphureted hydrogen and ammonia could be clearly detected, was entirely removed on the employment of three ounces of freshly burnt coffee. Refrigerators sometimes get musty from flesh, fowl, or fish, kept too long in them. No remedy for purifying such receptacles, so simple as burnt coffee, can be employed.

### THE TODD AND RAFFERTY HOISTING ENGINE.

The above named machine is so plainly represented in the annexed illustration that but few words are needed supplementary thereto. It is, in brief, a double reversible hoisting engine with drum attachments, the two drums, winding and unwinding at the same time, being geared to the actuating mechanism by spur wheels. The engines are of a well known type, and are constructed, as is the entire apparatus, with a view to economy, simplicity, and durability. Self packing pistons are employed, the link motion is used for reversing, and every device which experience can suggest has been added in order to produce a strong and reliable machine.

The manufacturers are the Todd & Rafferty Machine Company, of Paterson, N. J. They inform us that since its introduction the hoister has met with a wide appreciation, and a sale in numbers counted by hundreds. It is largely employed in the mines, mills, and furnace establishments of Pennsylvania, and no less than sixty machines are in constant use by the great Thomas Iron Company. We need hardly add that the reputation of the manufacturers is the best guarantee for the excellence of their work, and hence further recommendation at our hands is unnecessary. The reader interested can obtain further information by addressing the Todd & Rafferty Company, as above, or at their warerooms, 10 Barclay street, New York city.

### THE CORAL ÆCHMEA.

This plant (*æchmea fulgens*) is extremely elegant in habit, requires but little attention to grow it in perfection, and forms a very decorative plant for the greenhouse, stove, or drawing room. Some of the species are hardy in constitution, and remarkably tenacious of life; indeed, they may be grown with less trouble than any other class of plants, if we except succulents. The plant illustrated, says *The Garden*, to which we are indebted for the engraving, forms a striking object in a conservatory or drawing room vase, especially when bearing clusters of coral colored, purple-tipped flowers. The leaves are bright green, robust in character, and grace-

fully recurved. Its flower spikes continue in perfection for several weeks at a time, and form conspicuous objects. Nearly all the species grow vigorously in good sandy loam, to which a little leaf mold may be added, and they should be liberally supplied, when growing, with water at the roots. A little clear manure water, too, strengthens them in a marked degree, and assists them in producing strong flower spikes. They are easily propagated by taking the offsets produced by the old flowering plants, and potting them at once in small pots, which may be plunged in a gentle bottom heat until well rooted, after which they may be encouraged to make good growth, and will generally produce flowers the second year; but, for decorative purposes, this plant is always handsome either in or out of bloom.

### New Researches in Wines and their Colors.

M. Duclaux, has recently submitted to the French Academy of Sciences, two notes, in which he gives the results of recent investigations into the nature of the coloring matter and volatile acids of wines. Some interesting facts regarding the effect of the latter constituents are given, as well as in relation to the peculiar substance to which is due the rosy hue. The latter is a transparent mass having the color and consistence of currant jelly. It is soluble in water and in alcohol, to which it gives a violet reddish tinge which quickly turns to bright red on the addition of a trace of acid. Left for some time to the influence of the air, and especially in a heated place, the substance absorbs oxygen, darkens in color, and becomes more and more soluble in water. It finally is deposited in pellicales, which, when the solution is completely evaporated, remain in the form of a coherent paste, quite opaque, and finally hardening and becoming detached in scales after cooling. In this condition, the substance is not soluble in water, but remains so in alcohol, which it colors a fine purple even in the absence of acids.

This is Nature's coloring, but art frequently adds other materials to darken the hue, or to mask the fraudulent additions of water. The commonest substances used are mauve, phytolacca decandra, and cochineal. These can be distinguished, M. Duclaux tells us, as follows: For mauve, the coloring material under the action of oxygen acts in reverse manner to the true substance, that is, instead of becoming insoluble, it becomes more soluble in water. Cochineal may be detected by the characteristic absorption bands in the spectroscope, which are essentially different from those of wines. Lastly, phytolacca is found by means of the nascent hydrogen, which causes it to discolor quickly, while it does not alter the tinge of pure wine except very slowly.

With reference to the volatile acids in wines, M. Duclaux states that, when the latter are healthful, they contain acetic acid in very slight proportion, mixed with from one twelfth to one fifteenth butyric acid. He notes the existence of valerianic acid, of which the quantity does not exceed 0·1 grain per quart, and also, in proportions almost infinitesimal, a superior fatty acid, of which he is as yet unable to ascertain the nature. The various causes of deterioration in wine carry to the composition of this mixture of acids various modifications. Thus when the liquor is turned, nearly equal quantities of acetic and melacetic acids are formed. Bitterness develops acetic acid, butyric acid, and the fatty acid above referred to.

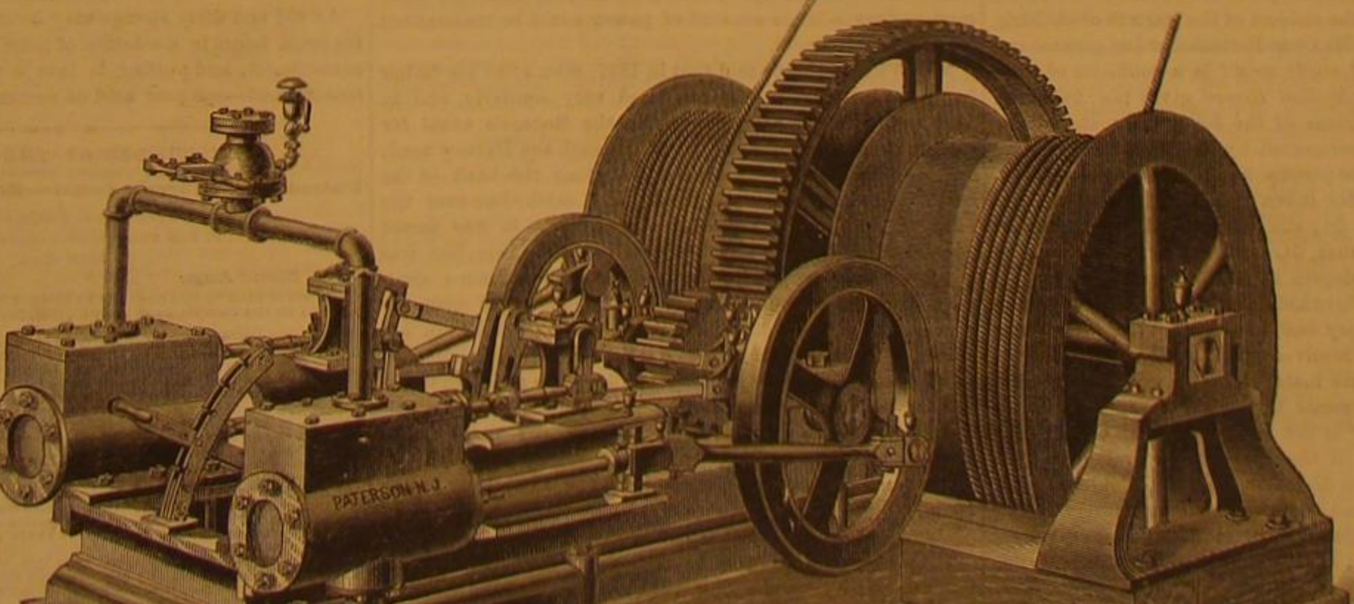
### An Amusing Chemical Experiment.

Place five glasses in a row, then pour into the first a solution of potassium, the second a solution of corrosive sublimate, the third a small quantity of iodide of potassium and some oxalate of ammonium, the fourth a solution of chloride of calcium, and the fifth some sulphide of ammonium. Now pour part of the contents of the first glass to the second, and a scarlet color will be obtained; next pour the second into the third, and the mixture will be colorless; again, pour the third into the fourth, and the contents will be white; finally, pour the fourth into the fifth, and the mass will be a dense black. Then you will have had two glasses colorless, one scarlet, one white, and one black.

### Refraction of Compressed Water.

M. Mascart followed M. Jamin's method, sending light through two tubes filled with water, and counting the interferential fringes which passed a point of the spectrum when a difference of pressure was produced. A change of pressure of 1 meter mercury caused the displacement of about seventy fringes; and as the tenth of a fringe could be measured, there was much precision in the arrangement. The number of fringes displaced by corresponding variation of pressure is not constant but increases with the pressure. The author deduces from his experiments the coefficient of compressibility, and the liberation of heat produced by compression of water.

AT a recent soirée of the Royal Society, Dr. R. Norris, of Birmingham, exhibited experiments to illustrate a form of contractive energy which displays itself in various substances. Among other things the doctor showed that the statement that india rubber contracts by heat is incorrect; this substance, it is true, contracts in the direction of its length, but it expands in breadth at the same time, thus resembling the so-called contraction of muscular fiber.




THE TODD AND RAFFERTY HOISTING ENGINE.

## SCIENTIFIC AND PRACTICAL INFORMATION.

### BLACK PHOSPHORUS.

The essential feature of this body, says M. Blondlot, is that in a state of fusion it does not differ from normal phosphorus. At the moment of solidification, however, it suddenly becomes black. On re-fusing, it again turns white, and so indefinitely.

### A SIMPLE LEVELING INSTRUMENT.

M. Goulier proposes for the above a pendulum hung by a double point, which carries, rigidly attached, a collimator formed of a small tube hermetically closed at one extremity by a piece of ground glass. At the other end is a converging lens, 18 inches in diameter and 54 inch focus. The radius of the exterior face of the lens should be six or seven times less than that of the interior face. At the principal focus is a diaphragm pierced with a hole 0 06 inch in diameter, across which is a thread of black cotton. By suitable construction, the pendulum being at rest, the plane passing through the thread and the optical center of the lens is horizontal. On looking through the lens, the observer sees the thread as a horizontal line, which marks on the field the intersection of horizontal plane through the instrument. By placing the eye in proper position, the thread and exterior objects may be seen at the same time, and the mark on a leveling rod may be adjusted to coincide with the thread, so obtaining a level.

### DANGERS OF METHYLIC ALCOHOL.

Serious maladies, says the Lyons *Médical*, have been engendered among the workmen in two industrial establishments by the employment of methylic alcohol, that is, wood naphtha, or alcohol derived from wood. The material is used in the finishing of felt hats and of silk fabrics. Its action is directly upon the mucous membrane exposed to its emanations, and also, through the nervous system, upon the entire organization.

The effect is first noticed upon the ocular *conjunctiva*, which becomes inflamed and injected, producing a sensation of sand in the eyes. A copious flow of tears and extreme sensibility to light (photophobia) follow, incapacitating the sufferer for work. Further symptoms include intense coryza and inflammation of the pharynx and bronchial tubes, together with trouble of the digestive organs. Severe headaches and feelings of heaviness and depression are always present. The rigor of the malady depends upon the extent to which the person is exposed to the alcoholic fumes. The workman who finishes the bottom of a hat is attacked more severely than the one who prepares the rim. It has also been noticed that cabinet makers who use the material in varnish are frequently attacked with tetanic convulsions of the fingers, unknown previous to the employment of the alcohol.

### THE COMMERCE OF THE WORLD.

*Les Mondes* says that the eleven principal nations of the world, Great Britain, United States, France, Germany, Belgium, Austria, Russia, Italy, Spain, Holland, and Sweden, have more than doubled their aggregate commerce in less than twenty years. The foreign trade of these countries amounted in 1855 to $4,251,700,000, and in 1872 to $9,272,000,000, showing in 17 years an increase of $5,034,300,000, or 118 5 per cent. The increase in population during the above period is 40,177,000 souls, or 14·8 per cent; and during the first mentioned year the commerce *per capita* was $15.62, in the last year $29.76, or an increase of $14.14 to each person.

Mr. Gladstone, we notice, recently stated that during the last half century Great Britain had accumulated more wealth than during the entire period of her history. The figures above given would seem to prove this view.

## The Warmth of Clothing.

In a careful study of the subject of the warmth of clothing, recently published, Dr. Max von Pettenkofer has pointed out that the permeability of stuffs to air is a condition of their warmth. The *London Medical Record* gives the following abstract: Of equal surfaces of the following materials, he found that they were permeated by the following relative quantities of air, the most porous, flannel such as is used ordinarily for clothing, being taken at 100:—Flannel, 100; linen of medium fineness, 58; silk, 40; buckskin, 58; tanned leather, 1; chamois leather, 51. Hence if the warmth of cloth depends upon the degree in which it keeps out the air from our bodies, then glove kid must be 100 times warmer than flannel, which every one knows is not the fact. The whole question, then, is resolved into that of ventilation. If several layers of the same material be placed together, and the air be allowed to permeate through them, the ventilation through the second layer is not much less than through the first, since the meshes of the two form a system of continuous tubes of uniform diameter, and the rapidity of the movement of the air through these is effected merely by the resulting friction. Through our clothing, then, passes a stream of air, the amount of which, as in ventilation, depends upon the size of the meshes, upon the difference of temperature between the external and internal atmosphere, and upon the velocity of the surrounding air. Our clothing, then, is required, not to prevent the admission of the air, but to regulate the same so that our nervous system shall be sensible of no movement in the air. Further, our clothes, at the same time, regulate the temperature of the contained air, as it passes through them, so that the temperature of the air between the clothing and the surface of our bodies averages 84° to 86° Fah. The hygroscopic property of different materials used for clothing essentially modifies their functions. This property varies with the different materials: wool, for instance, takes up more water than linen, while the latter takes up and gives off its watery contents more rapidly than the former. The more the air is displaced by water from the clothes, the less will be their power of retaining the heat; in other words, they conduct the heat more readily, and hence we are quickly chilled by wet garments.

## Transparent Photographs.

A laundress's flat iron is, perhaps, the most convenient thing that can be made available for mounting the print upon the glass—using a piece of bibulous paper between the iron and the print to absorb the superfluous paraffin. Such a mounting may be very usefully employed for securing the soft effect produced by placing a second picture behind the transparency.

In this method of manipulating it will be necessary to melt the paraffin, and perhaps the following mixture may be utilized with advantage, as it is fluid at ordinary temperatures, or, if not so, the warmth of the hand will render it liquid. The small quantity of Canadian balsam is introduced for the purpose of making the print more adhesive to the glass; but we really have grave doubts as to its proving of any great advantage in practice, because even this substance is, to a certain extent, amenable to the action of the light and oxygen: Paraffin 2 drachms, benzole 5 fluid drachms, Canadian balsam half a fluid drachm.

The paraffin should be melted, removed some distance from the light, and four fluid drachms of the benzole added during agitation. The Canadian balsam is to be dissolved in the other drachm of benzole, and the whole is then to be mixed together. Paraffin and Canadian balsam do not mix very well; but with interposition of the menstruum, benzole, they seem to blend perfectly.

The advantages of such a mixture as the above are that it can be applied cold with a brush, and that it drys perfectly in a very short time if the benzole be of good quality. To perfect the adhesion, however, we would recommend that the warm iron should be passed over the surface after it is quite dry. Such an operation also ensures the volatilization of any traces of the benzole that might remain. The same solution might, perhaps, be used with advantage to preserve prints from atmospheric influence.—*British Journal of Photography.*

## Transmission of Power by Wire Ropes.

At a meeting of the Institution of Mechanical Engineers, London, Mr. Morrison described the mode of transmission introduced by the Brothers Hirn, and now extensively used at Schaffhausen, on the Upper Rhine. It appeared that they first used flat metallic bands to transmit the power; but these being found objectionable, round wire rope was subsequently adopted instead. The rope is usually made of fine steel wire, as it must be very tough and flexible. This wire rope, which is about 1 inch in diameter, and contains 72 strands, is run at a high velocity, over pulleys of large diameter. The total loss of power by friction, etc., was stated to be 2½ per cent, and it appeared that, of 120 horse power existing at the motor wheel, 100 horse power was utilized at 2,200 yards distance; but it could not be elicited in the discussion how these figures had been arrived at. It was also estimated that iron shafting, capable of transmitting the same power, would involve the use of 3,000 tuns of material. Various materials were tried for facing the grooves of the pulleys, such as copper, leather, etc., as there either was excessive wear in the groove, or the facing destroyed the rope. The best arrangement was found to be a dovetail groove, filled in with gutta percha, in which the rope soon made a channel for itself, after which the wear was not excessive. The pulleys run at the rate of 50 miles per hour, and the ropes last from 1½ to 2 years.

Dr. C. W. Siemens, F. R. S., remarked that there was no doubt that, by running ropes at from 30 to 60 miles per hour over pulleys, a large amount of power could be transmitted with but little waste.

Mr. William Smith said that in 1837, soon after his father had invented wire rope, it was used very similarly, and in 1839 and 1840 it was introduced on the Regent's canal for towing barges through the tunnel beneath the Harrow road, and it was also taken 3½ or 4 miles along the bank of the canal. The bargeman simply threw a catch line over the running wire, and let go when necessary. It was tested against the screw, duck foot propeller, and others, but was not found to be economic. He had many times seen a similar application of the principle; the fly rope of an ordinary ropery was an illustration, but that had long since been obsolete. He would like to know whether the paper claimed, as a novelty, the introduction of endless wire ropes for transmitting power to a distance; if so, he doubted whether the claim could be substantiated. If the novelty merely consisted in the running of the ropes at a high velocity, which was all he could see in it, there might be something in the claim.

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IT appears from the soundings made by the Challenger expedition, from both the New York and the Halifax sections, that the true Gulf Stream or Florida current is a limited river of superheated water, of which the breadth is about sixty miles near Sandy Hook, while near Halifax it has separated into divergent streams forming a sort of delta; its depth (as determined by the use of the current drag) being nowhere more than 100 fathoms. This river rests upon the remarkable stratum of 60° to 65°, the thickness of which distinguishes the Western from the Eastern Atlantic between Bermuda and Azores, while at less than double the depth of that layer we come into what is clearly polar water.

## Permanence of the Hydrocarbon Gas.

A very natural doubt has existed in the minds of some of our best gas engineers whether the hydrocarbon gas could have the same permanence under the influence of low temperatures as ordinary coal gas. Considering the ease with which air or even poor coal gas which has been naphthalized parts with an important portion of its illuminants at a low temperature, it has been argued that the non-luminous substratum of combustible gases, got from water by the hydrocarbon process, would in like manner part company with the illuminants derived from the bituminous coal distillation as soon as the mixture should be powerfully refrigerated.

Experiment, before which all preconceived notions must bow, completely disproves this hypothesis, and we are able to declare most positively, say Professors Silliman and Wurtz, that the hydrocarbon gas is far more permanent under the influence of extreme cold than any coal gas we have been able to put to the same severe test.

The results of many careful experiments by these gentlemen show a loss of from 10 to 40 per cent of illuminating power for street gas under the influence of cold, and no loss for hydrocarbon gas.

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THE policy of the Russian Government is to compel all its subjects to worship under the forms of the Greek Church, otherwise to leave the country. A large and flourishing body of Russian Baptists, known as Mennonites, have been obliged to leave, and are now coming to this country. They have purchased large tracts of lands in Nebraska and Kansas. The advance guard, 185 in number, arrived here a few days ago with $60,000 in coin. The total number to be expected is about 25,000. They are industrious, reliable people, and will be gladly welcomed here. All despots who have similar good people to spare will please ship them to the United States. We have eight billions of acres of good lands in reserve, from which they may choose homes.

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MM. Crouzet and Colombat have just brought before the notice of the Paris Academy a method for rendering ships insubmersible through a new application of compressed air. They propose that the hull be divided into two parts by a bridge across at the water line, in such a way that air cannot penetrate from the lower to the upper part. If a hole be made in a hull through a collision, the water will immediately enter; but it will not wholly fill the lower compartment, for the inclosed air, not having any outlet, will be compressed, and will ere long equilibrate the external force. From this moment the ship will cease to sink. It will, in fact, be in the position of a diving bell.

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PHOSPHORUS AS A CURE FOR CATARACT.—Dr. Combas gives a case of a girl, aged twenty-four, of nervous, lymphatic temperament, suffering from capsulo-lenticular cataract, hardly able to discern light from darkness; suffered frequent headaches. Two or three drops of phosphorized oil were dropped into the eye daily, and frictions of the same used over the forehead. After four months of this treatment, which was used perseveringly, the eye improved, colors could be distinguished, and the opacity of the lens so far diminished that it could not be discerned at a distant of two or three paces.

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M. ALVERGNAT has devised an ingenious apparatus which shows that an electric current will not pass equally well in two directions. Two glass tubes are connected together at the ends by arched pieces, and in one the points of a number of small glass pipes are turned in the opposite direction from those in the other tube. The current instantly passes through the tube in which the points are apex toward the negative poles. The tubes are filled with hydrogen, showing the oscillation of the luminous zones with great clearness.

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AN old and dirty sponge may be cleaned by first soaking it for some hours in a solution of permanganate of potass, then squeezing it, and putting it into a weak solution of hydrochloric acid—one part acid of commerce to ten parts water.

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## DECISIONS OF THE COURTS.

### United States Circuit Court---District of New Jersey.

[In equity.—Before Nixon, Judge.—Decided April, 1874.]

PATENT FASTENING FOR TRAVELING BAGS.—WILLIAM ROEMER *vs.* EDWARD SIMM *et al.*

NIXON, *District Judge:*

The bill is filed in this case for an alleged infringement of letters patent granted to the complainant July 31, 1866, for "Improvements in Traveling Bags."

The defendants, in their answer, aver that the complainant is not the original and first inventor of the improvement claimed; that it had been previously in use and was known to a large number of persons named; that a knowledge of the invention has been acquired by the complainant abroad; and that he had surreptitiously and unjustly obtained said patent here; and that it had been described in a printed publication by one Samuel Fisher, in London, prior to the supposed invention thereof by complainant.

There was no contradiction of the witnesses, and their evidence seems to establish the defendants' proposition that there was a foreign prior use of the improvement described and claimed in the complainant's patent.

In reference to the knowledge and public use of the invention in this country, if the witnesses speak the truth, and there was no attempt made to impeach the accuracy of their statements, there is no reasonable doubt that the patented improvement of the complainant was known and in public use in the United States for several years prior to his application for a patent.

It must be borne in mind that it is not necessary to hold, in order to avoid the patent, that the complainant knew of the prior existence and use of his invention. He must not only believe himself to be, but he must be, both an original and the first inventor. If he acquires his knowledge of the invention from another, he is not the original inventor; and if another has anticipated him, without his knowledge, he is not the first inventor.

After a most careful examination of the testimony of the witnesses, and after reasonable allowances for the imperfections of human memory—giving such examination and making such allowance, from a strong predisposition in favor of the validity of the Roemer patent, arising from the adjudication of this court in the case of the same complainant against Samuel Logowitz *et al.*, in which the patent was sustained—it seems impossible to doubt that the device of the complainants for fastening together the jaws of satchels and traveling bags was known and used in this country for many years before the patentee claims to have made his invention; and that its use was not a single experiment by an inventor who afterward abandoned it from its supposed inutility, but was so frequently applied to, and used upon, traveling bags, as to invest the public with the rights to use the device, notwithstanding the patent.

The evidence sustains the defence of want of novelty and prior use, and there must be a decree for the defendants.

[*Jonathan Marshall, Esq.*, for complainant.
*Frederic H. Betts, Esq.*, for defendants.]

# Recent American and Foreign Patents.

### Improved Cotton Bale Tie.

James H. Lane, Waco, Tex.—This invention relates to an improved form of tie or buckle for cotton bale bands, the same consisting of a metal plate provided with a hook at either or both ends, and with one or more hooks located intermediately at the ends. These hooks are made by cutting away the ends of the plate so as to have central tongues, which are bent over.

### Improved Building Blocks.

Thomas B. Rhodes, Leetonia, Ohio.—Hollow spaces extend through the blocks from bottom to top, to make hollow walls. The parts by which the two sides of the blocks are connected are arranged sufficiently distant from the ends to form grooves therein, in which tongues on other blocks will fit to lock the blocks firmly together. These grooves and tongues may be in dovetail form. The parts will, in some cases, extend to the top of the blocks, and in others not; and in such cases binders may be used to lock the blocks together by placing them on the upper ends of said parts, so that the adjacent parts of the two blocks to be locked together are received between the parts of the binders. It is proposed to deepen and otherwise form the grooves, both horizontally and vertically, so as to use long binders of wood or iron, extending from end to end of a wall at the top, or from bottom to top. It is also proposed to arrange the openings in the top blocks so that hot air admitted to them may circulate throughout the spaces in all outside walls, and in partitions, if preferred, for heating the rooms, and connect said spaces with furnaces or other heating apparatus for the introduction of heat. By molding these blocks they can be readily and cheaply made, in any approved form and size, both plain and ornamental, and thus afford desirable building material for less cost than bricks or wood. Holes may be formed in the blocks when molded, to make continuous passages, where the blocks are joined, for conducting water from the eaves trough to the ground; also for speaking tubes, and the like. In laying up a wall with these blocks, each layer is temporarily enclosed in a casing of wood, and hot cement is poured in, to flow into the interstices and fill them up and unite the blocks.

### Improved Middlings Purifier.

Reuben Royer, Ephrata, Pa.—A reel receives the middlings through a spout. There is a partition in the chest, cutting off returns before the middlings are taken off. A fan blows into the chest upon the reel to cool and clear it, and there are chutes forming a hopper below the reel to discharge the middlings on the reciprocating sieve, and for preventing the blast from the fan below from blowing up into the reel space. The blast from the upper fan also aids to prevent the blast from the lower fan from passing upward. The fan at the bottom of the chest blows in through one side of the chest, up through the sieve, and out at the other side through a passage, which is regulated by a valve, to control the blast. The second fan and the passage are as long as the sieve, to cause the blast to act alike throughout the length of the sieve, by which the action is uniform and very efficient in separating the light fuzzy matters which do not contain flour.

### Improved Auxiliary Heater for Steam Fire Engines.

Absalom B. Hallock, Portland, Oregon.—This invention consists in so arranging an auxiliary heater on the hearth or foot plate of a steam fire engine, and so connecting its heating coil with the boiler thereof that the two shall form one compact and portable machine, capable of performing the functions of a steam fire engine of the ordinary kind in a more effective manner.

### Improved Saw Grinding Machine.

William Dreyer, Newark, N. J., assignor to himself and George B. Sharp, New York city.—The stone is mounted in the middle of the frame near one end, between the parts of the housing frame, whereon strong blocks, having the guide ways for the reciprocating frame, are mounted. The ways are outside of the blocks, where the grit from the stone will not get in and cut them and the slides out to any material extent. The slides of the saw-carrying frame are geared to the crank shaft in a simple and inexpensive arrangement. The wrists are adjustable to change the length of the throw, and the connecting wrists are also adjustable along the slides, to change the bar, to which the saw plates to be ground are attached, toward or from the stone. There is a presser block above the stone for pressing the saw down on it, which is attached to a long bar fitted to slide up and down, and provided with levers for raising and lowering it. Under the ends of the block are springs for holding the block off the stone when the saw plate is removed.

### Improved Bale Tie.

Abram B. Hagaman, Jackson, La.—This is a band for baling cotton and other commodities or articles, whereby a separate buckle or tie is dispensed with; and it consists in one or more projections on the edge or edges of the band, in combination with slits for locking the band around the bale. In locking the band, the end in which are the small slits is passed through a V shaped opening, which opening is re-enforced by one of the projections. The friction thus produced keeps the band in place, and protects the joint as the bale is tumbled about, and also facilitates the operation of locking the band.

### Improved Shaft Coupling.

Edward G. Shortt, Carthage, N. Y.—A cylindrical body is cast with an eccentric recess, forming a seat for the wedge to slide on along the circumference of the recessed part. The curved wedge is of eccentrically bored shaped, of less length than the recess, and is provided with grooves fitting into corresponding ribs of the body, to prevent the sliding of the same on the shaft in longitudinal direction. A wedge-shaped key is driven in at the broader end of the recess, and forces the wedge around the shaft, securing a rigid connection of the parts in either direction. The parts may, however, be quickly and easily detached on taking out the key which gives play to the eccentric wedge and shaft.

### Improved Mitering Machine.

Benjamin Bernstein, Max Hamburger, and Achille Klein, New York city.—In the frame are formed two grooves to receive brackets, said grooves being arranged at right angles with each other, and at an angle of forty-five degrees with the length of the table. The said brackets may be moved forward or back, to adjust them. In the upper ends of the brackets revolve the mandrels, to which the saws are secured. By this construction the saws, as they become smaller, may be so adjusted that their forward sides may meet. By suitable construction, by pressing a treadle downward, the table will be raised, pressing the molding upward against the saws, so that the saws will begin to cut upon the face of the molding, causing the same always to present a clean, smooth cut, and preventing all breaking out or splintering of said face. A gage may be moved forward and back to adjust it to the width of the molding to be mitered by moving a rack outward or inward longitudinally, the arrangement of the operating mechanism keeping the beveled ends of the parts of the gage all the time close to the saws.

### Improved Harvester Rake.

Jacob Graybill, Akron, Ohio.—The essential feature of this invention is that the rake head is drawn across the platform, sweeping the grain before it, and upon its return movement is carried above the said platform, so as not to disturb the grain, the roller of a slotted guide acting as a fulcrum to support it.

### Improved Pocket Book.

Gabriel Jasmagy, Brooklyn, N. Y., assignor to Morris Rubens, New York city.—This invention improves the manufacture of pocket books, of all sizes, so that the stitching hitherto employed for the connection of the folding side flaps with the partitions is entirely done away with, and a neater, stronger, and more durable connection of the same substituted. The invention consists in the construction of an inside lining for the folding side flaps of the pocket book, cut or stamped in such shape that, on folding, a semicircular or semi-oval piece, with as many folded projecting flaps or tongue pieces, is produced as partitions are used. The connection of the latter with the folding side flaps is obtained by gluing the semicircular pieces to the side flaps and the tongues between the double partition strips, so that, on folding them into regular shape, a strong and superior pocket book is furnished.

### Improved Cutter Head.

Henry Buchter, Louisville, Ky.—This machine consists of a head having two curved wings, formed with a vertical shank, for attaching to a mandrel or head block of a lathe, and having a removable center. These wings are arranged to receive extra cutters to vary the size and patterns and blank plates for balancing the extra cutters. The cutting edges of the wings may be in any form so as to cut a rosette of any desired style when revolved on a lathe or mandrel. Other cutters of triangular form, for cutting rosettes of differentdiameter, may be attached to the wings, and plates may be secured so as to counterbalance them.

### Improved Coffee Pot.

Alexander P. St. John and William P. St. John, Mobile, Ala.—This invention consists of a coffee pot or urn with an upper and a lower compartment, so contrived that, when steam is generated in the lower compartment, the water will be forced up through the coffee into the upper compartment. When the boiling ceases and the steam condenses in the lower chamber, the vacuum formed will cause the hot water to pass through the coffee again into the lower chamber, from which it will be poured for use; or, if need be, the operation can be repeated by setting the pot on to boil again to increase the strength of the decoction.

### Improved Mitten.

John L. Whitten and J. Hermon Whitten, Burlington, Vt.—The object of this invention is to increase the durability and usefulness of mittens and gloves, and consists in the peculiar arrangement of the back and palm pieces, and the ball and back pieces of the thumb. A seam starts at the wrist, and runs entirely around the hand and finger part of the mitten, and over the sides of the thumb to the wrist piece. The ball piece of the thumb is attached by this seam to the back pieces, and to the palm piece by another seam. The latter seam is carried down from the thumb toward the palm of the hand, so that it does not affect the crimping of the leather at the curve under the thumb, and is consequently not subjected to much wear, and does not rip or fail.

### Improved Cap for Glass Syringe.

Patrick F. Slavin, New York city.—This is an improved cap for glass syringes, so constructed that it cannot be pushed into the barrel of the syringe. The invention consists of a cap formed of the cork and a metallic tube having a flange formed upon its upper end, the end of which is spun over to clasp the upper end of the said cork and form a lip, and having the lower end spun outward to overlap the inner end of the said cork.

### Improved Starting Bar for Link Motions.

Frederick Wellington, Saginaw City, Mich., assignor to himself and Wilbur H. Hill, same place.—A swivel is connected to the starting bar in a slot, to allow it to work forward and backward along the bar by the vibration of the link. The swivel is pivoted to the yoke to allow the link to turn on the swivel, and the bar is prolonged beyond the link for a handle by which to work it for shifting the link. To stop the engine the link is shifted on the valve rod coupling to its center, and to start the engine it is shifted either way along said coupling, according to which way the engine is to be worked.

### Improved Ash Sifter.

Marcus P. Nichols, St. Paul, Minn.—This invention is an improvement in ash sifters of the class in which the ash holder has a reticulated or sieve bottom, and is attached to and revolved on a vertical shaft or axis. The improvement consists in a revolving circular table constructed of a flanged ring supported by radial arms having the removable ash pans reticulated on the sides and bottom.

### Improved Guide for Spooling Machines.

Lewis Leigh, Mansfield Center, Conn.—This is a water-circulating attachment for spooler guides for maintaining a circulation to prevent the heating of the guide by friction, so as to burn the thread. The invention also consists of a contrivance of buckets for utilizing a small quantity of water for cooling the guide, by shifting the buckets relatively to each other in respect of their hight, so that whenever one bucket has emptied into the other the water will be returned again from the full to the empty one, and thus a continuous current will be maintained through the guide.

### Improved Domestic Boiler.

Ernest B. Beaumont, Ann Arbor, Mich.—The handle is hinged to the vessel so as to swing upon the top and avoid being heated, and has plates or bars to brace it and to prevent its spreading.

### Improved Car Coupling.

Moses A. Keller, Littlestown, Pa.—The top part of the drawhead is recessed at the inside, and a coupling pin is pivoted therein, which is straight at the sides, slightly curved at the lower part, and provided with a slot at its upper part. The slot is arranged under some inclination toward the longer axis of the pin, so that the same is prevented from detaching, when coupled by sudden jars. A lever is pivoted to the drawhead, swinging in a longitudinal slot of the same, and arranged with a hook-shaped projection at its front part, and with a curved arm at its rear part. The hook locks over the front end of the pin, and couples thereby the coupling link. A pendent link is pivoted back of the fulcrum of the lever, being weighted by a roller at the lower end thereof, with the curved arm passing through said link. When the latter link is pending in vertical position, it presses the arm down, raising thereby the hook part. The pin slides on the arm till it is engaged by a recess, by which the regular position of the link and lever is secured. When the link is swung back by means of a connecting treadle chain, so that a roller strikes the curved arm, the hook is thereby carried down, detached from the pin, and the link uncoupled. In whatever position the lever may, therefore, be placed, whether in position for uncoupling or coupling, the entering link will, with equal certainty and security, engage the pin, which, on being locked by the hook, produces a firm and substantial connection, while the uncoupling may at any moment be performed by carrying the lever back and releasing the pin.

### Improved Dentist's or Barber's Chair.

Francis J. Coates, Cincinnati, O.—The seat and back are coupled together by a universal joint, so that the seat may be turned simultaneously with the back, and by it, the back being turned by hand. The back is fastened by a spring bolt and the seat by another spring bolt, which engage projections respectively. Both can be pulled back by pulling on the projecting part of the bolt. The foot rest is supported on long arms held at the front by an adjusting screw. This adjusting screw is connected, by a universal joint, with the crank shaft, which extends out through the chair at or about the right hand rear corner, where it is most convenient for the attendant to reach it, from his position behind the chair, to operate it.

### Improved Reed Organ.

Thomas H. Pollock, Richmond, Va.—Valves are arranged directly above the reeds in an organ operated by suction from below, so that the wind will have the most direct and unobstructed flow to the reeds, and, particularly, so that the passage from the reeds to the wind receiver will be entirely unobstructed, and the full measure of the sound will be utilized. Inclined reflectors in the air passages are used below the valves for directing the air upon the free ends of the reeds as much as possible, by which more powerful tones are produced. A plate or bar is placed under the levers at the stands, arranged on pivots, so as to swing down and let the levers fall, to be out of action while the other series is in action. Means will be used with said bar to restore the levers again whenever required. In order to throw the other set of reeds out of action while working the reeds governed by the levers, there is a sliding stop to cut off the supply of air to them. Devices are added to bring the wind receiver near to the reeds, to receive the sound directly from the reeds and as soon as possible, by which the full power of the reeds is obtained. The bagging leather valves heretofore used, which flap against the seats when the suction begins and make considerable noise, are dispensed with, and springs, which always close the rigid valves against a little pressure of air, are substituted. These prevent noise, and keep the valves closed and prevent them from falling, as the leather valves do. The tremolo fan is in the wind receiver at the issues of said pipes, which gives additional merit to the tremolo attachment. The explosive swell consists of valves on the wind receiver, either back or top, to be suddenly opened at any time, by any suitable action, to produce explosive sound.

### Improved Clothes Hanger.

Robert McCoy, New York city.—The common practice in laundries is to hang the shirts up by the flaps on hooks, which are thrust through them. The hooks are sometimes large and clumsy, and make large holes, and the flaps are sometimes torn and damaged, particularly when the shirts are frequently so hung. The present invention is a spring hanger, in which the garments are held between jaws. The tension of the latter is regulated by screws which secure them to the main portion of the device.

### Improved Car Coupling.

Levi Sutton, Ottawa, O.—The ends of the coupling bar are beveled upon their upper sides, so that, as they enter the cavity of the drawhead, they may raise the coupling bolt, and pass beneath its lower end, allowing it to drop through the slot in said drawbar. To the upper end of the bolt is swiveled a rod, which passes up through guides to the platform or top of the car. One of the guides is tubular, and has a notch formed in its upper end, straight upon one side and inclined upon the other, in which rests a pin attached to the rod, so that by turning the rod the pin may slide up the incline and thus raise the bolt out of the drawbar, thus uncoupling the cars. To the upper end of the rod is rigidly attached a lever by which the rod may be conveniently turned. A coiled spring placed upon the shaft rests upon the upper end of the bolt, and against the keeper, so as to force the bolt down when the rod is released, and prevent said bolt from being jarred out of place. A lever is pivoted to the end of the car in such a position that its forward end may rest beneath a toe formed upon the bolt, so that the latter may be raised to uncouple the cars by a person standing upon the ground at the side of the track.

### Improved Clothes Pounder.

Michael W. Fry, Guyandotte, West Va.—This invention relates to means whereby water and soapsuds or washing fluid may be forced through clothes and the dirt eliminated therefrom without using the ordinary washboards or rubbers. The invention consists in a clothes pounder whose parts are combined in a novel and peculiar manner.

### Improved Green Corn Cutter.

Henry B. Kelley, Foster's Crossing, O.—This invention consists of a series of three longitudinal concave knives, of different sizes in respect of their curves, arranged on a support, in combination with concave guides, to which the ears of corn, being held by a fork thrust into the butt of the cob, are presented endwise against the edges in succession, beginning with the knives having the largest curve, and passing to the others in the order of their decreasing size. The effect of this is to divide the corn into two or more parts by the knives in advance of the hindmost one, and to remove the remaining part from the cob by the last one, about a third or a quarter of the kernels being removed at one operation, and each ear being presented three or four times, and turned partly around each time.

### Improved Zinc Molding for Coffins.

George S. Eaton, Williamsburgh, N. Y.—This is an improved shell molding for use upon coffins and for other uses, which is so constructed that it may be bent around a curved surface without wrinkling at its edges. Strips of zinc are made a little wider than the curved surface of the discharge orifice of the die through which they are forced, so that the surplus metal may be forced inward by the flat surface of the cavity of the die to form flanges. This may be bent around a curved surface, and, being without elasticity, will fit upon said surface without any tendency to spring off.

### Improved Sash Fastener.

Bernard Almonte, Great Barrington, Mass.—This lock, which is mortised into the frame of the sashes, consists of a casing of metal, to which is attached the stop wheel, which is revolved on a central pivot. By raising a lever a stop is thrown back, so that the wheel can readily revolve. When the lever is down, it is held in position by a spring, and the stop bar is held in position by a pivoted finger connected with the lever. The end of this finger works against the projecting flange of the stop bar, but is raised when the finger lever is raised to unlock the sash. A cast metal rack is attached to the jamb casing of the window, with which the wheel engages. The lock is attached to either the lower or upper sash. When the lower sash is down, or the upper sash up, they are securely fastened, as well as when they are in any intermediate position.

## NEW BOOKS AND PUBLICATIONS.

LEVEY'S SOUTH AMERICAN, ASIATIC, AND OCEANIC BUSINESS DIRECTORY of the Principal Cities and Towns in the West Indies, Mexico, South America, Australia, New Zealand, India, China, Japan, and British Columbia. New York: The Foreign Directory Company, 2 Wall street.

The rapidly growing demand for American productions, especially for mechanical devices and tools, has rendered a directory of merchants and purchasing agents resident abroad a positive necessity to our manufacturers and shippers; and laborious and costly as the work must inevitably be, it has been thoroughly done by Mr. Levey in the volume now before us. The names and addresses of the dealers in each class of merchandise, in the principal importing countries of the world, are given with such detail and completeness as to raise wonder at the labor expended in the compilation of the book; and each section is preceded by a copy of the tariff of the country, and a short description of its features and the necessities of its people. We recommend this work to all who have goods for which they are seeking a market.

SANITARY ARRANGEMENTS FOR DWELLINGS, intended for the Use of Officers of Health, Architects, Builders, and Householders. By William Eassie, C. E., Author of "Healthy Houses," etc. Price $2.25. New York: G. P. Putnam's Sons, Fourth avenue and 23rd street.

This book is a concise treatise on one of the most important subjects on which scientific men and the public can bestow their attention. It cannot be too carefully read by those to whom it is especially addressed, particularly during the present inception of hot weather and its concomitant train of evil smells and tainted food, and the consequent zymotic diseases.

THE STEPPING STONE TO ARCHITECTURE, a Catechism of the Principles and Progress of Architecture from the Earliest Times. By Thomas Mitchell. Illustrated. Price 60 cents. New York: A. J. Bicknell & Co., 27 Warren street.

A much needed little handbook for beginners in a science which is too seldom understood by ordinary readers.

RESEARCHES IN THE LIFE HISTORY OF THE MONADS. By Rev. W. H. Dallinger, F.R.M.S., and J. Drysdale, M.D., F.R.M.S.

These treatises, reprinted from the *Monthly Microscopical Journal* and accompanied by the original illustrations, are very interesting accounts of persevering investigations of the nature of the lowest forms of life. We cordially commend them to the reader, not only on account of their general interest, but in the belief that they will encourage the use of the most fascinating of all scientific apparatus, the microscope.

THE ENGINEER, ARCHITECT, AND SURVEYOR. Nos. 1 & 2, Volume I. Subscription $3 a year. Chicago: Frost and Moore, 168 Washington street.

The prospectus of this new claimant for public support states that it is "sent forth to fill a vacancy existing in the engineering literature of the country;" and its first issues are promising, not only as to the manner in which the publication will be edited, but also as to the very extensive field it proposes to cover.

PROCEEDINGS OF THE ANNUAL CONVENTION OF THE AMERICAN INSTITUTE OF ARCHITECTS, held in Chicago, Ill. October 15, 16, 17, 1873. A. J. Bloor, F.A.I.A., Editor.

An interesting account of the annual gathering of one of our most valuable professional societies.

## Answers to Correspondents

F. M.'s lightning rod query is answered by anticipation on p. 347, vol. 30.—W. H. M. will find directions for making fusible plugs on p. 266, vol. 26.—D. A. will find a description of a filter for rain water on p. 241, vol. 27.—W. H. S. will find directions for placing a noon mark on p 234, vol. 29.—J. K.'s query as to using a wider belt is incomprehensible.—W. H. S. will find directions for a walnut wood filling on p. 262, vol. 30, and for green and yellow bronze in the same paragraph.—S. J. S. is informed that making billiard balls of hard rubber is a very old idea.—B. F. S. is informed that his device for making a glue joint on thin stuff is not new.—A. Y. and C. R. should consult our advertising columns.

W. C. V. N. asks: 1. How is mesmerism explained? A. By the well known facility with which ignorant and credulous people can be made the victims of charlatans. 2. Does it have an injurious effect on those who are operated upon? A. Yes, by allowing themselves to be deceived. 3. There has been a fellow around who claims to have a power to control which is not mesmerism, but he calls it animal magnetism and "mesmerism improved." Is it not mesmerism? A. They are both humbug.

J. P. asks: 1. What pressure will a boiler, 8 inches in diameter, 24 inches in length, with 3 flues 1½ inches in diameter, stand, the shell and flues being of galvanized sheet iron 1-32 of an inch in thickness, with 6 hoops of the same iron 2 inches wide? The hoops and boiler are soldered and locked together strongly. A. The boiler will safely sustain the 10 or 15 lbs. you speak of. 2. Would such a boiler be apt to burn out in 6 or 8 months, using the boiler 15 or 16 hours a week with wood as fuel? A. Whether or not it will burn out will depend greatly upon the manner in which it is set. 3. Will the boiler make steam enough for an engine 2 inches in diameter by 5 inches stroke, making 150 revolutions per minute, the pressure being 10 or 15 lbs. to the square inch? A. Probably. 4. In case it will stand that pressure, will steam ports ¾ inch long and ⅛ inch wide be large enough for an engine of that size? A. The size of steam ports you mention will answer very well.

A. X. & C. R. ask: What is the best kind of a skin for a banjo head? A. Parchment.

T. C. says, in reply to A. B., who asks in No. 17 for a formula for obtaining the force of the wind at different velocities: Wind blowing one mile per hour exerts a pressure of 0·005 lbs. to the square foot; as this pressure increases as the square of the velocity, the formula is $V^2 \times 0{\cdot}005 = P$. This may be calculated mentally by multiplying the velocity by half of itself and calling the last two figures decimals. For instance: wind blows 16 miles per hour: $16 \times 8 = 1{\cdot}28$ lbs. pressure per square foot.

W. T. Y. S. asks: Why does a body projected vertically into the air not return to the earth with as great velocity as it had on leaving the earth? A. Because it encounters the resistance of the air in its descent.

S. A. T. asks: 1. What is meant by "parts," that is, in 10 parts, 6 parts, etc.? Does it mean parts by weight? A. Yes, unless otherwise expressed. 2. Can you give me a method by which I can make an attractive light in a store window? A. Use a small carbureter and a silvered reflector. 3. Can you give me a recipe for coloring leather black? A. Use the recipe given on p. 357, vol. 30, leaving out the Prussian blue. 4. I have heard that Russia leather was red because the tanning process gave it both its red color and peculiar odor at the same time. Is this so? A. Russia leather can be dyed to any shade. The odor is due to birch tar, used in the tanning.

N. L. T. asks: 1. Would a candle burn in a boiler with a pressure of steam, provided it did not melt? A. No, because steam extinguishes a candle. 2. I made a plaster cast for a stereotype, which I dried 2 or 3 days on a stove; but when the melted type metal was poured on to it, large bubbles rose and spoilt the casting. What caused them? A. The moisture remaining in the plaster.

G. E. F. says: I wish to ascertain the pressure of the waves on a breakwater placed at right angles to the direction of the sea. Can you suggest a self registering gage that will answer for the purpose, be strong enough to withstand the force brought against it and not be affected by the water? A. The pressure of the waves is approximately equal to twice the pressure due to their hight. It might be practicable to arrange a piston against which the waves would strike, producing compression of some substance in the cylinder, which would be registered on a recording gage.

A. B. D. asks: What is the best manner of applying the blowpipe to the lamp flame and to the work? A. Apply the tip of the blowpipe to the edge of the flame when a reducing flame is wanted, and insert it a short distance in the flame when an oxydizing flame is wanted.

P. C. says: We have a condensing engine for which we use city water; there is a stream 1 000 feet from us and 10 to 12 feet lower than our condenser. Could we draw the water that distance? If so, what rule would govern as to size of pipe, etc.? A. It could be done, but we scarcely think such an arrangement would be advisable. It might be better to construct a reservoir, near the condenser, lower than the source of supply, and conduct the water to that. We can, of course, give but a meager opinion, knowing so little of the details; and we can assure you that it is generally true economy to entrust a matter of this kind to an engineer.

O. M. asks: Would a galvanized sheet iron boiler, 12 inches high and 7 inches in diameter, be strong and large enough for an engine of 1¼ inch bore and 3¼ inches stroke? A. The boiler would not be large enough.

E. A. C. says: According to Seydlitz, one degree of the equator is equal to 15 geographical miles. A friend of mine pretends it is equal to 60 geographical miles. Is there a difference between a geographical mile in Europe and in America? A. You and your friend are both right, a German geographical mile being equal to four English geographical miles. It is to be observed that the length of a degree of longitude referred to is the mean length at the equator.

J. P. S. says: 1. I am driving light machinery from a countershaft driven by a three inch belt. What sized engine shall I require to do the work? A. You have omitted one very important particular, the speed of the belt. 2. How can I get rid of insects on garden peas? A. We advise you to change your seed.

A. A. A. asks: 1. Why is dried beef called jerked beef? A. It appears to have no connection with the original roots from which the verb "to jerk" is derived, and the etymology throws no light upon it. 2. What property of water is removed when it turns to ice? A. A portion of its heat, which is rendered latent or hidden when water changes from the solid to the liquid condition, and is given out again when it changes from the liquid to the solid state. 3. Why is ice lighter than water? A. Because, in freezing, water expands. 4. Do you know of any way of making vinegar from a material so that the vinegar will cost from 3 to 10 cents per gallon? A. See p. 58, vol. 30.

F. O. G. says: 1. I put a little nitrate of silver in some water, and then I put in some ammonia and some muriatic acid, and there was something in the bottle resembling chalk. Can you tell me what it is and what it is good for? A. It was a precipitate of chloride of silver. It is good for sensitizing photographic paper, when suitably applied. 2. What substances mixed together will make a blue color? A. Perchloride of iron and yellow prussiate of potash, both in solution.

A. S. asks: 1. What would be the effect of lightning striking a boiler under a pressure of steam? A. None, if the lightning is carried off by proper connections with the ground. 2. Is it dangerous to be about machinery during thunderstorms? A. There is thought to be danger in the presence of large quantities of metal. 3. Has a boiler ever been known to be exploded by lightning? A. We know of no instance of this.

J. E. E. says: I have in my possession an autograph letter written by Charles Sumner more than one year ago. By the use of a solvent (spirits of turpentine) I succeeded in making two dim press copies, barely readable. Every trace is perfect on the paper. Is there any process by which the ink colors can be brought out so as to be more prominent and readable? A. Cover the letters with solution of ferrocyanide of potassium, with the addition of diluted mineral acid (muriatic); upon the application of which the letters will change to a deep blue color. To prevent the color from spreading, the ferrocyanide should be put on first, and the dilute acid added upon it.

F. O. B. asks: 1. What is the surest method of preserving eggs for a period of 6 or 8 months? A. Mix together in a tub or vessel one bushel of quicklime, thirty-two ounces of salt, eight ounces cream of tartar, with as much water as will reduce the composition to a sufficient consistence to float an egg. It is said that this treatment will preserve the eggs perfectly sound for two years at least. 2. Is there any work published on the art of preserving meat, fruits, etc.? A. We know of none. 3. Has vegetable charcoal the same properties for purifying and preserving as animal charcoal? A. No.

T. J. P. asks: What chemical, if any, is best calculated to clarify sugar cane sirup during its manufacture? A solution of common lime has been used in South Carolina, but without much improvement in the transparency of the sirup. A. The method mentioned is the one generally recommended. But care should be taken to add the lime in quantity just sufficient to neutralize the free acid, which is known by its no longer reddening litmus paper.

J. H. K. asks: 1. Of what dimensions ought a boat, to carry from four to six persons, to be light, run fast, and be easily managed, to be? Can I make a propeller to be worked by hand and to be easily removed from boat when not in use? A. We could not answer this question without an extended article, and you can doubtless obtain all information from a builder. 2. Will a cistern 10 by 25 feet hold water enough to run a 12 horse power engine for 3 months? A. No. 3. Could a pipe be connected with the escape pipe of the engine so as to condense the steam and lead it back to the cistern? A. No.

K. asks: 1. What is the reason that American lathes are made with a fine-threaded leading screw (of 8 or 10 threads per inch) while the English ones have a screw of 2 or 4 threads per inch? A. It is easier to secure accuracy by making the pitch fine. 2. English change wheels (Whitworth) are 22 in a set, ranging from 20 to 120 teeth by 5. The American lathes appear to have only 14 wheels. What is the reason of this difference? Will the American lathes cut as fine and as great a variety of threads as the English ones? A. If the pitch of the lead screw is finer, it will not require so much intermediate gear for fine work, and for the same number of variations.

T. S. R. asks: Does a column of mercury measure 2 4-10 inches to the pound, which, in order to get 200 lbs. pressure, would require a hight of 40 feet? A. It is approximately correct to allow 2 4-100 inches of mercury for each pound of pressure. For nice operations, corrections for temperature and for the pressure of the atmosphere should be applied.

L. P. O. says: My circular slide valve cuts off the steam at ¾ stroke. The length of stroke is 24 inches, and the exhaust closes 2 inches before the stroke is completed (that is, at 22 inches) and opens at 23 inches. Is this an economical arrangement, or is there any well settled point at which the exhaust should close and open to give the best results? A. You do not send sufficient data; but if your engine works smoothly, the arrangement probably answers very well.

T. P. says: 1. I am about building a stump machine in which I wish to hitch the horse to a 30 foot lever, so that he will have to go three times around with the sweep while the stump lifts two feet perpendicularly, the change of motion to be got by bevel cogs. How many horse power will a machine so constructed give? How large should the cogs be to stand the strain? How many pounds would the machine lift? Of what size should the shaft that bears the weight be? The latter will not be over 8 feet long. A. You can readily calculate the theoretical lifting force of the machine by the relative distances passed over by the horse and lifter, which are about as 94 to 1. Of course, friction and other prejudicial resistances will prevent the lifting of a weight 94 times as great as the tractive effort of the horse. But you can design your machine on this supposition. 2. Which is best for a person when angry, to keep his rage pent up within him or (to use a common phrase) to "spit it out?" I refer to the effects upon the health or body. A. We believe that Mr. Meagles' advice to Tattycoram, to take time, when she was angry, and count five-and-twenty before acting, is applicable in most cases.

H. C. asks: 1. How can I produce on small articles of malleable iron the coppery appearance or finish like that on curtain fixtures? A. By a bath of sulphate of copper. 2. Where can fluor spar be had A. See our advertising columns.

R. S. F. asks: What is the rule for calculating centrifugal force? Would 1 lb. on the periphery of a wheel 1 foot in diameter, running 100 revolutions per minute, have the same centrifugal force as the same weight on a wheel twice as large running half the number of revolutions in the same time? If I place 1 lb. on the periphery of a wheel and 2 lbs. on the opposite side, half way between the periphery and center, would the wheel be in running balance? If not, why not? A. Divide the weight by 32·2, multiply this quotient by the square of the velocity in feet per second, and divide by the radius expressed in feet. Calling r the radius, v the velocity in feet per second, w the weight, the expression for the centrifugal force is $\frac{w \times v^2}{32{\cdot}2 \times r}$. By the application of this rule, you can readily answer your other questions.

J. K. W. asks: How can I find, on the surface of a revolving cutting iron, the exact shape for striking any given molding? A. Double a piece of paper, cut out the form of a section of the given molding, then open the remaining paper, which will have the shape of a section of the cutting tool.

H. H. D. asks: 1. Is a carbon battery more effectual with nitric acid in the porous cell than with the usual bichromate solution? A. Yes. 2. Please give me instructions for constructing an induction coil. A. See answer on n x page. 3. To which current should the condenser be connected, and how many square feet should it contain? What effect does it produce? A. To the induced. Some of the large coils contain as high as seventy-five square yards. It intensifies the effect. 4. Would not eight layers of the primary wire produce greater intensity of the secondary current than a less number? It would certainly develop more magnetism in the core. A. Probably; you can easily try it. 5. Which is most effectual as an insulator, paraffin or shellac? A. Paraffin. 6. Is the insulation of the primary coil with shellac or paraffin as important as the careful insulation of the secondary? A. It should be thoroughly insulated, and is quite as important. 7. Should the fine wire be wound from end to end of the bobbin, or only in the center? A. From end to end. 8. Would it not be a good plan to wind the primary coil only at the ends of the core, thereby enabling the secondary to approach nearer to the magnet? A. It would not answer.

H. A. asks: 1. How can I make lemon sugar? A. To one quarter lb. sugar add about one half oz. tartaric acid. 2. Is Dr. Ure's "Chemical Dictionary" an American or English work? A. English. See our advertising columns for booksellers' addresses. Fowne's "Elementary Chemistry" is published by Blanchard & Lea, Philadelphia, Pa. In answer to your other question: We cannot recommend you to use any drugs which are dangerous in inexperienced hands.

H. H G. asks: What is the best material or preparation to line or cover the interior surface of a wooden tub for silver plating, to prevent the wood from absorbing the cyanide solution, and leakage? The material must be durable and not affect operation of plating. A. Paraffin varnish will answer.

J. N. P. says: In Auchincloss' treatise on "Link and Valve Motions," on p. 27, he says: "The circle from remote ages has (though not wisely) been divided into 360 equal parts," but he fails to say why it is unwise. Will you be kind enough to do so? A. Because if the divisions were made on a decimal system, so that there were 100 degrees in the circumference, 100 minutes in a degree, 100 seconds in a minute, reduction would be much easier. For instance, to reduce degrees to minutes, it would only be necessary to annex two ciphers, and so on.

J. H. P. asks: What is the best sized pipe for an engine placed a hundred feet away from the boiler, the engine being of 10 inches bore and 18 inches stroke? The boiler is 42 inches in diameter and 10 feet long. I contend that we can get the most power through a 2½ inch pipe, but my employer says that we can get more power through a 2 inch one. Which is right? A. It is well to use as small a pipe as can be employed without reducing the pressure, if the pipe is not covered. We would recommend the 2½ inch pipe in your case. 2. What is the difference between a low and a high pressure engine, and why does it take less steam for the low pressure than it does for the high? A. One condenses the exhaust steam, and the other does not. If there be less back pressure, as in the case of the condensing engine, of course less steam will be required to produce the same mean effective pressure.

H. W. S. asks: 1. What is the rule for calculating the revolutions of engines of circular saws? A. There is no rule; but a counter can be attached that will register the revolutions. 2. How can I calculate the revolutions of saws, run from countershafts? A. If you know the speed of the first shaft, multiply it by the diameter of the driving pulley, increased by the thickness of the belt, and divide by the diameter of the driving pulley increased by the same amount. This will give the speed of the countershaft. Then consider it the driving shaft, and find the speed of the saw, etc. in a similar manner.

T. F. H. asks: 1. What are the ingredients for making the best lubricator for large bevel gears exposed to the weather? A. Black lead and tallow will answer very well. 2. What is the best material for preserving timber exposed to sun and rain? A. Bethel's process of forcing the vapor of creosote into the pores of the wood is largely employed for the preservation of railroad ties and wooden superstructures.

A. V. K. asks: Is there any way to condense steam without using a continuous stream of some cold liquid? A. The steam must come in contact with something having a temperature lower than its own. Possibly a solid, such as ice, might be employed.

G. W. H. says: 1. What is the power required to pump 3 gallons of water per minute? A. You do not say how high the water is to be lifted. Ordinarily, it is well to allow at least twice as much power as would be required to lift the water only, neglecting friction and other prejudicial resistances. 2. What is the power produced by one of the best turbine wheels? A. About 75 per cent of the power of the water.

A. R. asks: How can I turn grooves in soft rubber rolls? A. It might possibly be done with a file, if the rollers are hollow, and could be revolved at a high speed.

W. F. asks: 1. What is the proper temperature of water when fit for bathing? A. A few degrees below the ordinary temperature of the human body. 2. What can I use to make wood adhere to glass? A. Diamond cement.

W. C. D. asks: How can I procure a perfect vacuum in a common bottle for an experiment? A. This cannot be obtained with a common bottle alone. As near an approach to a perfect vacuum as can be obtained by mechanical means can be effected by connecting the bottle with an air pump. The method resorted to in certain physiological laboratories in Germany when a so-called perfect vacuum is desired is to fill a large jar with mercury, invert it (the rim of the jar always remaining below the surface of the mercury), and then, when the mercury has fallen to the hight in the jar at which it would be sustained by atmospheric pressure, to connect a bottle, or other vessel in which it is desired to produce a vacuum, with the vacuum thus produced.

J. S. asks: 1. How can I make an electroplating battery? A. See answer to A. P., on this page. 2. Please give me a formula to make magic photographs. A. Consult *Science Record* 1873, p. 214. 3. What is a good remedy for a fogging negative silver bath? I have had much trouble with fogging baths, and can find no remedy. A. Fogging may occur from so many causes that any general rule cannot be given. Sun, filter, bring to proper strength and give proper reaction, and then the trouble will probably disappear.

T. S. asks: How can I make a fluid ink eraser? A. One such fluid is said to consist of chloride of lime solution, to which are added a few drops of muriatic acid.

A. E. P. says: I have a barometer in which the mercury has become separated. How can I get it together again? A. By inverting the barometer with great care, filling it entirely with pure mercury, and then restoring it to its proper position, taking precaution not to admit the smallest bubble of air.

H. E. B. asks: I make great quantities of chips impregnated with oil. I extract part of the oil by means of steam, but still a great deal is lost, and what is drained off is sometimes so thick with iron rust and scale as to be almost useless. I have also great quantities of oily waste, that I have found it impossible to clean in a thorough manner. How can I use bisulphide of carbon for the above purposes? A. The bodies to be cleaned are to be treated in closed tanks into which the bisulphide of carbon is drawn.

W. B. asks: Is there a marking fluid which is not affected by rain? I wish to use it on stone. A. It is customary for this purpose to use any good black paint.

B. M. H. asks: I find that old car springs are the best rubber I can obtain for erasing lead pencil marks. Do the properties that make it so belong to that kind of rubber, or do they result from the mechanical action, compression and vibration, to which it has been subjected? A. This is due to the quality of rubber used.

R. W. H. asks: 1. What are the chemical properties of common sorghum molasses? A. It is cane sugar in a non crystalizable condition. 2. What is the chemical process of converting sorghum molasses into sugar? A. The conversion of the non-crystalizable into the crystallizable cane sugar. 5. What is the best process of making vinegar without apples? A. By the purification of wood vinegar, a body which is obtained by the dry distillation of certain woods.

J. L. C. asks: Is the electricity generated by an electrical machine of a kind to form an electromagnet, and is it generated in sufficient quantity to keep it magnetized? A. No.

W. D. M. asks: Can you tell me what kind of an electric battery I should construct, that will be permanent for some time, say six months at least, and have power enough to run an electric alarm bell, such as is used in the burglar alarm telegraph? A. Into a porous cup about 5 inches high and 3 inches in diameter place a plate of carbon, such as is used in the ordinary Bunsen. Fill the cup with best manganese peroxide and seal with asphaltum. Place it in a small jar half full of strong solution of sal ammoniac in water, into which also place a rod of amalgamated zinc. In this battery the action is wholly upon the carbon, the zinc remaining unaltered and constituting the negative element of the battery. When the fluid becomes milky, add a few crystals of the salt. Two or three such cells will answer your purpose. When properly set up, it will run for from 6 to 12 months.

J. S. asks: 1. Please give me a simple process of silver plating articles with a battery. A. See p 170, vol. 28. 2. Would an engine with a cylinder 1x2 inches, running at 150 revolutions per minute, with steam at 50 lbs. pressure, be sufficiently powerful to run an ordinary sewing machine? A. Yes.

J. D. S. asks: 1. Does crude petroleum, as it comes from the earth, contain anything poisonous or injurious to the human system if introduced through the blood? A. No. 2. What is the difference between crude petroleum and lubricating oil? A. Crude petroleum consists of a mixture of numerous oils of different densities and boiling points. Lubricating oil consists of the heavier oils which are left after distilling off certain of the volatile constituents.

C. asks: How can rubber tissue be made? A. Ordinary gum rubber has a stratified composition. Rubber manufacturers say that rubber tissue is made by simply separating these layers.

A. B. asks: 1. What two or three metals or alloys expand longitudinally the most in a given degree of heat? A. Zinc, lead, and tin, zinc expanding 0 0000-29417 of its length for each degree centigrade, when heated between the freezing and boiling points of water; lead 0 00002875, and tin 0 00002173. 2. Is the molecular rotation sustained in high and low degrees of heat alike? A. No.

J. A. H. asks for information on the subject of carbureting hydrogen gas. A. Hydrogen gas, the chief constituent of coal gas, upon which our large cities depend so much for their light after sunset, has, as is generally known, no illuminating power of its own, but depends wholly for its value as an illuminator upon the amount of carbon associated with it; and attention has long been directed to the subject of supplementing with carbon the already partially carburetted coal gas, and to the problem of carbonizing the hydrogen obtained from peat and from the action of acids on some of the metals. The result is that hundreds of patents have been granted for various devices and machines for carbureting, carbonizing or enriching hydrogen and common coal gas up to the full measure of its light-giving quality; but if supersaturated, the light becomes smoky, and consequently disagreeable. This latter trouble has been one of the drawbacks. The discovery of petroleum has afforded an apparently inexhaustible supply of cheap gas-producing or carbonizing material in the form of highly volatile mineral hydrocarbon oils, such as gasolin, naphtha, benzole, etc., of specific gravities ranging from 0 664 to 0 785. The usual method of carbonizing is that of dividing the liquid into a minutely separated condition, so as to present as large a surface as possible. For instance, a large metallic receiver is constructed and filled with pumicestone: it is then made perfectly airtight and a quantity of gasoline or one of the other oils spoken of is poured on to the pumicestone until it is thoroughly saturated. Connections are now made in such a manner that the gas to be carbureted passes directly through the pumicestone, emerging from the machine saturated with the heavy hydrocarbon vapor. Another and perhaps a better method is that of suspending a large quantity of wicking, in a suitable receiver partly filled with the fluid to be used, and carefully closing all joints. The action here is the same as in the preceding, except that the wicking is kept saturated by the action of capillary attraction. The vapor from these oils is much heavier than the air, and for this reason it sometimes forms in layers in the lower part of rooms where the oil has been standing or used, and when mixed with air forms a terribly explosive mixture. If by any means an ignited match is thrown on the floor, in a room containing or that has contained any of this liquid gasoline, it is sufficient to explode the mixture with disastrous consequences. The principal danger of using these carbureters, then, lies in the highly explosive character of the material used to accomplish the desired result. The only safeguard against accidents seems to be in the rule: Never attempt to fill or charge these machines or reservoirs within doors, or in the vicinity of fire of any kind, but place them underground at some distance from the house.

A. F. S. asks: 1. Can you give me a recipe for a glue that will not soften in moisture? A. Take glue 12 ozs., water sufficient to dissolve it; add 3 ozs. rosin, melt down together and add 4 parts turpentine or benzine. This should be done in a carpenter's glue pot, to avoid burning. 2. Do you know of any way of constructing a good and cheap frictional electric battery? A. Perhaps the cheapest instrument of this character is Volta's electrophorus, consisting of a plate or cake of resin, set in a wooden mold lined with tin foil. A metallic plate with an insulating glass handle serves to collect the electricity.

B. F. B. Jr. asks: How can I dye silk a light slate or drab color? A. For 100 yards silk, boil together 4 lbs. fustic, 2½ ozs. cudbear, and 6 ozs. logwood. Cool to 2 0° Fah., enter the goods and winch for 20 minutes, air out and repeat: take a little of the liquor from the boiler, dissolve in it 1¼ ozs. copperas, reduce it to handling heat with water, and give one or two shots through it as the pattern requires.

G. T. B. says: 1. I want to make an induction coil to use with a small Daniell's battery, to take shocks with. What number of wire and how many feet should I use in the secondary and primary coils? A. Use No. 32, about 500 feet for secondary current and about 100 feet for primary. 2. How long should the coil be? A. About 9 inches. 3. How large should the hole be? A. About one half inch. 4. What size of soft iron wire should I use in the core? A. No. 20 will answer. 5. The zinc plates of my Smee battery are 2½x3½ inches square and a half inch thick. How large a piece of silver should I use? A. As large as your zinc plates.

J. W. C. asks: Does the water of the Mississippi river run up hill? A. No.

J. A. S. says: I took hydrochloric acid, and added small pieces of crayon. A portion of the solid crayon should have passed off in the form of a gas, but it failed. I then added chalk to try the experiment, and it worked successfully. What is the chemical difference between chalk and crayon? A. If the crayon were chalk it should have dissolved with effervescence. If you send a piece which will not dissolve, we shall have it analyzed for you.

T. W.—You can find a full description of ice machines in *Science Record* for 1874, pp. 132, 155.

M. C. B. asks: 1. What is the process for metalizing non-metallic substances for electroplating? A. Coat them with graphite or black lead. 2. What is the best hand book on metallurgy? What book gives the best description of the different modes of silver mining? A. "A Practical Treatise on Metallurgy," by Crookes & Röhrig.

A. P. asks: 1. Which is the best battery for plating and what is the simplest method of constructing the same? A. For small purposes, the Daniell will answer very well. It may be constructed as follows: Take for the outer jar, one of earthen or stoneware filled with saturated solution of sulphate of copper; for the inner porous cell, a common flower pot with the hole stopped or sealed. Fill this with water and place it inside of the larger jar. Place a rod of amalgamated zinc in the inner cell, and the sheet copper in the outer, so as to surround the porous cell. A few drops of sulphuric acid added to the water in the porous cell will suffice to develop the full power of the battery. The battery most used by electroplaters is that known as the electropoion; it consists of the ordinary Bunsen, the exciting fluid being a solution of bichromate of potassa and sulphuric acid. 2. What is the best book on the subject? A. Roseleur's "Galvanoplastic Manipulations."

J. S. McK. asks: Is there any known method of obtaining the exact square root of any number other than the perfect squares? Could they be expressed in numbers? A. To both questions: No.

A. B. O. says: An inveterate tea drinker complains that the last tea bought gives her a burning sensation in the throat after drinking, and thinks it must be adulterated. Is there any way to detect the adulterations of tea? A. Yes, it is possible to detect the adulterations. In the very little specimen which you sent we found none, but it was too small a quantity for a satisfactory examination.

G. W. D. asks: 1. What is the difference between carbonate of potash and hydrate of potash? A. The first is a compound of carbonic acid and potash, the second of water and potash. 2. What is the crude potash of commerce? A. Impure carbonate of potash mixed with sulphate and silicate of potash, chloride of potassium, ash, organic matter, etc. 3. What waterproof composition will adhere to elastic rubber and at the same time to the cuticle? A. Melt together in an iron pot equal parts of common pitch and gutta percha, kept liquid under water, or solid to be melted when wanted.

C. H. M. asks: 1. Is electricity employed especially in any chemical works for inducing, accelerating, or aiding crystallization? A. No. 2. Does any application of electricity promote or hasten the crystallization of substances? A. Yes.

A. A. B. says: 1. I have a kerosene lamp using an argand burner; after it has been burning 30 or 45 minutes, it becomes very hot and begins to puff and sputter so that we cannot use it. What is the cause? A. The burner is so badly arranged that it allows the heat to be conducted to the contents of the lamp. 2 What shall I use to stick gold or bronze leaf on glass and on paper? A. A solution of isinglass in water. Still better: for fixing gold leaf on wood, paper, etc., use a solution of linseed oil and lead plaster in oil of turpentine. This is made by first saponifying linseed oil with caustic soda or potassa, and precipitating the aqueous solution of the soap with a solution of sugar of lead, the lead soap thus formed being next dissolved in oil of turpentine. 3. What is the best varnish to use on very white wood, such as basswood, that will not stain or discolor it, but leave it clear and white? A. White picture varnish. 4. What is the best filling to be used on black walnut before putting on oil? A. Beeswax hardened with sealing wax and colored with umber may be used.

J. P. D. asks: What will prevent the dampness from rising in brick walls? Will three or four courses of brick laid in cement or a strip of galvanized iron, the width of the wall, prevent it? A. Lay two courses of brick in melted asphalt and two courses upon these in hydraulic cement, covering the exposed surfaces well. A layer of zinc is also a preventative.

W. asks: What length of time does it take to rip a piece of spring steel 6 feet long by ¼ inch thick with a toothless saw, made of soft iron? How should such a saw be made? A. The periphery of the saw should run about 20,000 feet per minute, and ought to melt (as it really does) through at least one foot in length per minute. The saw must be perfectly balanced and hammered very open in the center, that is, so that the center will be loose, in order to allow the periphery to expand by centrifugal force caused by its own velocity.

J. H. says: You state in your paper that plaster of Paris mixed with 8 per cent marshmallow root, powdered, would harden in one hour, and could be rolled out into plates and polished. I have tried this with hot and cold water several times, and it will not harden at all; it will set somewhat, but will crumble away if you handle it. What is the matter? A. Experiment demonstrates that: 1. The only effect marshmallow root seems to exert upon gypsum is to retard its setting or hardening. 2. That when set or hardened it becomes very brittle: and where a large percentage of marshmallow root is used, it either falls to a powder or crumbles when touched.

S. F. M. says: 1. I am making a foot lathe and do not understand laying out cone pulleys. The driving wheel faces are 24 and 25 inches diameter. I want the driven pulley to be 3 inches diameter for the smaller face; what should the other be? A. See p. 134, vol. 11. 2. What width of belt would be most suitable? A. Make the belt from an inch to one and a half inches wide.

B. says: I wish to drain the bottom of a cellar, on which I propose to lay a concrete floor. The method I have adopted is to sink longitudinal trenches 10 inches x 12, and fill loosely with bats broken about the size of a hen's egg; then to cover the whole with concrete. The trenches start near the footings of the party wall. Do you think this will effect the object? If not, can you advise something? At certain points in the foundation bottom, several springs and quicksands have been discovered. A. The plan you have adopted is a good one, provided that you connect the main trenches with lateral ones, and discharge the whole into a main drain leading away from the house.

S. B. McC. asks: What is the solid content of a stick of timber, the base of which is 14 inches square and the top 10 inches square, and length 20 feet? What is the rule for obtaining the same? A. This stick is in the form of a frustrum of a right prism, with the two bases parallel. The rule for calculating the solidity is as follows: Add together the area of the lower base and the area of the upper base; extract the square root of the product of these two areas. Multiply this sum by one third of the perpendicular distance between the two bases. Applying the rule to the case in question, we have area of lower base, $14\times14=196$; area of upper base, $10\times10=100$. Square root of the product of these areas, $\sqrt{196\times100}=140$. Perpendicular distance between the two bases, $20\times12=240$ inches. Contents of timber, $(196+100+140)\times80=814,880$ cubic inches. Contents in cubic feet, $184,880\div1728=20\frac{4}{7}$.

J. B. H. asks: What is the method of balancing the reciprocating parts of an engine, for which Mr. Main received from the Secretary of the Navy the sum of $600? A. As we understand the arrangement, it is not a true counterbalance, but consists of weighting one of the cranks, which can hardly be considered novel. Indeed it is said to give so little satisfaction that these so-called counterbalances are being removed from the cranks of many marine engines.

C. M. asks: What is dry steam? A. Steam of such heat that it will absorb moisture from any damp substance placed in it.

P. J. asks: How can I dissolve gutta percha so as to make a thin waterproof varnish, capable of being laid on with a brush? A. Take 4 ozs. clean gutta percha, dissolve in 1 lb. rectified resin oil, and add 2 lbs. linseed oil varnish, boiling hot.

S. D. asks: What will restore the color of or clean colored leather? A. Use 1 oz. oxalic acid dissolved in 1 pint distilled water.

G. L. M. says: I lately read a statement that Dr. Huggins has discovered that the star Arcturus is approaching the earth at the rate of about fifty miles per second. 1. Is this true? If so, in what part of the heavens can the star be seen at night? Can the star be seen with the naked eye? Does the star appear to grow larger? How far distant is the star from the earth at the time that this letter reaches you? A. Yes; Arcturus is a bright red star of the first magnitude, in constellation *Bootes*, overhead at 9 P.M. Its proper motion is 54 miles per second toward the earth, and its light, traveling 185,000 miles per second, takes more than twenty-six years to come here. 2. What is the greatest depth that man has ever attained, and where? A. One of the deepest holes we recollect is the "Road to Heaven" silver lead mine, near Freiberg, Saxony, 2,000 feet down to the sump.

S. says: I wish to construct a telescope for a rifle. Can you inform me how many lenses will be required, and what the diameter and focus of each lens should be, and in what manner they must be mounted on the rifle? A. Object glass half an inch diameter focus 24 inches or as long as convenient. Eyepiece may be a single lens of low power with cross spider lines fixed in its focus. The target will then appear inverted. The lenses are enclosed in a brass tube with a hinge or ball joint at the breech or eyepiece end, and slides at the muzzle, to depress the object glass, for increased elevation. The two points of attachment to the barrel are the same as for ordinary fore-and-leaf sights.

T. S. C. says: In your answer to N. L., you say that "the shrinkage of wood endwise is very slight, if any." It is probable that if the wood were perfectly straight grained, there would be no shrinkage endwise I have seen places in board fences where the board was displaced endwise 3 inches from where it had been originally nailed; and I have seen the top rails (3x4, oak) in picket fences drawn apart 8½ inches in a fence 150 feet long. I have, however, always attributed this to the lumber not being at all times sawn parallel with the grain of the wood.

J. M. says, to help B. and J. out of their trouble of bubbling in casting zinc: Do not overheat it; but when melted, pour at once, and you will find you can get a sharp model in quite moist sand. I stir with a pine stick until all the metal is thoroughly liquefied. I have used various sizes of zinc, and since following the above directions I have had no trouble.

R. S. says, in answer to A. A. W.'s query as to breaking gage glasses: If you get good flint glass tubes, and your gage cocks are set true, they will last a long time Instead of taking them out to clean them take the nut off the top cock and pour a little oil down the tube: it will remove the scale.

W. H. S. says, in answer to J. A. McC.'s Jr.'s question as to the tube and disk of paper: A number of years ago the Royal Society offered a gold medal and one hundred guineas for the explanation of the phenomenon mentioned by him. The following was the explanation which received the prize: Supposing the diameter of the disks to be to that of the hole as 8 to 1, the area of the former to the latter must be as 64 to 1. Hence, if the disks were to be separated (their surfaces remaining parallel) with a velocity equal to that of the air blast, a column of air must meanwhile be interposed, sixty-four times greater than that which would escape from the tube in the same time: consequently, if all the air needed to preserve the balance be supplied from the tube, the disks must be separated with a velocity as much less than that of the blast as the column required between them is greater than that yielded by the tube. It follows then that, under the circumstances in question, the disks cannot be separated with a velocity greater than one sixty-fourth the blast. Of course all the force of the blast will be expended on the movable disk and the ring of air between the disks and since the aforesaid disk can only move one sixty-fourth the velocity of the blast, the ring of air must receive nearly all the force of the blast, and be driven out in currents radiating from the common center of tube and disks.

---

C. H. M. asks: I have several times read that in order to make it possible for some birds to talk their tongues have to be split, or that after their tongues were split they could talk. Among common birds, this has been asserted of the crow and jay. Is this true, and if so, how is the splitting done? How far would the bird's tongue have to be split? I cannot see how this operation would enable them to speak.—X. X. O. asks: How can I make a burnishing liquid to produce a light straw color on sole leather?—H. M. D. asks How can I dye aniline scarlet on mixed goods?

---

## COMMUNICATIONS RECEIVED.

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

On Screw Propellers. By J. H.

On the Climate of the United States. By J. S. McA.

On Alkaline Waters and Fish. By G. A. F.

On the Wisdom of Science. By J. A. B.

On Acoustics of Public Buildings. By A. W. C.

On Aerial Navigation. By L.

On a New Local Anæsthetic. By F. L. J.

On the Moon's Axial Revolution. By C.H.M.

On Lunar Attraction. By W. B.

On Light Freight Cars. By H. S. B.

Also enquiries and answers from the following:

A. P.—H. R. C.—F.—J. E.—J. H. D.—W. D.—W. F. M —A. B. C.

Correspondents whose inquiries fail to appear should repeat them. If not then published they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

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

[OFFICIAL.]

# Index of Inventions

FOR WHICH

**Letters Patent of the United States**

WERE GRANTED IN THE WEEK ENDING

## May 12, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]



### 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:

29,286.—File Cutting Machine.—E. Bernot. July 15.
29,562.—Boots and Shoes.—L. R. Blake. July 29.
29,561.—Making Boots, etc.—L. R. Blake. July 29.
29,576.—Piston.—H. D. Dunbar. July 29.
29,579.—Engine Governor.—R. W. Gardner. July 29.
29,633.—Cutter Head.—H. D. Stover. July 29.
29,648.—Sewing Machine Needle.—F. H. Drake. July 29.
29,694.—Clothes Dryer.—D. K. Hickok. Aug. 5.
29,707.—Cultivator.—T. W. McDill. Aug. 5.
30,088.—Windmill.—J. K. Babcock. Sept. 2.
30,281.—Lamp.—J. E. Ambrose. Sept. 30.

### EXTENSION GRANTED.

28,314.—Water Wheel.—A. M. Swain.

### DISCLAIMER.

28,314.—Water Wheel.—A. M. Swain.

### DESIGNS PATENTED.

7,421.—Steering Wheel.—D. N. B. Coffin, Jr., Newton, Ms.
7,422 to 7,424.—Carpets.—J. Fisher, Philadelphia, Pa.
7,425.—Pin or Badge.—R. B. Freeman, Blossburgh, Pa.
7,426.—Harness Rosettes.—W. Greacen, Newark, N. J.
7,427 to 7,430.—Vases.—J. W. Fiske, New York city.
7,431.—Automatic Toy.—E. R. Ives, Bridgeport, Conn.
7,432.—Ruches.—A. A. Rockwell, New York city.
7,433.—Pill Packing Case.—C. T. White, New York city.
7,434.—Vase.—J. W. Fiske, New York city.

### TRADE MARKS REGISTERED.

1,774.—Angelus Clocks.—Angelus Clock Co., Phila., Pa.
1,775 and 1,776.—Medicines.—Dr. J. Ball & Co., N. Y. city.
1,777.—Fruit, etc., Prepared.—L. Contencin, N. Y. city.
1,778.—Shirtings, etc.—Jackson Co., Nashua, N. H.
1,779.—Mineral Water.—E. W. Johnson, Boston, Mass.
1,780.—Ginghams.—Lancaster Mills, Clinton, Mass.
1,781.—Medicine.—R. Pengelly *et al.*, Saugatuck, Mich.
1,782.—Buttons.—Porter Bros. & Co., New York city.
1,783.—Ginger Ale.—S. L. Simpson, New York city.
1,784.—Gin.—S. L. Simpson, New York city.
1,785.—Pickles, etc.—Skilton & Co., Somerville, Mass.
1,786.—Candles.—W. H. Woods & Co., Cincinnati, O.
1,787.—Yeast Powders.—A. G. Dooley, New York city.
1,788.—Flour.—J. B. Ficklen & Bro., Fredericksburgh, Va.
1,789.—Tooth Paste.—Forster *et al.*, Philadelphia, Pa.
1,790.—Roof.—J. McDerby *et al.*, Manchester, N. H.
1,791.—Extracts.—McMillan *et al.*, San Francisco, Cal.
1,792.—Telegraph.—R. W. Pope, Elizabeth, N. J.
1,793 and 1,794.—Lard.—W. J. Wilcox & Co., New York city.

### SCHEDULE OF PATENT FEES.

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| On each Caveat | $10 |
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| On filing each application for a Patent (17 years) | $15 |
| On issuing each original Patent | $20 |
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| On application for Design (14 years) | $30 |

### CANADIAN PATENTS.

**List of Patents Granted in Canada.**

**May 12 to May 19, 1874.**

3,431.—William Green, 92 Croft street, Hyde, Cheshire county, Eng. Improvements in automatic couplings for railway and other carriages, called "Green's Automatic Couplings for Railway and other Carriages." May 12, 1874.

3,432.—G. A. Danet, Paris, France, and X. C. E. Feuillant, same place. Improvements in the process of preserving animal and vegetable substances, called "Danet & Feuillant's Improved Process of Preserving Animal and Vegetable Substances." May 12, 1874.

3,433.—J. P. Woodbury, Boston, Suffolk county, Mass., U. S. Improvements on planing machines, called Woodbury's Planing Machine." May 13, 1874.

3,434.—G. Selfridge, St. John, N. B. Improvements on harness for horses, called "Selfridge's Breeching Round and Chape." May 13, 1874.

3,435.—G. Forsyth, Seaforth, Ont. Improvements in the manufacture of portable wire fences, called "Forsyth's Improved Portable Wire Fence." May 13, 1874.

3,436.—D. Allard, St. Albans, Franklin county, Vt., U. S. Improvements on smoke stacks of railway locomotive engines, called "Allard's Smoke Stack." May 13, 1874.

3,437.—J. H. and B. Zieglar, Berlin, Waterloo county, Ont. Improvement in the construction of vehicles, called "The Champion Road Wagon." May 13, 1875.

3,438.—D. Bradford, Hamilton, Wentworth county, Ont. Improvements in car couplings, called "Bradford's Improved Automatic Car Coupling." May 13, 1874.

3,439.—S. Wright, Hillsborough, Jefferson county, Miss. U. S. Improvement on self-adjusting step ladders, called "Wright's Self Adjusting Step Ladder." May 13, 1874.

3,440.—L. Pond, Foxborough, Norfolk county, Mass., U. S. Improvements on hose coupling spanners, called "Pond's Hose Coupling Spanner." May 13, 1874.

3,441.—William J. Shilling, Brooklyn, Kings county, N. Y., U. S. Improvements in locks, called "Shilling's Improved Circular Lock." May 13, 1874.

3,442.—C. W. Woodford, Montreal, P. Q. Improvements on the manufacture of horse shoe nails, called "Champion." May 13, 1874.

3,443.—G. Stacy, Holborn Circus, London, Eng. Improvements in revolving tools applicable to stone dressing, hammering metals, and crushing mineral and vegetable substances, called "Stacy's Revolving Hammer." May 15, 1874.

3,444.—P. M. Thompson, Ascot Township, P. Q., assignee of A. M. Putnam, Peterborough, N. H., U. S. Improvements on pumps, called "Thompson's Improved Pump." May 15, 1874.

3,445.—P. A. Riley, Boston, Suffolk county, Mass., U. S. Apparatus for supplying a water closet with water called "The Riley Water Closet Hydraulion." May 18, 1874.

3,446.—S. W. France, Hamilton, Wentworth county, Ont. Improvement in feed water heaters for steam boilers called "Combination Feed Water Heater." May 19, 1874.

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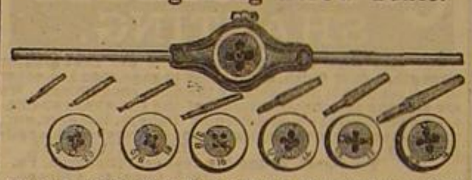

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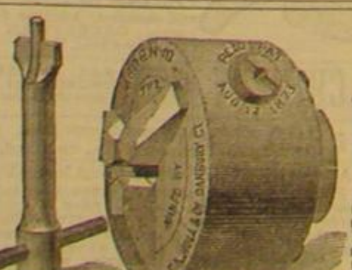

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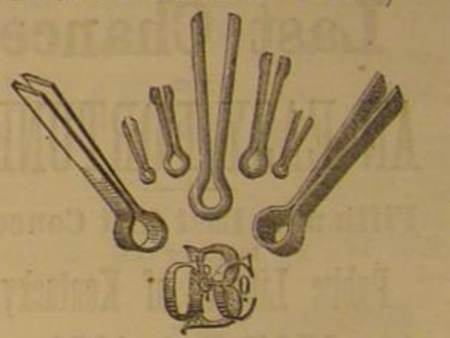

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Vol. XXX.—No 25. [NEW SERIES.] NEW YORK, JUNE 20, 1874. $3 per Annum. IN ADVANCE

## PATENT UNIVERSAL JOINTER.

Messrs. Bentel, Margedant & Co., of Hamilton, Ohio, are the inventors and manufacturers of so many excellent machines, which, from time to time, have found prominent places in our columns, that, in adding another invention to the list, we think that no higher commendation will be necessary to secure for the device the careful attention of the reader, than to refer to it as the handiwork of the above mentioned firm. In wood-working machinery, there is an abundant field for the resources of the inventor; but judging from the frequency with which improvements in that class of mechanism have, of late, been brought to our notice, it is evident that there is no lack of ability and genius being devoted to the production of not only new machines but useful and successful improvements on well known machines.

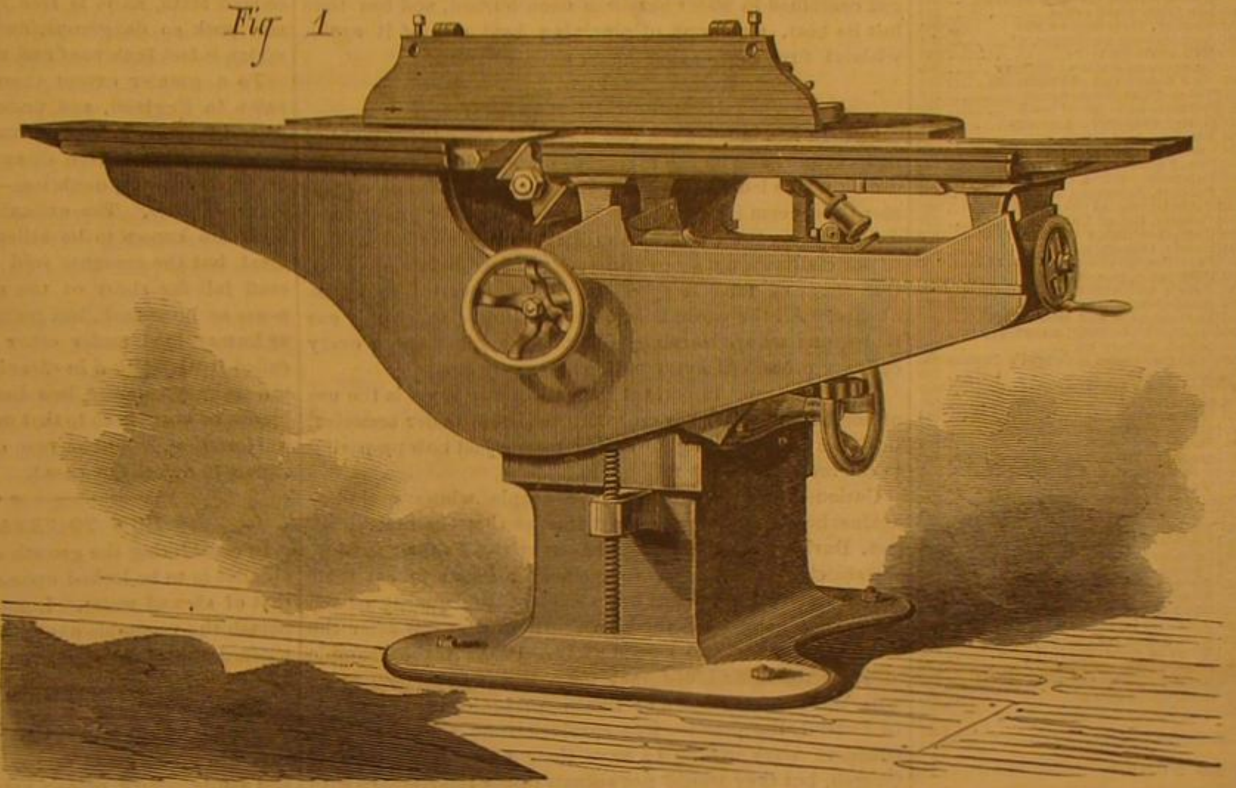
Among those who have done a great deal in this line of invention, the above mentioned manufacturers deserve to be placed foremost in rank. The device last produced by this firm is a planer, and is termed by the manufacturers the Universal Jointer. It will plane out of wind, parallel or taper, joint, square, bevel, and make a perfect glue joint, also a rolling joint. It will square; it will raise and finish one or both sides of a panel at the same operation with square, bevel, scotia, cove, or ogee raise; it will gain and plow, making a square, bevel, or round gain or groove, from $\frac{1}{8}$ inch up to 8 inches wide; it will make straight, bevel, and elliptical moldings, and rabbet any cut from $\frac{1}{16}$ to $1\frac{1}{2}$ inches deep, and $3\frac{1}{2}$ inches wide. It will corner, bevel, hand match, smooth, bead, flute, chamfer, round, nose, saw, bore, and rout; and all of this work is done on the single machine by merely changing heads, the labor of a moment.

The heavy iron body of the tool is cast in one solid piece, and, while occupying very little floor room, is a rigid support of the machine. The table frame, although heavy, and also cast in one piece, can, nevertheless, be easily brought to any required hight, raising both tables of the machine at once, keeping, if required, the given attitude of the tables. The latter are both adjustable. The table in front of the cutter head, which is raised and lowered independently of the table in rear of the latter, or of the table frame, can be moved to or from the cutter head, and at any distance from the same, raised or lowered, or otherwise adjusted. The table, in brief, raises always towards, and lowers from, the cutter head. Back of the two front tables, there is a third table (also adjustable by means of a hand screw), which serves to rest long material upon when gaining, cross cutting, or sticking circular or elliptical molding. The same table serves as a rest for the adjustable fence or guide for planing square, or beveling, and for other purposes. The other side of this machine, shown in Fig. 2, is provided with a boring and routing table, which can be raised and lowered by means of a hand screw. The different kinds of boring and routing can be done here, it being no matter whether the front side of the machine is being used or not at the time.

The machine is suitable for light and heavy work, and therefore will be useful for railway car builders, agricultural carriage and wagon works, planing mills, house builders, sash, door, and blind, furniture, and cabinet, factories.

Two sizes are being made, the one to plane 6 inches and the other 8 inches wide, and are warranted and guaranteed in every particular as to the capacity, quality, and finish of the work. If required, countershafts for the same can be furnished. The pulley on the cylinder should make 3,800 revolutions per minute.

Fig. 1

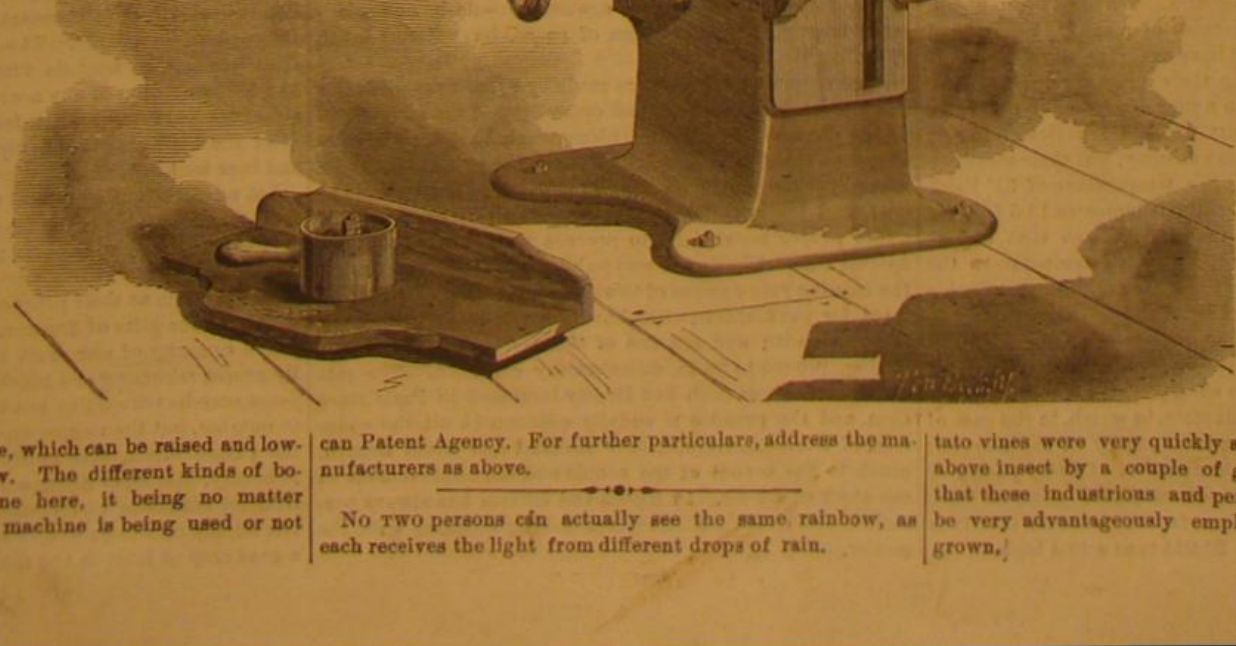


PATENT UNIVERSAL JOINTER.

The body of this very useful machine is so designed that the belt may be brought from below or from a different position on the side. This enables the tool to be placed in an upper story and the belt to be led up to it, thus economizing room, a point of considerable importance in many manufactories.

The device is covered by three patents, the latest dated April 7, 1874, and all obtained through the Scientific American Patent Agency. For further particulars, address the manufacturers as above.

Fig. 2



No two persons can actually see the same rainbow, as each receives the light from different drops of rain.

### The Czar at Woolwich Arsenal.

The London *Telegraph* relates the following account of the Czar's visit to Woolwich arsenal during his recent stay with the Queen: The party made their longest halt in the factory where the Nasmyth hammer, the largest in the world—fitted with top steam—is worked. Adding to the forty tuns dead falling weight of the hammer the fifty-one tuns given by a full pressure of steam above, a blow equivalent to a weight of ninety-one tuns can be given by it with as much control as a child may exercise over a toy mallet. The Imperial party occupied a specially erected platform to witness the welding of the trunnion coil of a thirty-eight tun gun. The Cesarewitch last year witnessed a similar process with the trunnion coil of a thirty-five tun gun. The massive door of the furnace was raised, and, in a fire terrible from the fierceness of its golden glow, stood the white hot coil—a cylinder weighing twenty-three tuns and a half. This trunnion coil consists of two thicknesses of bar iron, coiled one upon the other, and the work of the steam hammer was to weld them into a homogeneous cylindrical mass. The powerful crane was set in motion, and the swarthy smiths sprung to the beautifully adjusted machinery by which the fiery mass was seized by giant tongs, swung glowing and hissing out of the fire, and placed under the hammer. Blasts of hot air rushed across towards the spectators, but the vast size of the building rendered eye protectors unnecessary. The coil, it is needless to say, was welded effectually; the very floor, although its foundations are on a rock, vibrating with the tremendous blows. The force, wielded by but a dozen men at the lever of the crane, was astounding; yet the hammer was subject to a steam power more formidable than itself. In their anxiety to see the next process, the visitors passed hurriedly through the heavy turnery and sighting room, where they might have seen thick slabs of metal peeled off the partly built guns, as apples are peeled by a dessert knife. The party, without bestowing more than a passing glance at the great guns on the lathes, went into the open air to witness the shrinking on of the breech coil of a thirty-five tun gun. Lying side by side, smiling in their new polish, lay a remarkable collection of guns ready for use. The largest cannon was the famous thirty-eight tun gun, the heaviest yet completed. The Woolwich infants (thirty-five tuns) were an interesting family of four; of twenty-five tun guns there were twenty-five, and twenty of eighteen tuns. After these frightful engines of destruction, no one troubled himself much with the smaller cannon, whose name was legion.

REMEDY FOR THE COLORADO POTATO BUG.—Mrs. Samuel Deforce, of Businessburgh, Belmont county, Ohio, writes us that her potato vines were very quickly and effectively cleaned of the above insect by a couple of guinea fowls, and she thinks that these industrious and persevering bug pickers might be very advantageously employed wherever potatoes are grown.

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Contents:

(Illustrated articles are marked with an asterisk.)



## WATER AS FUEL.

Among the attractions at the Colosseum in this city, where the wonderful views of London and Paris are exhibited, are certain practical demonstrations of scientific phenomena, conducted in the side rooms. Here we found a lecturer who has the merit of successfully illustrating his points with some of the most striking standard experiments of the chemical lecture room, but the theories he propounds are not always consistent with the present state of scientific knowledge.

During one of his recent lectures, we heard him expound the idea that, at a future time, when all the wood and coal have given out, we shall use water as fuel, as it contains large amounts of the combustible hydrogen, and is everywhere present in unlimited quantities. Such an idea would have been pardoned forty or fifty years ago, before the doctrine of the correlation of forces was established, before the nature of heat was known, before the mechanical equivalent of heat was determined, and before we knew how to account for the heat of combustion; but it is untenable at the present day, when we know that the heat developed and diffused when the oceans were formed (by the combustion of almost all the hydrogen on our earth) must be given back to this hydrogen, in some form or other, before we can reconvert it into the combustible gas.

In fact, the waters on the surface of our earth are nothing more nor less than the result of the burnt hydrogen, which gave out its heat at the time of its combustion. We know at present that this heat pre-existed in the gaseous hydrogen, stored up in its atoms or molecules. We have become convinced that the atoms or molecules of a gas are not in fixed positions, but move in straight lines or elongated ellipses, hurrying to and fro, encountering their neighbors, rebounding and continuing their course in a new direction, according to the established laws of impact of elastic bodies. They do not move with exactly the same velocity, but their mean velocity is, for hydrogen gas at the temperature of 32° Fah., about 6,100 feet per second, while it increases 12·5 feet for every degree of rise of the thermometer; so that at 522° Fah. or 12,200 feet per second, at which temperature the gas must consequently, under the same volume, exert double the pressure, they will possess twice the velocity.

A pound of ice-cold hydrogen gas possesses, therefore, an internal energy as great as that of a pound ball moving 6,100 feet per second; and it is this energy which is taken from it when changed from its gaseous state, to which, in the case of combustion, is added the internal energy of the oxygen; hence the result that, by the combustion of every pound of hydrogen, an energy is developed of 62,030 units of heat, equivalent to 47,888,400 foot pounds, which means that it is sufficient to raise a weight of 23,944 tuns a foot high.

It is evident that this energy cannot be developed for the second time from the hydrogen in the water; but, on the contrary, it must be given back in case we wish to separate the two elements composing the water. One of the means of effecting the separation is great heat. By passing steam through a white hot platinum tube, it is decomposed into its elements, while a part of the heat applied totally disappears, to be changed into the molecular motion of the gases. A second method is the electric current. When we pass a sufficiently powerful current from a voltaic battery through the water, the latter will be decomposed into its separate elements; while the electric energy, apparently disappearing, becomes in its turn transformed into the molecular motion of the gases. The third method is found in the play of those energies which we call chemical affinities. In this case, the most simple illustration is the introduction of a piece of sodium amalgam under a bell jar containing water. The sodium oxydizes, and the energy developed by this oxidation is appropriated by the hydrogen, which thus finds the conditions under which it can assume again the hidden molecular motion necessary for its existence in the gaseous state.

It is evident from the above that it is as impossible to burn the hydrogen in the water, or in its vapor, as it is to burn the carbon in the lime rock or in the atmospheric carbonic acid. No fuel can be burnt up twice; and as the hydrogen contained in water has been once burned, and has thus lost its heat, any hope of obtaining heat out of it again, without first introducing heat, must be vain.

## THE HORSE IN MARKET.

Modern life broadens in two ways: by the development of new customs and by the revival of old ones. Whenever the causes which led to the abandonment of the customs of former times seem insufficient or inoperative under present conditions, there is a tendency to reëstablish them, thus giving to our civilization a scope and variety never before enjoyed. Our range of food is specially wide and varied in consequence. All the world is laid under tribute to supply our tables, and we are learning to imitate or improve on every culinary process of every nation and every age.

One of the most important revivals of late years is the use of horse flesh, which for centuries has been under ecclesiastical ban except among the sturdy people just now preparing to celebrate their first millenium.

Curiously it was through the people whose prejudice against horseflesh remains most intense that the revival began. During the siege of Copenhagen by the English, in 1807, the scarcity of provisions compelled the Danes to eat their horses; and the practical knowledge of the quality of the meat thus gained led them to continue its use after the original necessity had passed away. Possibly the example of their Icelandic allies may have had a good deal to do with the breaking down of Danish prejudice in the matter. In Iceland, the practice had survived from the first. The islanders were willing to have their souls saved by the Church, but they would not submit to any interference with their stomachs; so, rather than lose them, the Church gave them special permission to eat the "execrable food," which they have continued to do to this day.

The first State to imitate the example of Denmark was Würtemburg, which legalized the sale of horseflesh in 1841. Bavaria followed in 1842, Baden in 1846, and Hanover, Bohemia, Saxony, Austria, and Belgium the year after. In 1853 the prejudices of Switzerland and Prussia were overcome, and two years later Norway and Sweden were added to the list of countries authorizing the sale of the long rejected food.

The struggle against religious prejudice was continued eleven years longer in France, though an impression prevails that the revival is a Gallic eccentricity, rather than the result of Germanic good sense.

At one time the feeling against the use of this heretical diet must have been exceedingly intense in the land of good cooking, for it is on record that as late as 1629 a man was condemned to death and executed in France for the crime of eating horseflesh on a Saturday in Lent.

A hundred and fifty years later, the use of the abhorred flesh was publicly advocated by a French physician. Not many converts to the doctrine were made, however, until the retreat from Moscow. During that terrible march, when the alternative was starvation, the French soldiery ventured to eat their disabled horses, and discovered that horse flesh would not only sustain life, but was really savory and inviting. Several of the surviving officers afterward endeavored to break down the prejudice against horseflesh, and advocated its regular use in times of peace, but without much effect.

More strenuous efforts were made by French savants after the surrounding countries had demonstrated the advantages of the change, and a grand hippophagic banquet was celebrated at the Grand Hotel in Paris early in 1865. In the meantime, the meat had begun to appear in the markets as beef, and the government was forced to authorize its sale under proper restrictions to prevent the exposure of uninspected cuts. The decree was published in 1866, and during the ensuing year upward of two thousand horses were slaughtered for the markets, after having been passed by a veterinary surgeon; and not one of them, on inspection after killing, proved to be in an unhealthy condition. The sale and use of horse flesh has largely increased in Paris since then, and the practice is equally common in all the countries of Northern Europe, save Holland and Great Britain, much to the benefit of the people and the improvement of the stock of horses. In Russia the custom has always prevailed, the Greek Church never having meddled with the matter.

The English, like ourselves, occupy an extremely absurd position in regard to the use of horse flesh. We both eat it in large quantities, yet profess to consider it unfit for food.

It is true that, of the thousands who give the meal a place on their tables as an imported delicacy, very few are aware that it is horse flesh. Possibly the most of those who use it would reject it if they knew its real character; nevertheless the fact remains that horse flesh is largely eaten here and enjoyed, and the inference is legitimate that the flesh of American horses would be found just as savory and just as wholesome.

We call the article, which is kept for sale by every first class grocer, Bologna sausage: so called for the excellent reason that it is manufactured at—not the Italian city of the name—but at Boulogne.

Originally the basis of Bologna sausage was asses' flesh, a more delicate meat than that of the horse, though not less obnoxious to common prejudice. Latterly, however, horse flesh has been its chief component, not used secretly, but openly, since at the place of manufacture the sale and use of horse flesh is as legitimate as the sale and use of mutton or beef. For sausage making, indeed, the flesh of the horse is a safer ingredient than any other meat. No other will bear so well to be eaten in a raw or partially cooked state, as it is free from the trichina which makes raw pork so dangerous, and the undeveloped tapeworms which infest both beef and mutton.

To a greater extent than here the abominated meat is eaten in England, and under less favorable conditions; for in addition to the wholesome Bologna, large quantities of suspicious horse flesh disappear—down the throats of deceived humanity, doubtless—every day in London and other English cities. The animals—broken down hacks and the like—are known to be killed, ostensibly for cats' and dogs' meat, but the amounts sold by the hawkers of that sort of stuff fall far short of the supply. The difference disappears as horseflesh, but reappears, there is reason to believe, as human food under other names. The Parisian caterers called it "*bifsteck à la cheval.*" It is altogether likely that the cockney caterers, less honestly, stop at beef, the resemblance of horse flesh to that much respected commodity being so close that, whether raw or cooked, it would require an expert to detect the cheat.

## HOW TO TREAT FRUIT TREES.

In considering the growth of organisms, the action of the alkalies is to be looked upon as scarcely less important than that of air and water. Lime is the great animal alkali, and potash the vegetable one; its old name of vegetable kali expressed that fact, and all the potash of commerce is well known to be derived from wood ashes. The importance of potash as a manure has been frequently overlooked by farmers, who rarely know the large amount of this material found in grass, grain crops, leaves, barnyard manure, roots, and fruits. How potash acts in plants, in conjunction with carbon and silex, to form woody fiber, starch, sugar, and oil, is yet unknown to chemical observers, but the fact of its action is beyond a doubt. Liebig long since pointed out that the chief cause of barrenness is the waste of potash carried off by rich crops, especially tobacco, with no replacement by proper manure. How many millions of pounds of potash have been sent to Europe from the forests of America, and in the grain, tobacco, and hemp! Luckily one alkali may be replaced by another, and we have received a considerable quantity of soda from European seaweed and in the shape of salt. Latterly, nitrate of soda from natural deposits in South America is brought to us at a cheap price.

The point to which we now call attention is that our farmers and fruit growers have ignored, or rather been ignorant of, the importance of wood ashes as a vegetable stimulant and as the leading constituent of plants. Even coal ashes, now thrown away as useless, have been shown, both by experiment and analysis, to possess a fair share of alkaline value. According to our observation, if the practice of putting a mixture of wood and coal ashes around the stems of fruit trees and vines, particularly early in the spring, were followed as a general rule, our crops of apples, grapes, peaches, etc., would be greatly benefitted in both quality and quantity, and the trees and vines would last longer. We will relate only one experiment. Some twenty-five years ago, we treated an old hollow pippin apple tree as follows: The hollow, to the hight of eight feet, was filled and rammed with a compost of wood ashes, garden mold, and a little waste lime (carbonate). This filling was securely fastened in by boards. The next year, the crop of sound fruit was sixteen bushels from an old shell of a tree that had borne nothing of any account for some time. But the strangest part was what followed. For seventeen years after the filling, that old pippin tree continued to flourish and bear well.

Let us call attention to still another point of importance in fruit-raising. This is the bearing year for apples and fruit in general in New England; probably it is also in some other parts. Now when such years come, the farmers rejoice too much at their prosperity and abuse it, as nearly all people do the gifts of fortune. We should be temperate as to the quantity of our fruit as well as of our fruit juices. By proper trimming and plucking, the apple crop in bearing years may be reduced to but little more than half a crop as to number, but the improvement in size and price, and in the future effect, will more than balance the loss. Next February, March, or April, according to latitude, let the tree trimmer stimulate and nourish his trees and vines with a fair supply of ashes; and in nearly every case he will have a good crop of fruit in the non-bearing year.

### COFFEE GROUNDS.

Not long ago, *Punch* figured that social bore, the chronic fault finder, in the guise of a complaining recruit. "Now then, Pat," says the sergeant testily, "what's the matter now?" "Sure, sor," the undeveloped hero replies, "they ch'ate me out of the thick of me choffee, sor!"

At sight, no complaint could seem more destitute of "grounds." To the average reader, none could be more absurdly ludicrous; for every one has learned by bitter experience what it is in the ordinary way not to be cheated of the "thick of the coffee."

Yet, without becoming the champion of cheap restaurants and boarding house madams, it is possible to argue seriously that Pat was the victim of a real wrong, that in losing the substance of the coffee berry he lost what would have been of actual service to him. The chemistry of the question is simple enough.

As commonly made, the infusion of coffee which we drink contains not more than twenty per cent of the substances which compose the berry. Of the remaining eighty parts, which we throw away as "grounds," about thirty-four are woody matter without nutritive value. The rest, or forty-six parts out of the hundred, contain in large proportions nitrogenous matters, fats and mineral salts, demonstrably useful for the nourishment of nerves, muscles and bones. In other words, by our mode of making coffee we lose more than half its available and valuable constituents. Considering the tuns of coffee imported every year, this wholesale wastefulness becomes a matter of considerable magnitude, this of course only on the condition that the rejected matter can be used with pleasure and profit. That it can be so used is shown by the practice of the Turks, who make coffee as we do chocolate. The coffee, finely powdered, is drunk with the infusion. In this way all the stimulating qualities of the infusion are secured, with the full aroma and all the nutritious elements of the berry. It is perhaps needless to add that, for use in this way, the coffee must be reduced to an impalpable powder.

To those unaccustomed to oriental coffee, the limpid infusion may seem much to be preferred. As a stimulating drink, it is undoubtedly preferable, but the good qualities of coffee are not exhausted with the infusion; and as a matter of economy, it may be worth while to sacrifice limpidity for nutrition. Besides, as one becomes accustomed to thick chocolate and learns to like it more than the clear infusion of the cocoa bean, so, it is claimed, the taste for *café a l'Orientale* may be acquired, with a corresponding improvement in the beverage.

### EVERYBODY'S CENTENNIAL.

If we did not have a fair degree of confidence in the ability of our people to carry through any great enterprize in a very short space of time, after their interest and enthusiasm in its behalf is once thoroughly aroused, we should feel serious doubts regarding the certainty of the success of the Centennial, in view of the apparent apathy which now exists concerning that undertaking. We believe, however, that the present tendency, though it is perhaps to be deplored, is to procrastinate and to leave to the last few months the accomplishment of work which might be more leisurely if not more completely performed within the two years to come. While therefore the people as a nation should be urged to appreciate the necessity of early preparation for so important an event, it would appear advisable to encourage besides other plans, tending to what may be termed the individual celebration of the anniversary. In other words, while in no wise neglecting a national enterprise such as the proposed exposition, the commemoration of the day by separate States, cities, or towns, professions, trades, or individuals, by the erection of statues and monuments, or by the establishment of useful institutions, would we think, involve an idea which would meet with a universally favorable reception, and at the same time would evoke a more immediate and more direct interest in every class of the community. Such a scheme has already been suggested by Mr. W. S. Ward, of this city, and has encountered no small share of general approval. The plan is well calculated to excite a spirit of emulation and to arouse local attention. "It is proposed," says Mr. Ward, "that each class of artisans, artists, and students, and professors, scientists, and theologians, be requested to undertake the erection or endowment of some fitting memorial of the day, which should at the same time be of service either in educating and amusing the living or honoring the worthy and distinguished dead. Thus the artisans might, through their various organizations and in different localities, erect reading rooms, night schools, etc.: there might be art museums, law, medical, and theological libraries, museums of natural history, zoölogical and botanical gardens, aquaria, etc."

It is hardly necessary to descant upon the advantages of the scheme, which is at once practical and feasible, and at the same time free from the clog of politics. We would especially commend it to the classes to which the large majority of our readers belong. The mechanics, through their trade societies, might provide training schools for apprentices, establish centennial funds for the poor or unfortunate of their craft, and, in their various abodes, erect halls for meetings or educational uses.

As an instance of what the manufacturers might do, there is the proposed testing laboratory of the Stevens Institute, an establishment which they would find of constant benefit. Let them endow that, and half a dozen similar ones throughout the country. The wealthy in the same calling might found scientific scholarships, erect colleges, or additions to those already in existence. There is the Cambridge Museum, Agassiz's great work, now with an income inadequate for its support. The teachers' memorial subscription Plan, it is true, has met with a noble response; but cannot the scientists, and the manufacturers who depend upon the teachings of Science, endow the institution with a centennial gift sufficient to place it above all possibility of future want? And speaking of Agassiz, who out of the many scientific men in this great city will contribute toward erecting a statue of him in Central Park? Are there not enough teachers and students of Science in the metropolis to raise the necessary sum by a very small subscription from each, and thus to provide a noble memorial both of the Centennial and of the great naturalist?

We might continue, and devote columns to suggestions similar to the above, did we believe the same were necessary to interest the people. That such interest has been aroused and has borne fruit is seen in the offer of Mr. Gordon Burnham to place a statue of Daniel Webster in our beautiful park, at his individual expense. Now let some of our millionaires help the people of the city to establish the Museum of Natural History, the corner stone of which has just been laid, or to found a free lending library, or to add to the Metropolitan Museum of Art, or to build the proposed aquarium in Central Park. Or perhaps we have another Peter Cooper among us, who will erect such another grand and enduring monument of whole souled charity, or a second Peabody who will give our working classes cheap and commodious homes and emancipate them from the miseries of the tenement house.

But it must be remembered that in thus honoring the past to serve the future, it will not do to delay. What is to be done, must be done now. Those first in the field will do the greater service in arousing others to like action. If every one, and the gift is purely a matter of individual choice, will determine to contribute something, whether a subscription of a few pence or a check for thousands, and carry out his determination right speedily, we shall have such a celebration for our hundredth birthday as the world never before saw, and besides shall have conferred upon posterity lasting benefits, of which as a nation we may well be proud.

### THE AMERICAN MUSEUM OF NATURAL HISTORY.

"In this country, we popularize knowledge and give to Science a holiday air; and instead of putting our collection, as some have proposed, into cold catacombs of Science and long, gloomy galleries in which Nature is classified, ticketed, stuffed, and covered with dust, in a manner well adapted to create weariness rather than to attract people to the study of natural objects, it is our purpose to provide such structures as shall furnish agreeable entertainment to the general visitor, while at the same time affording valuable aid to common school education." We quote from the very able address of Mr. Salem H. Wales, read, in the absence of that gentleman, by Mr. Henry G. Stebbins, on the occasion of the recent laying of the corner stone of the Museum of of Natural History in this city; and the words, we are confident, will excite the hearty satisfaction not only of our own citizens, but of every advocate of popular science throughout the country. They denote the fact that the days when the people were content to read of the rare and wonderful in Nature, or when even their knowledge of her teachings was confined to the limited horizon of their daily existences and abodes, all else being but as abstractions, are passed. We are no longer satisfied with the claptrap of the showman and the presentation of Nature in connection with the tinsel of the arena; nor yet with the other extreme, as exemplified in the classic collections of the academy, which, buried under a mountain of technical knowledge, speak but to the erudite, and are dumb to the ordinary mind. With the growing taste for Science and her teachings, so palpably apparent in this country during late years, has arisen a desire for closer intimacy with the foundation on which our human learning is based, and in that spirit of inquiry the people demand to see more of Nature in intelligible form.

To gratify this thirst almost as soon as recognized has been and is the object of all thinking men, who, in the wider dissemination of useful and valuable knowledge throughout the masses, see the road to a higher national existence and prosperity. In this great movement the press is the pioneer; then follow the lecturer and individual teacher to expand and impress the ideas suggested; and lastly, as the outgrowth of the interest awakened, appears the museum, in which the public may study, in palpable shape, objects existing formerly but in the imagination. Here in the metropolis, the journalist and the teacher have labored long and faithfully, and it is to their lasting credit that, amid the whirl and confusion of a vast city, more rapid, more active in its business life than any other in the world, temples of Science, now nearly equal in magnitude to, perhaps in time to excel, all elsewhere, are slowly rearing their massive walls. New York, although at present behind some of her sister cities in devotion to scientific culture, will, be believe, eventually lead in the van; and the recent ceremonies initiating the construction of the first of her great permanent museums, to which the presence of the Chief Magistrate of the country lent a dignity and importance which they well merited, are but the presage of future and greater work which will more than cover past deficiencies.

The Museum of Natural History was incorporated by the legislature of this State some five years ago. Up to the present the trustees have been steadily at work securing collections and carrying into practical operation the object of their trust. Many contributions have been received from public spirited citizens, and with means mainly thus raised the extensive collection of mammals, birds, fishes, etc., belonging to the late Prince Maximilian, of Neuwied, the Elliott collection of birds, besides a large part of the celebrated Verreaux and other collections of specimens in natural history, have been purchased, the whole forming a large and sufficient nucleus for future additions. These objects are now temporarily deposited in the former arsenal within the limits of Central Park, a building too small to contain even the aggregate of all now in the possession of the institution. In view of the latter fact, as well as from the appreciation of the need of popular museums in the city, a number of influential citizens petitioned the legislature for a permanent and fitting structure, in response to which a large plot of ground, covering some four city blocks, known as Manhattan Square, and adjoining the Central Park on Eighth avenue, was set aside for the site of a substantial fireproof edifice, to cost $600,000. The basement of this structure has been completed, and the exterior walls rise, at the present time, to a few feet above. The materials used will be brick, granite, and iron, and the building will be four stories high, with mansard roofs and towers. The ground floor will measure 66 feet by 200 feet.

The proceedings incident to the laying of the corner stone were witnessed by a large gathering of the best known residents of the city. There was an address by the President of the Museum, Mr. Robert L. Stuart, giving the objects of the institution, followed by the speech from which, as above remarked, we extract the initial paragraph of this article. Mr. Stebbins, after reading Mr. Wales' written address, hinted that at some future time the Museum of Natural History, now begun on one side of the Central Park, together with the Lenox Library, nearly finished, and the Metropolitan Museum of Art, soon to be commenced on the other side, might be joined with other buildings to form a national university worthy of the greatest city on the continent. The idea is a lofty one, and, from its magnitude and grandeur, may well invoke serious consideration. Governor John A. Dix then made a few appropriate remarks, and an able and learned address by Professor Joseph Henry, mainly devoted to the subjects of endowments for fostering original research, and the value of popular museums as educators, closed the verbal portion of the ceremony. The stone, under which copies of the city papers, coin, currency, etc., had been deposited, was then lowered, the mortar being previously spread by the President. A promenade concert and inspection of the collections, at the Arsenal where they are deposited, completed the proceedings.

### STEEP GRADIENTS.

We are indebted to Mr. Henry Handyside, of London, for a copy of a small publication entitled as above, containing a description of his newly invented method of surmounting steep railway grades, together with a statement of its merits and other facts relating to railways in general. Mr. Handyside's invention consists in attaching a drum and traction rope to the bottom of the locomotive or tender. When the train reaches the foot of a steep grade, the engine is uncoupled from the train, and runs up the grade, paying out the rope, one end of which is attached to the train. On reaching the summit the locomotive is locked to the track by means of a pair of griping levers, steam is applied to the drum, the rope wound and the train drawn up. By the use of this simple and cheap attachment, Mr. Handyside shows that any ordinary locomotive will readily draw the heaviest trains up grades of one foot in ten, or 528 feet to the mile, and he therefore proceeds to point a few of the advantages that would result in railway construction by the adoption of his plan of operation, among which are the following:

Saving in first cost of survey. Saving on embankments. Saving on face cuttings. Saving in the length of tunnels. Saving in the length and hight of viaducts. Materially shortening all lines which have high land between their extremities. A corresponding saving in length of rails. Any locomotive capable of hauling a given weight up a gradient of say 1 in 50 to be capable of hauling the same load up 1 in 10 or even 1 in 8. A much lighter class of locomotive necessary. A corresponding reduction in weight of rails. Simplicity of construction, inexpensive, and not easily deranged. Less friction and ware and tear on all steep gradients, of say 1 in 10, than on the generality of gradients now in ordinary use. No break of gage necessary, and applicable to any gage. Especially applicable to tramways, which as feeder lines will often penetrate into hilly districts. The carrying power along the whole line not limited by the frequent occurrence of steep gradients.

All of these are important points in favor of the invention which will be readily appreciated by railway engineers and projectors.

An application of steam to the towage of canal boats, somewhat analogous to the foregoing, was patented in this country last year, by G. S. Olin. He uses a light steam tug carrying a rope drum on deck, one end of the rope to be attached to a train of boats. The tug steams rapidly ahead, paying out the rope, then drops pole anchors, and winds up the rope, drawing the boats along at a good speed. The tug then starts ahead, unreels the rope, and, before the boats have lost headway, begins to wind up the rope again. In this way a small tug of light draft, burning but little fuel, may successfully tow several hundred tuns of freight through the canals, at the required average velocity of 3 miles per hour. This method appears capable of being worked out into a valuable system of canal navigation. It is worthy of careful attention and encouragement.

A WHALE, 60 feet in length and 10 feet in diameter, was recently captured in the Raritan river, near Perth Amboy, N. J. The fish accidentally ran aground, and was shot by a farmer.

## A NEW DOMESTIC STEAM ENGINE.

M. Fontaine has recently received a prize of $200 from the French Société d'Encouragement, for the invention of the domestic steam motor represented in the annexed engravings. The boiler of the device contains enough water to furnish some 42 foot pounds, during the continuous period of work of a woman—some four or five hours; and the design is to renew the supply during meal hours, allowing such interval for the generation of steam, ready to begin work again. The device is composed of a generator—an engine and a gas furnace with automatic register. The engraving shows the exterior of the invention, and also a sectional view. A is the body of the boiler, in the lower side of which are twenty-four copper tubes, B, the upper ends of which enter the smoke box, C. D is a sleeve through which the gases of combustion descend to the chimney, and E is a superheating tube which is closed at the bottom and extends down through the smoke box, as shown. F is the feed water tube, closed by a screw plug, indicated by dotted lines. Water cannot be put into the boiler except when there is no pressure of steam. At G, dotted lines, is a cock which draws off the steam when water is to be supplied, through a pipe, H, and thence into the chimney. I is the flue connecting with the sleeve, D. J is the furnace composed of twenty five Bunsen burners. The gas, on leaving the meter, goes to the upper part of the machine and enters at L. Here it meets a flexible tube, M, which resembles a bellows, and forms a pressure regulator. N is a counterweight suspended to the tube, M, maintaining it at a length corresponding to the desired pressure. When the limit fixed is exceeded, the tube elongates and checks the flow of gas by closing smaller the orifice, L. K is the tube conducting the gas from this apparatus to the burners. Steam is taken from the superheating pipe by the tube, O, and is led to the slide valve, P, which communicates with the cylinder, Q. R is the slide eccentric, S the crank, T the belt wheel, U the exhaust pipe leading to the chimney, V the manometer, and W the supporting legs of the apparatus. X is the wooden envelope, having dilatable joints which surround the boiler and cylinder, and is lined with thick felting. Y is a small inclined mirror, which allows the operator to see a reflection of the gas burners, and so to judge of the heat of the fire.

Cylinder, valve, chest, slides, and frame of the engine are all cast in a single block, in which the necessary apertures are bored. No cores are used in the molding. Steam goes to a simple slide valve operated by an eccentric, and is admitted during one third, and exhausted during five sixths, of the stroke. The shaft, crank, and eccentric are cast in one piece. All rubbing surfaces are of steel. The piston is made in segments, of cast iron, on the Ramsbottom system, and all the ports are circular.

The object of the device is to do any light work now performed by hand, such as driving sewing or washing machines, turning wringers, operating pumps, etc. Its hight from floor to top of fly wheel is about 43 inches, and exterior diameter, 14 inches.

## Wire and its Manufacture.

We extract from the *Commercial Bulletin* the following interesting facts regarding the manufacture of wire in New England, and the various uses to which it is employed:

There are now sixteen wire-drawing establishments in New England, of which two are located in Maine, two in Connecticut, and twelve in Massachusetts. Of these last, Boston claims two. Among the Massachussetts wire-drawing mills, that of the Washburn & Moen Manufacturing Company, of Worcester, is probably the largest in the country.

### VARIED USES OF WIRE.

There are few branches of metal manufacture whose products are in wider use. Wire is employed for the thousands of miles of telegraph lines; it is woven by machinery, strong enough to make fences, and of such delicacy as to make the finest wire cloth; large quantities are used for galvanic batteries and for other scientific purposes; it is twisted into the powerful cables of suspension bridges, and furnishes cables for submarine telegraphs, and ropes for ships, for use in mines, and for other purposes. From steel are made crinoline wire and wire to be drawn into needles of all kinds. A large business has sprung up in the manufacture of wire for piano strings, and of the delicate plated wire for covering the strings. Tinned broom wire makes a considerable item. Of late years there has been a great sale for white wire culinary and ornamental table utensils. It is used in the manufacture of card clothing, heddles, reeds, and other machinery. Woven wire of iron, brass and copper, appears in flour, paper, and other machinery; it makes its way into baskets, screens, sieves, cages, fenders, dish covers, nets, and an infinite variety of similar forms. Coppered pail bail wire is a considerable product. Gold and silver wire is plated or woven into exquisite filagree work, into chains, and into threads for making gold lace; and wires of the various metals are employed for scores of other purposes, in articles useful and ornamental.

### PROCESS OF MANUFACTURE.

The wire rods, varying from a quarter to a half an inch in thickness, which are received from the rolling mill in bundles, are heated and re rolled in grooved rollers, one above another, so that the rod can run from the first roll to the second, and so on, without reheating. The rollers run with great rapidity, and the final groove reduces the rod to a coarse wire, about one eighth of an inch in thickness, which is ready for the first hole in the draw plate.

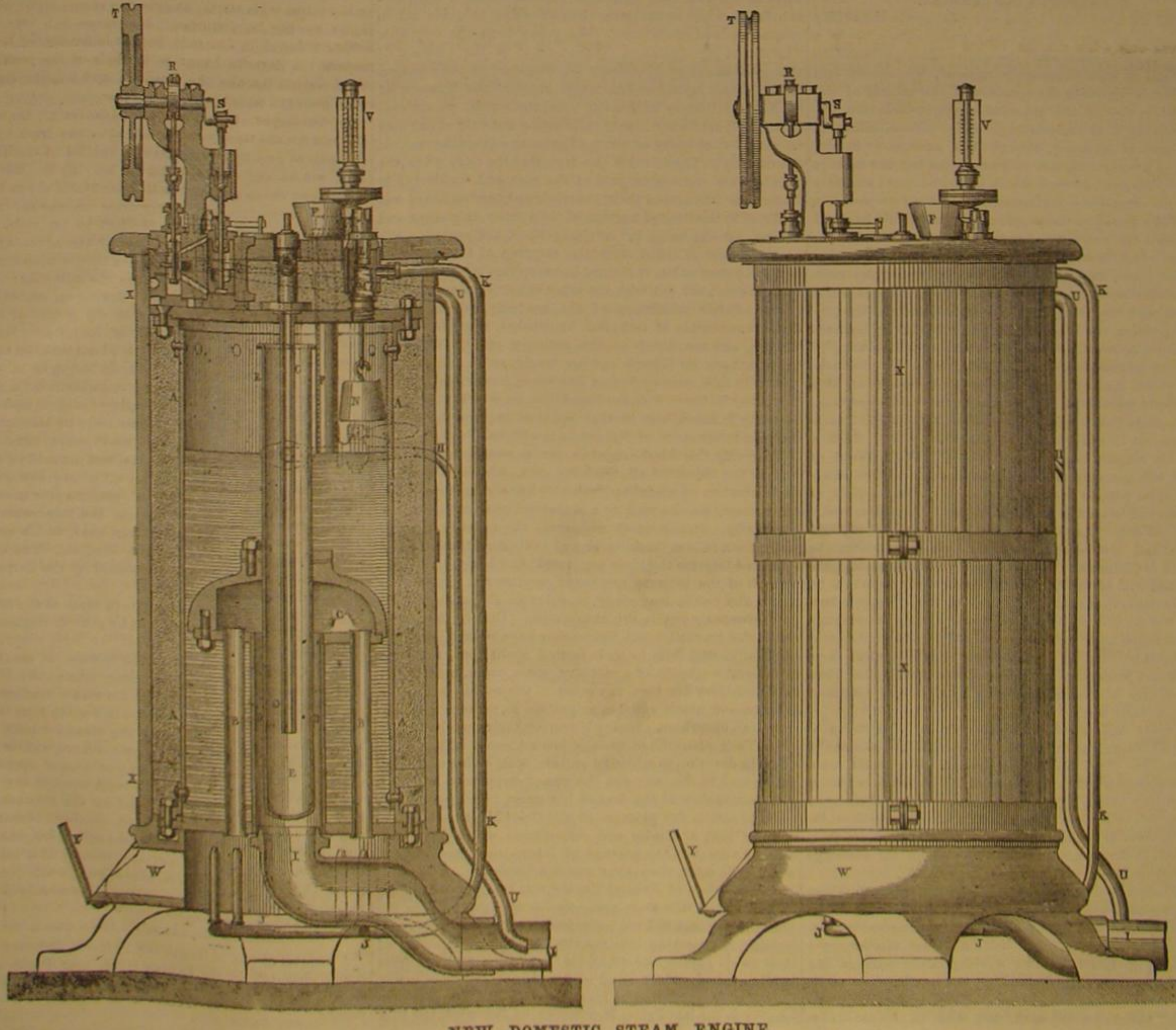
The draw plate, the most distinctive piece of mechanism in this manufacture, is a flat piece of hard steel, with holes corresponding to the various numbers or sizes to which wire for different purposes is drawn. The best ones are made of a combined plate of highly tempered wrought iron and steel, the steel face being on the side through which the wire is to come. The holes are tapering, the smallest end being on the steel side. For drawing very fine wire, in which the greatest uniformity is necessary, the plates are prepared with perforated rubies or other hard stones.

The wire is annealed and drawn cold. The machinery for doing this includes a draw bench, which lifts the wire from a reel to the first hole in the draw plate. The wire passes through this to another reel or drum, on which it is wound, ready for its journey through the second orifice. The same process is continued down the series, until the wire is reduced to the required size. The wire has to be often annealed and cooled during the process, since it becomes less ductile and more brittle as it is drawn down. Grease and wax are used for lubricating. A method has come into use lately of covering brass wire with a thin film of copper, which is of great help in drawing, while the copper can be wholly removed at the last annealing.

The ductility of the metal and the size of the wire regulate the rapidity of drawing. Zinc is the least ductile of the metals used, then brass, next iron, steel, copper, silver, platinum and gold. As the wire becomes attenuated the speed may be increased. Iron and brass, according to size may be drawn from twelve inches per second to forty-five inches per second and the finer sizes of silver and copper are drawn at the rate of sixty or seventy inches per second.

### WIRES OF REMARKABLE LENGTH.

Silver wire has been run through plates of rubies to the length of one hundred and seventy miles, in which the most delicate test could detect no difference in diameter in any part. Gold and platinum have been drawn to a "spider line" for the field of a telescope, by coating the metal with silver, drawing it down to the finest number, and then removing the coating by acid, leaving the almost imperceptible interior wire, which, in an experiment made in London, was so attenuated that a mile's length weighed only a grain.



NEW DOMESTIC STEAM ENGINE.

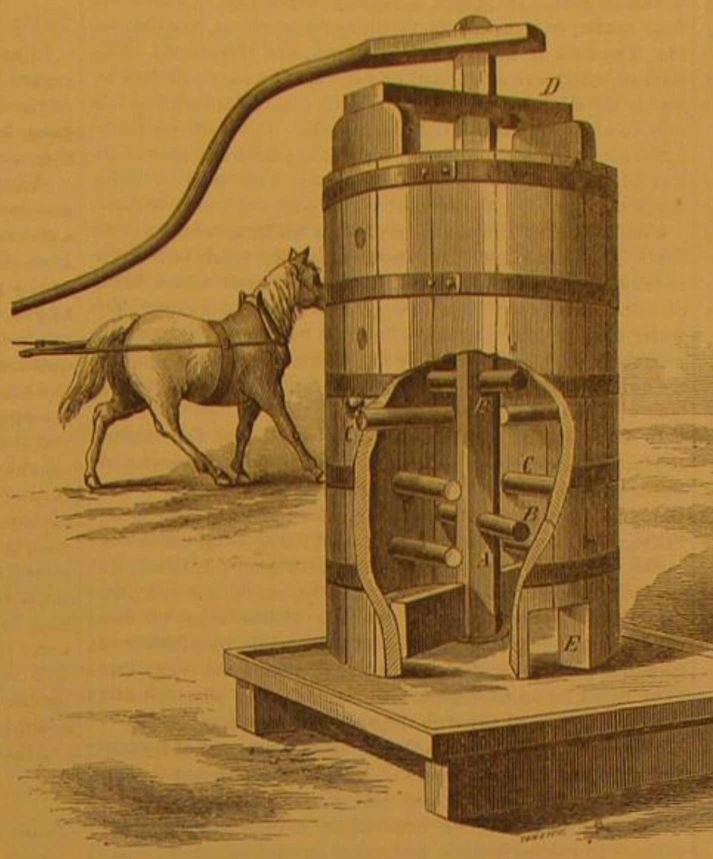
## MAY'S PATENT BUTTER WORKER.

Our illustration represents a new butter worker, by the aid of which, the inventor claims, two or three men can work, rework, color, and pack ready for shipment from two to four thousand pounds of butter per day. The machine, it is stated, will work all colors of either soft or hard butter, mixing the same so thoroughly as to cause it to appear freshly churned. The sour milk and water are removed, and the butter, being solidified and condensed, is greatly improved, both in quality and in capability of preservation.

The cylindrical vessel shown is secured to the platform, and within it rotates a central shaft, A. On the inside of the body, and attached to the shaft, are placed, one above another, a series of horizontal and rounded arms, B, each pair of which is located at an angle to the couple next above or below. Across the interior of the vessel, and on opposite sides, are secured the stationary chord pieces, C, also made rounded. The shaft is journaled to the diametrical board, D, and power is applied to its upper extremity by means of a sweep, as shown. The vessel has at the bottom a discharge orifice, E, which is cut obliquely in order to allow the butter to escape freely, as the lower pair of rotary arms carry it around.

The mode of operation consists in placing the butter in the receptacle, where it is successively worked by the arms and bars until it reaches the bottom, whence it emerges by the aperture above referred to. It will be noticed that the entire working parts of the machine are of wood, and that no metal comes at any time in contact with the butter.

Patented, through the Scientific American Patent Agency, March 10, 1874. For further information address the inventor, Mr. Alexander May, No. 419 West Market street, Louisville, Ky.



MAY'S PATENT BUTTER WORKER.

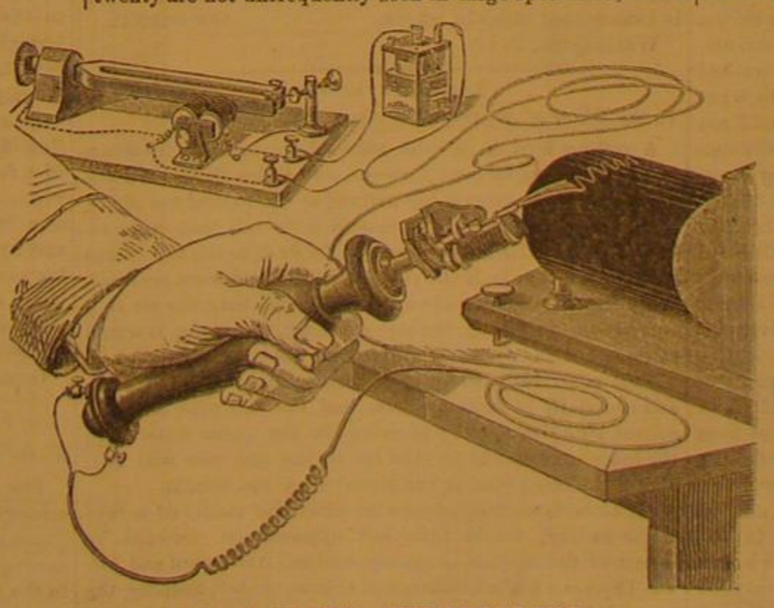
### The American Tin Ware Trade.

For a long time past one of the best customers of the British maker for tin and terne plates has been the United States of America. At one time we were sending to that country great consignments of tin plate goods in varied shapes and of different values; lately the Americans have learned themselves to use up the tin plates, and now we have them shipping tin plate wares to this country, made from the tin plates with which we have supplied them. In America itself it was at one time thought an extraordinary thing for the Western and Southern States to send into the Northern States articles for which they had before been indebted exclusively to the latter. It was only a few months before that, in conversing with a manufacturer in the Western States of hardware goods at one time obtained by the new world almost solely from Birmingham, we were assured by the American that he should soon be forwarding this same class of goods to compete with those of the Birmingham district in their home market. The goods were not those which have tin plates for their fabric; but what the tin plate makers of the United States are doing would seem to imply that his assurance was something more than empty boasting. The United States manufacturer displays an amount of ingenuity in invention which is but seldom seen in England, and the handicraftsmen in the new world, unlike those of the old, are ready to adapt themselves to a new pattern so soon as it can be shown that it is at all probable to be a success. The American tin plate goods that are now being offered in Birmingham and South Staffordshire are described as simply marvelous, both as to the price of the articles and the ingenuity displayed in their construction. Surely there is something very wrong in this country when the Americans, after buying our tin plates and paying heavier wages for the manufacture of the article, are able to offer it here at prices much under those at which we can produce it.—*The Engineer.*

## DR. MAREY'S CHRONOGRAPH.

The use of the tuning fork for the measurement of very short intervals of time presents certain advantages which have led to its extended employment in recent chronographic apparatus. Our illustration represents a new instrument of this description, which is an improvement on a device of M. Mercadier, or rather is an attachment to the latter for the purpose of ensuring greater accuracy. M. Mercadier's invention is shown in the upper portion of the engraving, and consists of a tuning fork horizontally placed. One branch is attracted by an by an electromagnet. Its movement toward the core, however, breaks the current, causing the arms to spring back. This phenomenon is repeated indefinitely, throwing the branch into very rapid vibrations, each of which causes the contact of a platinum wire with a small platinum disk communicating with the battery. Suitable registering devices were connected with this instrument which it is unnecessary here to describe, as Dr. Marey found that its employment was frequently difficult on account of the extremely small amplitude of the vibrations. In order to remedy this defect, the above inventor places, in the circuit of the electromagnet of the tuning fork, a second electromagnet which naturally becomes magnetized or demagnetized coincidently with the first. The second coil has a single bobbin, and attracts its armature a hundred times per second. The armature moves in a plane parallel to the polar face, and is carried by a spring. In order to obtain an absolute unison between the two vibrations, the spring is regulated to proper length by means of a delicate screw. The armature being attracted laterally, its sudden stoppage is avoided, and a much larger amplitude is obtained; and by means of a piece of quill, forming a prolongation, it traces curves corresponding to hundredths of seconds on a blackened surface. The electromagnet is carried, as shown in the principal figure, in a handle through which passes the conducting wires establishing the communication with the battery and tuning fork. These wires, which for convenience are united in a single cord, may be of suitable length to allow of using the instrument in any portion, for instance, of a room.

If it be desired to measure the exact period of revolution of a pulley and its variations of velocity during its rotation, the face of the wheel is covered with lampblack, and the quill point of the chronograph brought in contact therewith. The tracing will show the angular movement during each one hundredth of a second, enabling the builder, for example, of a machine requiring delicacy of construction, to detect errors which otherwise might escape his notice. By the same means, suitably arranged, Dr. Marey is enabled to govern the movement of an escapement, and hence to regulate accurately the operation of a train of wheels, an application of value in telegraphic instruments.



DR. MAREY'S CHRONOGRAPH.

### Rattlesnakes and Tarantulas in Colorado.

The *Rocky Mountain Miner and Mechanic*, published at Denver, under the head of "Cyclopædia Colorado," devotes a column or two to describing some of the natural products of that wonderful region. In the last number, the editor speaks of rattlesnakes as venomous serpents, to be found in all parts of Colorado.

He says: "It is popularly supposed that the age of the snake can be estimated by the number of rattles; but this is a mistake, for though these may increase with age, their fragility is such that many may be lost by accident; and moreover, more than one may be added annually owing to the vigor, food, state of captivity, etc., of the reptile—twenty are not unfrequently seen in large specimens, but it would be incorrect to conclude from these that the snake was neither more nor less than twenty years old. As the bite of these reptiles is speedily fatal to small animals, it has been generally believed that the use of the rattles is to warn animals and man of its vicinity; but it is more likely that its use is to startle the creatures, upon which it preys, from their retreat, and bring them within the reach of its spring, or some other purpose for its own welfare rather than the safety of man. Dangerous as they are, they rarely attack man unless provoked, and are fortunately sluggish in their movements, unable to spring except from a coil, and are disabled by slight blows. They are viviparous, the eggs being retained until hatched, and ths young expelled alive. In winter they retire to holes in the ground, and there remain torpid, several interlaced with each other. They are unable to climb trees in pursuit of prey, and do not follow a retreating animal that has escaped their spring. The most common of the rattlesnake tribe found in Colorado, the prairie rattlesnake (*c. tergeminus*), is a little over two feet long; it is cinorous above, with a triple series of dark brown spots, and a double series of dusky spots below; it is fond of hiding in the holes of the prairie dog

From the same source and under the same heading, we learn something of the tarantula or tarentula, "which," the writer says, "is a terrestrial hunting or wolf spider, belonging to the genus *lycosa*, the *l. tarantula* (Latr.) It is the largest of spiders, measuring 1½ to 2 inches in the length of the body; the color is ashy brown above, marked with gray on the thorax, and with triangular spots and curved streaks of black bordered with white on the abdomen; below saffron colored, with a transverse black band. It received its popular name from being common in the vicinity of Taranto, in South Italy. It makes no web—wandering for prey which it runs down with great swiftness, and hiding in holes in the ground and crevices lined with its silk; there is one spiracle on each side, one pulmonary sac, and eight eyes; it is very active and fierce, and the females defend their young and eggs with self sacrificing bravery. Its bite is supposed to be highly poisonous. The *l. Carolinensis* (Bosc.) is called tarantula in the Southern States; it attains a length of 2 inches, with an extent of legs of 4; it is mouse-colored above, with white sides and whitish dots and lines on the abdomen; below, blackish; legs whitish tipped with black. It makes deep excavations in the ground, which it lines with silk; the females carry their young on the back, giving them a hideous appearance, as if covered with warts; the young run off in all directions if the mother be disturbed. Its poison is active Both kinds are found in Colorado, but the latter are the most numerous. A favorite haunt is the hole of the prairie dog, where the rattlesnake, the tarantula, and the dog may generally be found sociably living together.

[It would seem from the above that the attractions of Colorado are not strictly confined to its grand scenery or its agricultural and mineral products, but that the naturalist may there find specimens venomous enough to gratify the ambition of the most enthusiastic student of Nature.—EDS.]

### Expansion of Steam.

At a recent meeting of the South Midland Institute, Mr. Bernard Walker said that the subject of economizing fuel in the production of motive power, or, in other words, the principal points in the construction of steam engines, on which depended their wastefulness, was one of great importance, and nowhere more so than in that district. Professor Joule had calculated that the best engines at present in existence did not render available more than from one tenth to one twelfth of the motive force stored up in the fuel. Remembering that the ordinary steam engines used in manufactories, in mines, and on railways, consumed at least four times more fuel than if they had been made according to well known scientific principles, the national loss thus arising must strike every one as enormous, but the loss was far greater by the use of ill constructed engines. In this part of the country, in the past, consequent on low priced fuel, this matter had been disregarded. Now, however, with costly fuel, it behoved every one to consider the avoidance of waste. From considerable acquaintance with the kind of steam engine used in England, he assumed that few were taking less than from 7½ to 10½ lbs. of coal per horse power per hour. Those of the best construction, however, were being worked with as low a consumption as 1½ lbs. to 2 lbs. of fuel. Mr. Walker thought simple, plain, easily managed engines, that, with ordinary care, would not require more than 2½ lbs. to 3 lbs. of slack per horse power per hour, could be made. After pointing out the importance of all those numerous items included under the head of "good workmanship," and appealing to the members to detail the results of their observations as to the perfection being attained in these respects, he drew attention to the great saving that was being effected by what was termed working steam engines expansively, and the principles therein involved. Mr. Walker then showed cogent reasons for expecting better results from double than single cylinder engines. The drawback to their employment appeared chiefly due to their greater first cost and expense of maintenance, but in very many—nay, most—cases, the saving of fuel thereby gained far more than compensated for the interest on first cost and amount of repairs.

## Correspondence.

### Notes from Washington.

*To the Editor of the Scientific American:*

Since my last letter, several bills have been introduced in Congress, having a bearing on patent matters. One, by Henry B. Sayler, "to regulate the manufacture, use, and sale of patent right articles," enacts that every patent shall grant to the inventor, for two years only, the exclusive right; and on application before the expiration of this term, an extension of 15 years shall be granted without further payment, subject, however, to the condition that any person may manufacture and use such patented article or machine by paying a royalty of ten per cent of the market value. The same bill also allows the printing of any book protected by copyright on paying ten per cent of the wholesale market value.

A bill, introduced by Mr. McDougal, provides that no injunction shall be granted prior to final decree unless the complainant shall execute to the defendant an undertaking conditioned to pay to such defendant all damages which shall be sustained by him by reason of the issuing of such injunction, in case the court shall finally decide that said complainant was not entitled thereto; and further provides that in case of appeal from the final decree, the appellant may stay the effect thereof, during the pendency of the appeal, by executing a like bond.

Mr. Mills introduced a bill on the 18th instant to annul the patent No. 110,774, issued to T. W. Mitchell, of Fore Bend, Texas, for a cotton worm destroyer.

Another bill, introduced by Mr. Amos Clark, appropriates $100,000 to pay Montgomery & McClure for the use of their patent No. 24,947 for journal boxes, in the vessels in the United States service.

There was quite a discussion in the House on a bill to allow Norman Wiard to make a new application for an invention that has been forfeited under the two years' clause of the act of 1870. One of the members wanted to make a provision in the act that the United States should have the free use of the invention. Wiard's friends objected, and quite a spicy debate ensued, in which considerable personality was indulged in, after which the bill passed without the obnoxious clause.

One of the largest of the extensive jobs before Congress—the Atwood car wheel—has been reported unfavorably.

I understand that the House Committee on Patents decided on Tuesday last the course to be pursued with respect to the sewing machine extensions, but all information on this subject is denied.

The Senate Committee heard the argument to-day of John Pope Hodnett, counsel for the opponents to the extension of the patent of the Wilson sewing machine, when the Committee, at the request of the applicants, deferred the further consideration of the subject for two weeks. A large number of opponents were present, and much interest was manifested by the contestants.

As mentioned in my last, Mr. Sutro is giving a series of lectures on "Mines and Mining," but devoted mainly to a description of the Comstock lode, the Sutro tunnel, and the advantages that will result therefrom on its completion. These lectures are illustrated by a large number of photographic views, which are exhibited by the aid of a stereopticon and the calcium light, and, being free to all, are tolerably well attended.

The Sutro tunnel is designed mainly for an immense drain to carry off the water which is constantly accumulating in the mines of the Comstock lode, and also a means for removing the ore and providing proper ventilation to the mines. To thoroughly understand the importance and necessity for the tunnel, it will be advisable to give a brief description of the Comstock lode: This celebrated mining district is found at the foot of Mount Davidson, in the Washoe Mountains, and appears to have been formed by some terrible convulsion of Nature, which caused the separation of the surrounding greenstone formation from the mass of rock forming Mount Davidson, leaving a fissure, which became filled in the course of time with argentiferous rock and is now known as the Comstock lode. It was discovered by some poor miners, who were prospecting for gold, of which they had washed out a small quantity, but in washing were troubled by what appeared to be a heavy black sand, which they could not readily separate by the ordinary process, and which was consequently a great difficulty in their way. Happening, however, to subject some of it to the action of fire, they discovered that it was silver. Previous to this discovery, they had thrown away about five thousand dollars worth of this black sand. Directly after this the lode was quickly covered with claims, and mining has been pursued with so much success that about two hundred million dollars worth of silver has already been taken from it.

One of the greatest hindrances to the profitable operation of these mines is found in the immense quantities of water collecting in them, which requires a large number of very powerful pumps to keep them going, and in the difficulty of supplying fuel for the engines employed for working these pumps and raising the ore (of which there are not less than sixty on the Comstock lode alone), requiring, it is said, about six hundred cords of wood in each twenty-four hours. This wood has to be brought to the mines over a railroad which is probably the crookedest railroad in the world, as it pursues a waving course of twenty-three miles to reach a distance of about four and a half miles, owing to the necessities of the grade, there being something near twenty-five hundred feet rise in that distance.

The expense of operating this railroad, most of the fuel, and the great danger and delay caused by the mishaps to the pumping apparatus, whereby the mines are liable to be flooded, will be saved by the tunnel which Mr. Sutro is running to connect with the mines. It stands at a distance of over four miles from the lode, at a point more than two thousand feet below its upper surface, and is intended to run in a westerly direction until it strikes the lode, after which main branches will be run north and south, parallel with the lode; and from these main arteries smaller branches will be driven in various directions to connect with such mines as may be off the principal lines.

The main stem is now being run in and reaches about six thousand feet. Its length is rapidly increasing. There are four shafts, to increase the facilities for working, ventilation, etc. The first of these is 525 feet deep, and the second 1,042, both of which are completed, and the first has been drifted towards the mouth until it met the drift coming from it, so it is now in communication with the mouth. The third would be 1,385 feet deep if completed, but, owing to the immense influx of water, it had to be abandoned. The fourth will be, when completed, 1,500 feet, of which over 700 are now done.

The bottom of the tunnel will form an immense sewer or drain, above which will be placed a double track railroad to convey the mineral to the mouth of the tunnel, which being on a down grade will require very little power to operate. The water issuing from the tunnel will be used to drive immense reduction works conveniently situated at its mouth, and, after doing its duty there, will be employed in irrigating the land surrounding the town of Sutro.

In all those mines not sunk below the bed of the tunnel, the immense expense entailed by hoisting ore and pumping water will be avoided. A few figures will give some idea of the large amount of material to be raised. According to Mr. Sutro, 1,000 tuns of waste rock and 2,000 tuns of ore are raised each twenty-four hours; and with each tun lifted, five tuns of dead weight are raised, namely, cable four tuns, and cage and car one tun each, making 15,000 tuns of dead weight, and 3,000 tuns of ore and waste rock, to which must be added 8,640 tuns of water. All of this immense weight has to be lifted on an average to each tun of silver obtained after the ore has passed through the reducing process.

When the tunnel is completed, all this amount of hoisting and pumping will cease, as the water will run out through the tunnel, and the rock, ore, etc., may be allowed to fall to the bottom, or it may be lowered in a cage and its weight utilized in raising timber and other needed supplies; and it may even, with suitable machinery, be made to assist in pumping water from those mines which have been sunk below the tunnel. The water that now collects in such large quantities in the upper parts of the lode may be used in the same manner before entering the tunnel, by passing it through turbines suitably arranged above it. In this manner such mines as may be below the tunnel will be kept dry by the same water that is now such a trouble, thus turning a curse into a blessing.

In addition to the economic advantages thus obtained, there is another feature, which is the most important in a humanitarian point of view, namely, the ready means of escape the tunnel gives in case of fire in the shafts above the miners. One fire in the Yellow Jacket mine caused the loss of forty-two miners, who were burnt and smothered to death, but might have been alive at this day had the tunnel been in connection with the bottom of the mine.

In view of these advantages, the cost of mining will be so much reduced by the completion of the tunnel that it will pay to mine for low grade ores that are now passed by as useless. It is estimated by Mr. Sutro that, of the immense quantity of ore in the lode that can be profitably worked when the tunnel is completed, only one per cent will pay for working under the present expensive system.

The idea of tunneling for drainage is no new and untried idea, for it has been practiced in Europe for hundreds of years, where mining tunnels are of a length undreamed of as yet in the United States, there being two in the Hartz Mountains, the Georg and the Ernst-August, ten and a half and fourteen miles long respectively, besides several shorter ones. A still longer one may be found at Freiburg, which is twenty-four miles in length. OCCASIONAL.

Washington, D. C.

### Aerial Navigation.

*To the Editor of the Scientific American:*

A sailing bird, in a calm atmosphere, spreads its wings and tail, throws its head forward, and slides downward and forward. Now, after it has arrived at the foot of the plane, if all the conditions which caused it to fall thus were reversed, it would slide upward and forward to the top of the same plane; that is, if the position of the bird were reversed, and every part of it made as much lighter than the air as it was heavier in falling, the size remaining the same, it would fall upward and forward, obeying all the laws of descent.

This same result will also be seen in many falling leaves, and especially in letting a palm leaf fan fall with its more convex side down, or by pressing the fan under water with the more convex side up; the fan in the one case will fall, and in the other rise, in the direction of the handle.

An aerial boat, built somewhat after the model of a bird while sailing, would thus sail upward and forward by reason of the surplus buoyancy, and sail downward and forward by reason of a discharge of this buoyancy, keeping the bow of the boat elevated while rising and depressed in falling, and thus in one ascent and descent a journey would be made. The angles of ascent and descent and the momentum will depend upon the amount of surplus buoyancy, the weight, and the size of the wings or resisters.

For the purposes of aerial navigation, we are at the bottom of a boundless sea; and in a boat constructed as I suggest, with surplus buoyancy, we will be pushed upward, and with weight we will be pushed downward, the forward movement depending upon the form of the boat and of the resisters, and on the elevation or depression of the bow, as stated. In a very imperfect model, I have secured, in a hall, a forward movement of thirty feet in rising or falling eight feet.

As this idea is new to me, I would like the opinion of some practical aeronaut as to its probable utility. LEE.

Wilkes Barre, Pa.

### Combining Steam Engines and Water Wheels.

*To the Editor of the Scientific American:*

In an answer to N. P. S., page 363, issue of June 6, in regard to using a steam engine to assist a water wheel, it is advised to "use each separately, and divide the work to be done between them." In ninety-nine cases in a hundred this could not be done.

Wherever more power is needed, either constantly, or at seasons of low water, or when variable work is being done, a steam engine may be attached to the line shaft which leads from the water wheel, by means of its main band passing over a pulley on said line shaft (situated as near the wheel as practicable), said pulley to have such diameter as will permit both the engine and the water wheel to make each its own regular speed. The effect of this is as follows: When the supply of water is ample for the work, the governor on the engine will shut off its supply of steam or nearly so, and the steam will be retained in the boiler, little fuel being consumed. But when the supply of water fails, or the work is greater, for longer or shorter intervals of time, the speed of the water wheel is decreased, when this governor instantly opens the steam upon the engine, which in turn supplies just the amount of power needed to supplement and maintain the requisite speed of the line shaft. So that, as long as the power from the water wheel is sufficient to overcome its own friction and that of the line shafting, so long will its own water be utilized, even when it would be insufficient alone to accomplish any work at all beyond overcoming said friction. HORACE L. EMERY.

Albany, N. Y.

### Steam Pressure on River Steamers.

*To the Editor of the Scientific American:*

I am glad to see, by your issue of June 6, that Mr. Little has called attention to the excessive steam pressure allowed tow boats on our rivers. I am informed that the new law allows an increase of steam pressure on our passenger vessels of 20 per cent for single-riveted boilers; in other words, instead of requiring one sixth of the tensile strength of the iron for the working pressure, it allows one fifth.

Under the present law, a cylindrical boiler, ¼ inch thick, 40 inches in diameter, of 60,000 lbs. tensile strength, single-riveted, is allowed a working pressure of 125 lbs. to the square inch. By the new law it will be allowed 150 lbs.

If this be the case, we are going backwards. I have for many years investigated this matter of boiler explosions on our western steamboats, and am prepared to say that I do not know of a single instance (except in some cases where the flue collapsed) that the cause could not be traced to either the boiler being too weak or the steam too strong. Some of the oldest and most experienced river men have expressed the opinion that 100 lbs. per square inch should be the maximum. It is a matter of mere dollars and cents. By increasing the size of the cylinder, you reduce the pressure in the boiler, and the boat will run just as well. This has been tried. JAMES F. NOBLE.

Cincinnati, Ohio.

### New Local Anæsthetic.

*To the Editor of the Scientific American:*

Noticing a paragraph with this heading in your issue of May 30, detailing the action of camphor rubbed up with a few drops of spirit in connection with chloral hydrate, it occurred to me to call the attention of your chemical readers to the action of chloral hydrate on gum camphor when brought in contact in the solid state. If a piece of gum camphor be placed in a phial in which there has been previously placed an equal amount of chloral hydrate, each substance begins slowly to deliquesce, forming a very limpid, viscous, and highly refractive liquid. In the course of a few hours, the solution of the two solids will be complete. I have used this camphor chloral, or chloral camphor, as a local anæsthetic in neuralgia, and also as an anterotic and hypnotic in the chordee of blennorrhagia with considerable success. I should be much pleased to have some of the many able chemists who read your paper examine and report on the compound. A country practitioner in these regions has neither the means nor the time to experiment. F. L. J.

Osceola, Ark.

### Fish in Alkaline Waters.

*To the Editor of the Scientific American:*

The disastrous effects of alkali, with which our water is strongly impregnated, upon the finny tribe was strikingly illustrated during the past winter, when the thermometer ranged as low as 41° below zero Fah. The lagoons adjacent to the Humboldt river vary in depth from two to four feet at this season of the year, and are well stocked with fish. During the past winter, ice formed on many of them, 18 inches in thickness; as a result of the freezing process, the alkali was precipitated and formed so strong a solution that both fish and frogs all perished. F.

Elko, Nev.

## PRACTICAL MECHANISM.

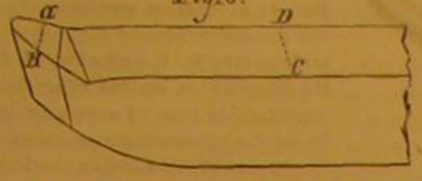
NUMBER II.

BY JOSHUA ROSE.

SIDE RAKE.

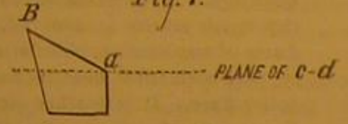
The power required to feed a lathe or other tool, which is moved into its feed at the same time that it is cutting, is considerable when a heavy cut is being taken, unless it possesses what is termed side rake, as represented in Fig. 6.

Fig. 6.




The edge, B, is here supposed to be the cutting one, the face from *a*, to B, being an inclined plane (as compared to the face C D) of which B is the apex, the sectional view at *a*, B, being as given in Fig. 7.

Fig. 7.




This form gives the tool a tendency to feed itself along and into the cut, the cause of which is that the pressure upon the top face, B, *a*, (the result of its having to bend the shaving out of the straight line) is placed, in consequence of the side incline, more upon the side and less upon the top of the face. It has, in fact, followed the direction of the rake, decreasing its tendency to run or spring in (as shown in Fig. 3), with a corresponding gain in the above mentioned inclination to feed itself along, or into, its lateral cut.

When side rake is called into use, a corresponding amount of front rake must be dispensed with, or its tendency to feed itself becomes so great that it will swing round, using the tool post as a center, and (feeding rapidly into the cut) spring in and break from the undue pressure, particularly if the lathe or machine has any play in the slides. So much side rake may be given to a tool that it will feed itself without the aid of any feed motion, for the force required to bend the shaving (in heavy cuts only) will react upon the tool, forcing it up and into its cut, while the amount of bottom rake, or clearance as it is sometimes called, may be made just sufficient to permit the tool to enter its cut to the required thickness of shaving or feed and no more; and it will, after the cut is once begun, feed itself and stop of itself when the cut is over. But to grind a tool to this exactitude is too delicate an operation for ordinary practice. The experiment has, however, been successfully tried; but it was found necessary to have the slides of the lathe very nicely adjusted, and to take up the lost motion in the crossfeed screw.

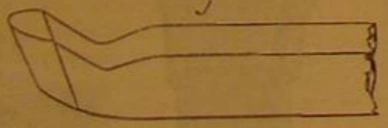
For roughing out and for long continuous cuts, this tool is the best of any that can be used; because it presents a keen cutting edge to the metal, and the cutting edge receives the maximum of support from the steel beneath or behind it. It receives less strain from the shaving than any other; and will, in consequence of these virtues combined, take a heavier cut, and stand it longer, than any other tool; but it is not so good for taking a finishing cut as one having front rake, as shown in Fig. 1.

Having determined the position of the requisite rake, the next consideration is that of the proper form of the cutting edge, the main principles of which are as follows

ROUND NOSED TOOLS,

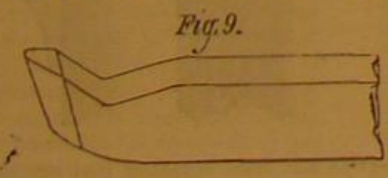
as shown in Fig. 8, have more cutting edge to them (the

Fig. 8.



depth of the cuts being equal) than the straighter nosed ones, shown in Fig. 9, receiving as the result more strain

Fig. 9.



from, and becoming more liable to run into or out from, the cut. If sufficient rake is given to the tool to obviate this defect, it will, under a heavy cut, spring in. It is, however, well adapted to cutting out curves, or taking finishing cuts on wrought iron work, which is so strong and stiff as not to spring away from it, because it can be used with a coarse feed without leaving deep or rough tool or feed marks; it should, however, always be used with a slow speed. On coming into contact with the scale or skin of the metal, in case the work will not true up, it is liable to spring away from its cut. If held far out from the tool post, it is apt to jar or chatter; and unless the work and the tool are both firmly held, it is liable to cut deeper into the softer than into the harder parts of the metal. The angles or sides of a cutting tool must not of necessity be quite flat (unless for use on slight work, as rods or spindles), but slightly curved, and in all cases rounded at the point, as in the tool shown in Fig. 9. If the angles were left flat and the point sharp, the tool would leave deep and ragged feed marks; the extreme point, wearing away quickly, would soon render the tool too dull for use, and the point would be apt to break.

For the finishing cuts of heavy cast iron work, which is not liable to spring, the broad square nosed tool, given in

Fig. 10.

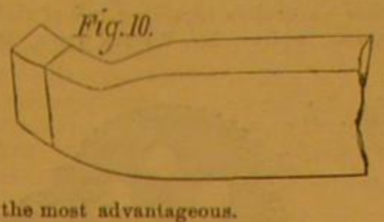


Fig. 10, is the most advantageous.

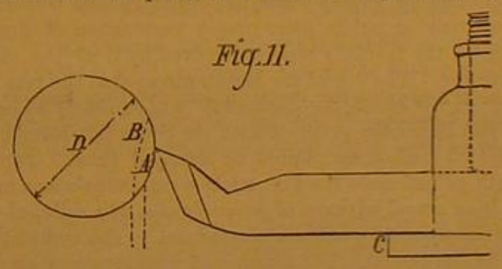
SQUARE NOSED TOOLS.

A feed can be used with this tool almost as broad as a cut as the nose of the tool itself, providing, however, that it is set in position with great exactitude, so that its flat nose or front will be even or true with the face of the work it is intended to cut, and that it is held as close in to the tool post as it can conveniently be, and that, if fed by hand, it be fed evenly, because all tools possessing a broad cutting surface are subservient to spring, which spring is always in a direction (as in this case) to deepen the cut; so that, if more cut is taken at one revolution or stroke than at another, the one cut will be deeper than the other. They are likewise liable to jar or tremble, the only remedy for which is to grind away some of the cutting face or edge, making it narrower. For taking finishing cuts on cast iron, more top rake may be given to the tool than is employed to rough it out, unless the metal to be cut is very hard; else the metal will be found, upon inspection, to have numerous small holes on the face that has been cut, appearing as though it were very porous. This occurs because the tool has not cut keenly enough, and has broken the grain of the metal out a little in advance of the cut, in consequence of an undue pressure sustained by the metal at the moment of its being severed by the tool edge.

HOLDING TOOLS.

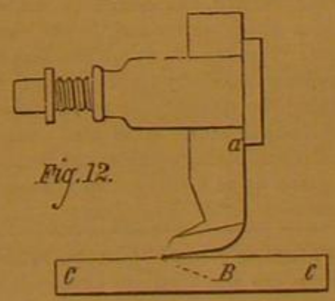
All tools should be fastened or held so that their cutting edges are as near the tool post as possible, so as to avoid their springing, and to check as far as possible their giving way to the cut, in consequence of the play there may be in the slides of the tool rest; but if, from the nature of the work to be performed, the tool must of necessity stand out far from the tool post, we should give the tool but little top rake, and be sure not to place it above the horizontal center of the work. The point or fulcrum, off which the spring of a lathe tool takes place, is denoted in Fig. 11, by C, the

Fig. 11.



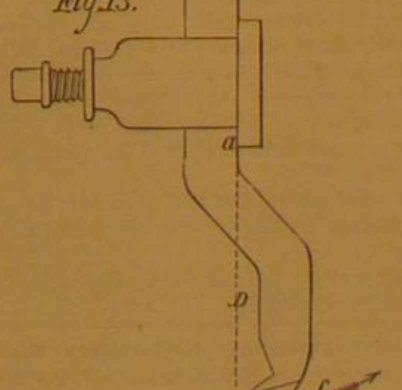

dotted line, A, indicating the direction in which the point of the tool would spring, and the dotted line, B, representing the direction in which it would spring if it stood at B; from which it becomes apparent that, if placed at the point, B, the spring would be more in a direction to run into the cut or diameter of the shaft, D, than is the case when placed at *a*.

Fig. 12.



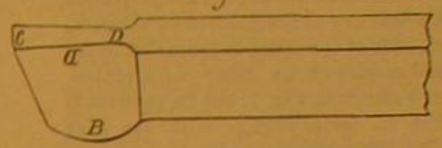

Cutting tools used in a planer are subject to the same conditions, as represented in Fig. 12. *a* is the fulcrum from which the tool springs, C is the work to be cut, and the dotted line, B, represents the direction in which the point of the tool springs into the work, thus increasing the cut according to the amount of spring, as in the case of a lathe too. This may be obviated, in a planer tool, by bending its body, as shown in Fig. 13. *a* is the fulcrum off which the tool takes its spring, B is the work to be cut; and the dotted line, C, is the line in which the point of the tool would spring (being in the direction denoted by the arrow) which is not in this case into the cut, but rather away from it, in consequence of the point of the tool standing back from a line perpendicular to the line of the back part of the tool, as shown by the dotted line, D.

Fig. 13.




Tools that are necessarily straight in form, especially those for use in a planer, are more subservient to the evil effects of spring than those of stouter body; and in light planers, when the tool springs in, the table will sometimes lift up, and the machine becomes locked, the cut being too deep for the belt to drive. The tool most subservient to spring is the parting or grooving tool shown in Fig. 14, which,

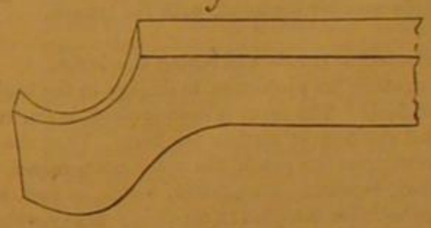
Fig. 14.




having a square nose and a broad cutting surface placed parallel to the depth of the cut, and requiring at times to be slight in body, combines all the elements which predispose a tool to spring, to obviate which, it should be placed at or a little below the center, if used in a lathe under disadvantageous conditions, and bent similarly to the tool shown in Fig. 13, if for use in a planer, unless under favorable conditions.

The point at C is made thicker than the width at D to give clearance to the sides, so that it will only cut at the end, C;

Fig. 14'.



and the breadth at *a*, B, is left wider than other parts to compensate in some measure for the lack of substance in the thickness. An excellent substitute for bending the body of the tool is to set the cutting edge of the tool back, as shown in Fig. 14', which represents a parting tool for wrought iron.

### The Value of Oatmeal as Infants' Food.

In a communication to the *Société Médicale des Hôpitaux*, MM. Dujardin-Beaumetz and Hardy make known the results of the employment of oatmeal on the alimentation and hygiene of infants. According to them, oatmeal is the aliment which, by reason of its plastic and respiratory elements, makes the nearest approach to human milk. It also is one of those which contains most iron and salts, and especially the phosphate of lime, so necessary for infants. It also has the property of preventing and arresting the diarrhœas which are so frequent and so dangerous at this age. According to the trials made by M. Marie, infants from four to eleven months of age fed exclusively upon Scotch oatmeal and cow's milk thrive very nearly as well as do children of the same age suckled by a good nurse.

### A Beneficent Californian.

We have heretofore published an account of the donation of Mr. James Lick to the public, consisting of a sum of money for the purpose of building the largest telescope ever known, the scheme for which has been much commented on in these columns. We now hear from San Francisco that Mr. Lick has deeded more than a million dollars additional, to be devoted to several most praiseworthy objects. The total amount of these benefactions is $1,780,000, and its distribution is as follows: $700,000 to the construction of the largest and best telescope in the world and for the observatory at Lake Tahoe; $420,000 for public monuments; 150,000 for public baths in his city; $100,000 for the Old Ladies' Home; $10,000 to the Society for the Protection of Animals; $25,000 to the Ladies' Protection Relief Society; $10,000 to the Mechanics' Library; $25,000 to the Protestant Orphan Asylum; $25,000 to the city of San José for an Orphan Asylum; $150,000 for the erection of a bronze monument to the author of the "Star Spangled Banner," in Golden Gate Park; $300,000 for the endowment of a School of Mechanical Arts in California, and the residue to the Pioneer Society. He makes ample provision for his relatives, and reserves a homestead and $25,000 per annum for himself.

Mr. Lick, by this judicious liberality, has the pleasure, perhaps the highest a man can attain, of seeing his wealth do good and fructify during his lifetime, instead of being a bone of contention to his heirs after his death.

### To Build a Transverse Sled Body.

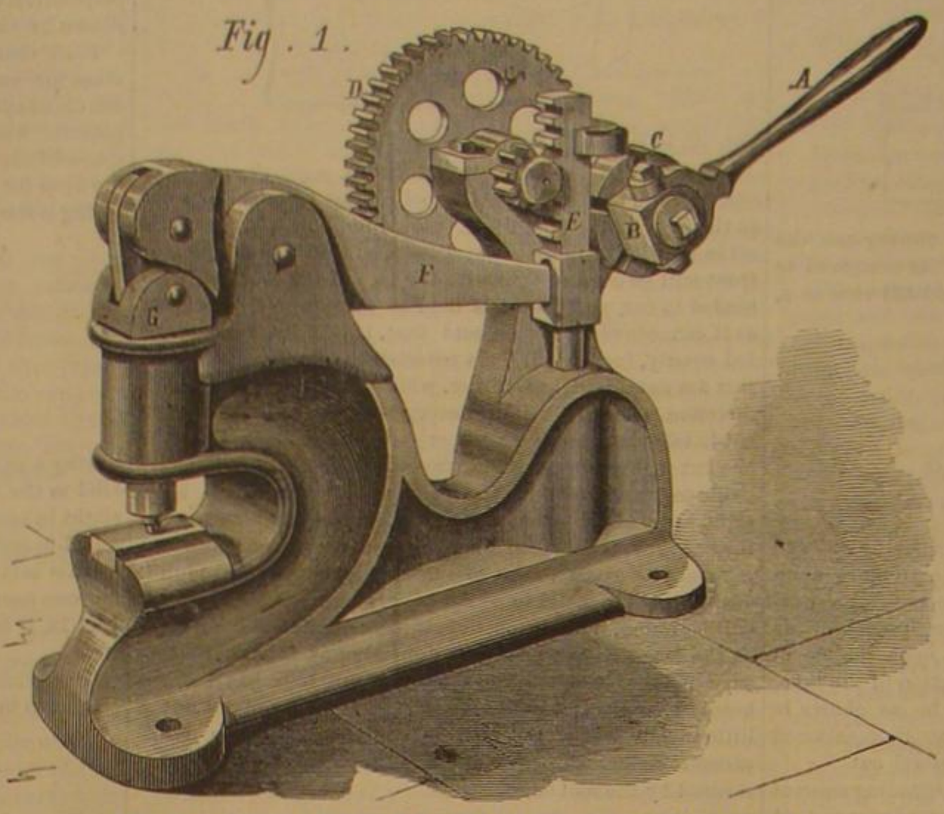
W. A. W. says: "The best way to build a traverse sled body is to make the sills out of one inch or three quarter boards, with cross pieces of the same thickness bolted between the sills, which are double. You can make these very light and limber. Now put on your side boards with a bolt down through the rave and sill, which will make it very stiff, and can be made very light, and with all the strength possible. This is the best form I ever saw in practice."

## IMPROVED PUNCH AND SCREWDRIVER.

The invention which our engravings illustrate furnishes a method of applying power to two useful implements, so as to gain a strong purchase through the interposition of simple and effective mechanical contrivances.

Fig. 1 is a punch, such as may be used for piercing boiler plates or other metal. The construction is such that no long lever is required, and hence room is greatly economized; while the mechanism by which several movements of the short hand lever are transmitted to produce a very short motion of the punch, and to develop in the latter a strong power, is quite simple and readily understood. The hand lever, A, is provided with jaws which are pivoted to a block, B, which turns loosely and is secured by a nut on a horizontal shaft. Upon the latter is fastened a disk, C, the face of which is notched as shown. Upon the under side of the lever, A, and just at the throat of the jaw, is a projection which fits into any of the grooves on the disk, C. The shaft of the latter is journaled in the frame and carries on its other end a pinion. This is not shown in Fig. 1, but its position is such that its teeth engage with the gear wheel, D. This wheel is also journaled in the frame, and on the further end of its shaft carries a pinion, which, as clearly shown in the engraving, engages with the teeth of a vertical rack, E. The lower and plain portion of the latter enters a hole in the frame, so that by this means, together with a suitable guide grasping the rack above, the rack is kept perpendicular. Just below the toothed portion of the rack is a slotted enlargement of the same, through which passes loosely the diminished end of the punch lever, F. This is pivoted to the frame, and connects, in the simple manner depicted, with the punch bar, G.

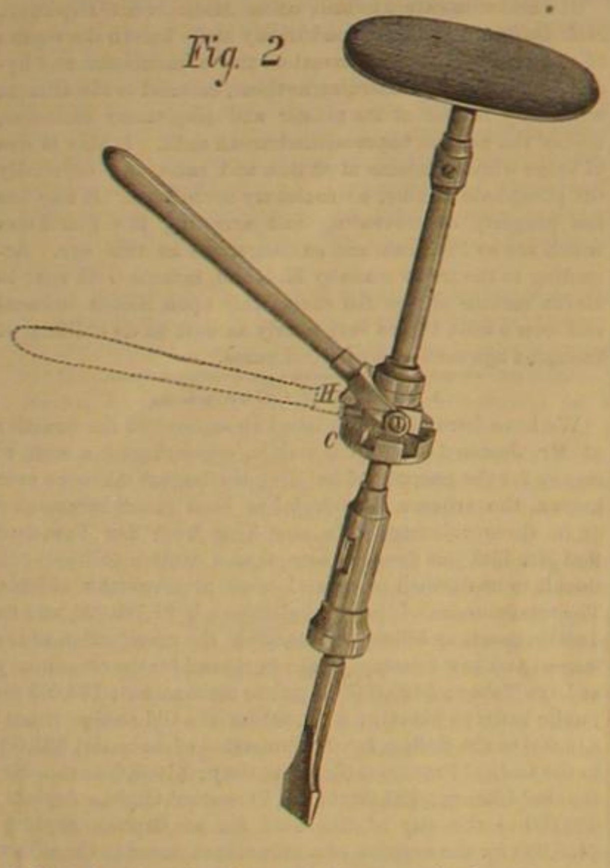
Fig. 1.




LYONS' IMPROVED PUNCH AND SCREWDRIVER.

The operation consists in lifting the lever, A, and causing its projection to engage in the highest notch on the disk, C. The lever is then pressed down, turning the disk until the former strikes the floor. Then the projection is removed from the notch, the lever again raised, and a new hold taken, repeating the process, which, in fact, is precisely the same as that adopted in moving a heavy weight with a crowbar. The workman lifts the load as far as possible with the latter, then blocks it in position, and shifts his bar for a new purchase, and so on until the labor is accomplished. By means of a crank to be placed upon the shaft of the disk, D (not shown in our engraving), the punch, after descending, may be raised very quickly. This avoids the delay of engaging the lever projection in the successive notches of the disk, and of turning the arm in the opposite direction from before.

Fig. 2




We need not enter into any details of the inter-relation of the wheel, pinions, and levers, to show that an immense power may thus be applied piecemeal toward forcing down the punch; nor is it perhaps necessary to add that this machine, as is the case with many others which have appeared in our columns, is an ingenious plan for utilizing hand power where other motors do not exist or where their application would be inconvenient.

Passing to our second illustration, we have another adaptation of the device, to a screwdriver. Further description of the mechanism is not needed; so that in that connection it remains but to say that the dotted lines indicate the position of the lever when its projection, H, is engaged with a notch in the disk, and that the block to which the jaws are attached necessarily works loose on the shaft. The invention, as shown, is a convenient substitute for the unhandy combination of screwdriver and tongs commonly employed. The leverage is straight and applied at the best advantage. The instrument may be employed for cutting taps in corners, and it is constructed to hold screwdrivers of any proper form. It will, we think, prove of especial handiness in operating upon screws in positions difficult to reach by the ordinary tool.

For further particulars regarding sale of rights, in both inventions, etc., address Mr. Warren Lyon, Mamaroneck, Westchester county, N. Y. The tools will be manufactured by the Biddle Machine and Tool Company, of 164 West 27th street, New York city, at which establishment they will shortly be ready for examination.

### The St. Gothard Tunnel.

In reply, no doubt, to rumors, circulated from French sources, that the St. Gothard tunnel was to be abandoned as a failure, its progress being so slow as not to promise its completion for twenty years, the Swiss Federal Government is now making public, after proper verification of their correctness, the monthly reports received by it of the state of the works. The report for March shows that the rate of advance of the boring for the month was as nearly as possible 500 feet linear, the proportion on the Swiss side being greater than that made from Airolo by nearly a third. The total length gained since the first trials were made sixteen months ago is an actual advance of seven eighths of a mile, of which very nearly 1,200 yards are cleared out to the complete section of the tunnel. The number of workmen now employed on an average daily is 1,380; but this appears to include the labor in extensive workshops outside each of the two openings. The boring from the Swiss end continues to be entirely through solid gneiss rock. The temperature is found remarkably equable within the tunnel, varying little during the month from 70°, while outside the average was 41°. At the southern end the mica schist, through which the boring has been carried, has ceased to contain quartz, and has become of a much softer and looser character as the work advances. The reports as to the leakage of springs into the tunnel are decisively contradicted in this report, according to which the quantity of water entering in March was perfectly insignificant. It is also announced that so far from the Belgian boring machines of Dubois and François having been given up as a failure, they are working on with the greatest success.—*Pall Mall Gazette.*

### Painting Magic Lantern Slides.

The following are the methods employed by the artists whose profession is the painting of magic lantern slides:

1. Use transparent colors, like Prussian blue, gamboge, and carmine. These will give the three primary colors, and by their mixture the other tints. Apply with a brush, and a transparent drying varnish, like dammar varnish. Allow one coat to dry before applying a second. Considerable aid can be derived from stippling, the color being strengthened, where necessary, by applying it with the point of a fine brush. The colors must not be used too thin.

2. Flow the glass plate with albumen, after the manner of photographers, and paint with aniline colors. This process gives great softness and brilliancy to the pictures, but they are apt to fade.

3. Paint with water colors and then flow the entire surface with Canada balsam, covering the painted side with a glass plate.

4. Use water colors, but mix them with turpentine, instead of water, and work rapidly.

### The Sphygmograph in Bright's Disease.

The investigations of Mr. Mahomed, of the fever hospital, Madras, tend to show that in the form of Bright's disease which follows scarlet fever, there is an early stage, the first indication of which is usually a pulse exhibiting high tension, though this may be preceded by dry skin and confined bowels. Next comes, as first in the order of changes in the kidney, a urine which contains no albumen recognizable by the ordinary tests, but some blood stuff, which yields the blue reaction with ozonic ether and tincture of guaiacum. If matters still go on, this is followed by the ordinary serum albumen, and when that is abundant no blue reaction can be obtained. Moreover, Mr. Mahomed says that he has only been able to get this blue reaction when the tension is arterial, not when it is purely venous.

### Fuel in Furnaces.

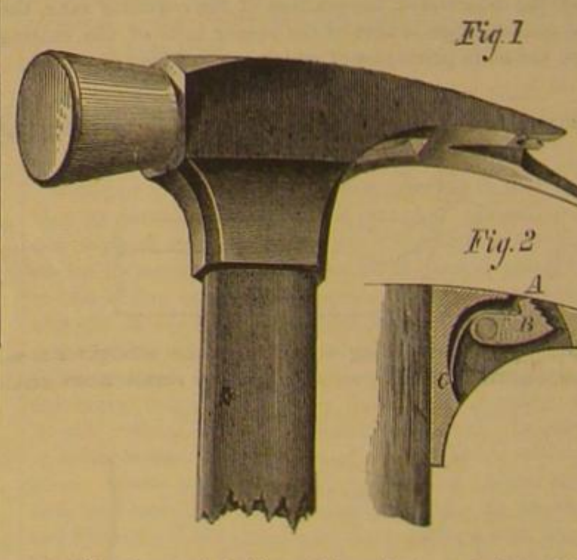
M. Foucault, in a report to the Industrial Society at Rheims, combats the idea that the smokelessness of a fire can effect a notable saving in the amount of fuel burnt. He alleges also, on the other hand, that a considerable loss of economy is produced by smoke-consuming apparatus. He brings in support of his opinion the long series of observations made by the Industrial Society of Mulhouse, which have proved that, with the ordinary boiler furnaces, it is only necessary to consume from 125 to 150 cubic feet of air for each pound of coal, while for the most part furnaces pass twice that quantity. If the draft be reduced in quantity much smoke is evolved, but the products of combustion, circulating more slowly, part with their heat more readily to the boiler flues. It is further proved that the best means of reducing the loss of heat by the chimney is by the use of feed heaters in the flue, so as finally to reduce to 200° the products of combustion, which are often discharged as hot as 400°. Feed water heaters, well set, will produce an economy of from eleven to twenty per cent with a reduced draft.

The conclusion is that furnaces with large area and suitable feed heaters are the most economical in all respects. But in order to obtain the best results, much care is needed in stoking. A little at a time and often, should the coal be spread over the front of the fire, and the bright coal pushed back to the bridge. At the same time, the least possible quantity of cold air should be admitted.

## IMPROVED HAMMER.

In drawing old or poorly made nails with the claw end of a hammer, it is a common annoyance for the heads of the former to be pulled off, causing considerable difficulty in extracting the remaining portion. Mr. Candidus Bilharz, of Pittsylvania Court House, Va., has recently devised an ingenious arrangement which, in connection with the ordinary hammer, is stated to obviate the trouble. The tool is represented in the annexed engraving, and the portion above referred to is shown in section in Fig. 2. At the base of the claws is an orifice, A, in which, by a pivot pin, an eccentric jaw, B, is attached. This jaw works in connection with the forward end of the orifice, and is pressed toward that end by a spring, C. Its face is notched or serrated to prevent slipping from the nail.

When the pull on the claw tears off the head, the end of the nail is made to enter the orifice, A, between the serrated side of the jaw and the body of the hammer, and, becoming thus tightly held, is drawn in the usual manner. The improvement will gripe and hold anything that can be introduced, and hence may be applied to other uses than simply extracting nails.




The claw end of the hammer (Fig. 1), it will be noticed, is provided with one long and one short claw. At the extremity of the former is made a point in order to enable the operator to punch a hole in the wood in which the nail will stick without holding previous to driving. The short claw is suitably formed on its end for driving tacks.

This invention was patented through the Scientific American Patent Agency, April 21, 1874. Further particulars, as to sale of patent or rights to manufacture, may be obtained by addressing the inventor as above.

DYEING WITH MAHOGANY SAWDUST.—A Mr. C. Dreyfuss a correspondent of the *Farber Zeitung* residing in England, has patented mahogany sawdust as a ware for dyeing and printing browns on cotton. He mordants with tin, and uses a little lime and glue in the dye beck.

## A MICROSCOPIC AQUARIUM.

Our engraving represents a microscopic aquarium, such as would be seen if there could be embraced, at a single view in the instrument, the majority of objects examined by the microscopist, when the wonders of the infinitely little world existing in stagnant fresh water are studied.

The illustration, for which we are indebted to *La Nature*, though presenting a somewhat fantastic appearance, is, nevertheless, simply a combination of separate observations. The objects were drawn from their images on the field of the microscope, and then grouped so as to show their positions during the natural state.

All have their names. At the upper portion of the picture is a scrap of reed stem, a thin branch like a stalk of straw, beneath which a crowd of *confervæ* have sought shelter against the agitations in the water. The parasite life of the latter is necessary for their existence, because of their extreme delicateness. The diatoms, which are placed beside the *confervæ*, are represented in their natural state, that is, pendent in bunches. The *diatoma vulgaris*, which is the variety shown, is found in so great abundance that hundreds of thousands are often united in a single group. They propagate themselves in indefinite clusters, united by delicate though strong membranes.

At the lower part of the aquarium are shown *confervæ* less elementary than those above. These do not become parasites, and, in fact, have some relation to aerial vegetation. Such are the *characeæ*, the *batrachospermæ*, and the multitude of *algæ*, which are often taken for simple mold. In the midst of the vegetation, which appears to belong to another world, are infusoria of all sizes, from the proteus, a mere gelatinous mass, to the superior organisms furnished with exterior members.

If the infinity of forms which aquatic vegetables assume in some stagnant pool be examined, it will be found that all the floating bits of stick and the stalks of the weeds growing in the water are covered with a light brown and adherent slime. This is composed of a mass of *confervæ*. If one of these stalks be removed and placed in a flask of clean water, it may be transported and submitted to scrutiny under the microscope, when nearly all the species represented in our engraving will be recognized. Sometimes the observer will see a *spirogyra* with its heliocoidal shape of a brilliant green, sometimes scattered diatoms. Frequently hideous infusoria suddenly appear, a mass of gelatinous substance, in the midst of which something resembling viscera may be traced.

Microscopy is one of the most beautiful studies in the world; and to those of our readers whose coming summer will be passed in the country, we would recommend the purchase of a moderate priced instrument. To one not familiar with its revelations, the microscope opens a new world, and, in the drop of stagnant water, in the grain of earth, and in the leaf, shows wonders which are a constant source of surprise and admiration.


A MICROSCOPIC AQUARIUM.

## REMARKABLE BALLOON ASCENT.

Aerial navigation, since Science has utilized the balloon for the purpose of observation and investigation, has received a fresh impetus. Though Biot and Gay Lussac, as early as the year 1804, gave the first impulse to the employment of balloons for scientific research, it was not until the British Association for the Advancement of Science laid down (in Leeds, in 1858) the first systematized plan that regular balloon ascents were undertaken. Among a number of very valuable results ascertained thereby, the existence of a warm current of air, which sweeps (at an altitude of about 18,000 feet, and with a vertical magnitude of 2,000 feet) from the southwest to the northeast, in about the same direction as the Gulf Stream, has been discovered.

The French have hitherto undoubtedly held the foremost rank in aerial navigation. They showed, during the siege of Paris, the practical value of the balloon. The French papers are now seriously discussing a proposition for transferring the work of the surveyor to the aeronaut. It has been found necessary to revise the real estate maps throughout France, and it is proposed that an aeronaut should take a photograph of each tract or section, which would, after being suitably enlarged, exactly indicate the contour and features of the district. This may be practically accomplished, as such photographs have already been made from a balloon; but the expense of carrying such a plan into execution, being estimated at about three and a half million dollars for the whole country, is so large that the work may at present be done at less cost by a surveyor.

MM. Croce-Spinelli and Sivel made, on March 22, a balloon ascent under the auspices of the Society for Aerial Navigation, to which we alluded on pp. 280 and 337 of our current volume. We give an illustration showing the aeronauts in the car. They carried with them, as we have stated, a considerable quantity of oxygen, inclosed in suitable vessels, and inhaled by means of a tube. By similar means life can be supported at an altitude where the rarity of the atmosphere is such as to make breathing impossible. This latter was the main obstacle to higher ascents, and it has now been successfully overcome, and it is possible to remain at altitudes of 30,000 feet as long as the oxygen lasts.

Of the many observations which were made by these aeronauts at hights up to 21,000 feet, we will mention only two. At 12,500 feet above the earth, they passed a cloud of suspended ice crystals, which glittered in the sun, but were so perfectly translucent that a clear view of the panorama below the balloon was seen, and it was not in the least blurred. The second point is one of great importance. The lines indicating water in the solar spectrum have created much discussion; and Father Secchi argued that they were watery evaporations from the sun, while others assert that they are moist vapors in our atmosphere. The latter view is now known to be the correct one, as the solar spectrum showed, in the dry air of the upper altitudes, no water at all.

THE BALLOON ASCENT OF MM. SIVEL AND CROCE-SPINELLI.

### Stalactites from Masonry.

The North Bridge, which spans the deep valley lying between the Old and New Towns of Edinburgh, Scotland, was built upwards of a hundred years ago. Between the arches of the bridge and the roadway above are a number of chambers or vaults which have not been opened, till recently, since the bridge was built. One of them has been visited by Professor Geikie, who says:

"From the vaulted ceiling, and especially from the joints of the masonry, hung hundreds of stalactites—delicate spar icicles of snowy whiteness. In many cases they reached to the floor, forming slender thread like pillars. Usually they were slim stalks, somewhat like thick and not very well made tobacco pipes: but towards the sides of the vaults they became thicker and stronger, one which we carried off measuring about four feet in length, and as stout as an ordinary walking stick. The same material as that forming the stalactites spread in ribbed sheets down the sides of the vault. The floor, too, was dotted all over with little monticules of the same snow white crystaline spar.

"A more illustrative example of a stalactitic cavern could not be found. The whole process was laid open before us in all its stages. Along the joints of the masonry overhead could be seen here and there a drop of clear water ready to fall. At other places the drop hung by the end of a tiny white stone icicle, to which it was adding its own minute contribution as it evaporated. From the mere rudimentary stumps, the stalactites could be traced of all lengths until they were found firmly united to the spar hillocks on the floor. Every one of these hillocks, too, lay directly beneath the drip, catching the remainder of the stone dissolved in the dropping and evaporating water. In every case the stalactites were tubes; even the thickest of them, though it had undergone great changes from deposit on its outer surface, retained, nevertheless, its bore. Usually there hung a clear water drop from the end of the stalk, ready to descend upon its white stony mound beneath.

For a hundred years this delicate tapestry has been hanging and growing, and breaking and growing again, quietly in darkness, beneath the grind of our carriage wheels, and yet high in air, with the stream of human life flowing underneath it too.

"As the bridge is built of sandstone, wholly or almost wholly free from lime, it is evident that the material which has converted these vaults into such picturesque caverns has been derived from the mortar. All rain water, as is well known, takes up a little carbonic acid from the air, and of that acid there is in the air of a town usually more than the normal proportion. Filtering through the masonry, it dissolves the lime, carrying it downward in solution, and, if made to halt and evaporate, depositing it again in the form of the white crystaline substance which we call spar. It would be a curious question for the architect how long his masonry could resist this action. Certainly, in spite of what these vaults in the North Bridge reveal, the masonry of that structure is, to all appearance, as solid and firm as ever. It is evidently impossible, however, that the mortar, if necessary at all, can be piecemeal removed without in the end causing the destruction of a building."

### Oyster Culture in America.

Frank Buckland, in *Land and Water*, says:—"As regards the cultivation of the New York oysters themselves, I must again hold up a warning hand to American proprietors. If they go on with the present system, the oysters will shortly run short. I protested, some months back, against burning the culch old shells for lime, instead of putting it back to catch spat; and now I find they are selling their broods attached to the parent shell. I have picked out specimens from the tub at Scott's, at the top of the Haymarket. On the two shells of one edible oyster there were no less than twenty-three spats. In another case I counted a "clump." Two edible oysters only were in this clump, but it was covered all over with spat; so that for the sum of 4 cents, between thirty and forty oysters were sold all at once, only two being edible. The tub at Scott's was piled with examples of this "economy." I trust the American oyster dealers will not take it amiss if I warn them that, if they sell their young stock in this wasteful manner, they will soon be suffering from an oyster famine."

### Butterine---Artificial Butter.

J. Campbell Brown, D. Sc., says that a chemist, seeing the word butterine, would be apt to suppose that it is a misprint for butyrin, but it is not so; it is the registered name under which substitute for butter is introduced in this country from New York. [Known in New York as artificial or suet butter]. Its general appearance, taste, and consistence are very similar to those of ordinary butter; but notwithstanding that its solidfying point is lower than that of some butters, it retains much of the peculiar crumbly texture and fracture of dripping.

Examined, it gives the following results: It softens at 78° Fah., and melts at 86°; when heated and slowly cooled, it obscures the thermometer at 62°, and solidifies at 60°: It contains:

| | |
|---|---|
| Water | 11·25 to 8·5 |
| Salt | 1·03 to 5·5 |
| Curd | 0·57 to 0·6 |
| Fat | 87·15 to 0·6 |
| Coloring matter | — — |
| | 100·00 |

The fat consists of olein, palmitin, margarin (?), a trace of stearin, and about 5 or 6 per cent of butter. When dissolved in about four times its weight of ether, and allowed to evaporate spontaneously, it does not deposit any fat until more than half of the ether has passed off, and, if the temperature is not below 60°, the deposit is not solid. The first deposit, when dried, fuses at 108°; the second deposit fuses at 88°, and solidifies at 64°.

Under the microscope, butterine does not appear to consists of acicular crystals of fat, but of irregular masses containing a few butter globules, particles of curd, and crystals of salt. With polarized light, the irregular crystaline structure is beautifully seen, and is clearly distinguishable from butter which has been melted and recongealed. When old and rancid, it acquires the odor and taste of dripping, but it keeps longer undecomposed than butter. When fresh, it is a wholesome substitute for real butter; and if not brought into the market as butter, no one can reasonably take exception to its sale.

Butterine may be selected by the following characters:

1. Its crumbly fracture.
2. Its loss of color when kept melted for a short time at 212°.
3. The behavior of its etheeral solution.
4. Its action on polarized light.

### Wheelerite, a new Fossil Resin.

During the past season's field work of the explorations and surveys west of the 100th meridian, under the command of Lieutenant George M. Wheeler, to which expedition I was attached as chemist, many interesting chemical facts were observed. Among these may be mentioned the occurrence of a new fossil resin, whose name heads this article. This resin, which is yellowish in color, was frequently found in the cretaceous lignite beds of northern New Mexico, filling the fissures of the lignite, and even interstratified in thin layers with the same. More of this substance was seen in the vicinity of Nacimiento than in any other locality. The strata of lignite, slate and clay, in the numerous sandstone mesas of this region, are plainly to be seen in passing by. The behavior of this resin with reagents and the analysis made proves this to be a new compound, heretofore undescribed.

On treating the resin with alcohol, the principal portion is readily dissolved, while a small part remains insoluble. The hot alcoholic extract of the resin deposits, on cooling, a few yellow flocculi. After the separation of the solution from these flocculi, there remains, after evaporation, a yellowish resin, which is very brittle and becomes strongly electric on friction. This resin melts at 309° Fah. At a higher temperature it emits an aromatic odor, burns with a smoky flame, and leaves a voluminous coal behind.

It is soluble in ether, less so in bisulphide of carbon. It dissolves readily in concentrated sulphuric acid, producing a dark brown solution. From this solution water precipitates it. It forms a compound with potassa in aqueous solution, and is precipitated by acids unchanged. Strong nitric acid readily oxidizes it, with the evolution of nitrous fumes.

0·106 grm. gave 0·284 carbonic acid and 0·076 water.

0·101 grm. gave 0·270 carbonic acid and 0·071 water.

The data give the formula $C_5H_6O$.

| | Theory. | Experiment. I. | Experiment. II. |
|---|---|---|---|
| Carbon, | 73·11 | 73·07 | 72·87 |
| Hydrogen, | 7·31 | 7·95 | 7·88 |
| Oxygen, | 19·58 | | |

The true molecule of the resin is probably 5-6 times larger than the above formula expresses. Many fossil resins have been investigated; but none identical with the above, so far as known, has been described.

The retinic acid of Johnson, which he obtained by extracting the retinasphalt of Bovey with alcohol, is the only combination that bears a resemblance to the substance under discussion. This has the formula $C_{40}H_{45}O_6$, is slightly soluble in alcohol, readily so in ether, and melts at 248° Fah.

I have taken the liberty of naming this new mineral after Lieutenant George M. Wheeler, Corps of Engineers, U. S. Army, the honored and energetic leader of the expedition to which I am attached.—*O. Loew.—American Journal of Science and Arts.*

GILDING ON ZINC.—C. D. Braun dissolves sulphide of gold in sulphide of ammonium, and deposits a layer of gold upon pieces of clean zinc plunged into it, the air being excluded as far as possible.

### Acoustics in Public Buildings.

A. W. C. states the inability to hear distinctly in our public buildings is due to the architects, and that those gentlemen should remember that an ounce of prevention is worth more than a tun of cure. "Please advise any of your friends who contemplate building a church, hall, lecture room, or other public building, to observe the following rule, and they will find the principles thereof to be true:

"Let the whole structure be held in entire subserviency to the auditorium, regardless of needless ornamentation, and let the clear inside lines thereof be as follows: Make or take the whole length as one sum in feet, make the whole width one half that sum, and the whole hight, to the center of the ceiling, one half of the latter sum."

### Interesting Legal Decision.

A St. Louis court, says *The Trade Bureau*, recently made the following decision as to how far an employer is answerable for injuries received by an employee in his service. The court said: While an employer is an insurer of the safety of his employee, as far as the apparatus and machinery are concerned, and for injuries received when the employee is unconscious of the defects in the apparatus, yet if the employee knows of the defects, and continues to work and incur the risk, he must take the consequence of his own negligence. This view is sustained by recent decisions of the Supreme Court, and by the General Term of the Circuit Court. In a case where a laborer was injured by the breaking of a worn out rope, it was decided that he could not recover, as he knew the condition of the rope, and continued to use it at his peril.

A MADEIRA correspondent of *Nature* writes concerning the damage caused to objects of natural history from cedar wood cases. A naturalist in Madeira, to do his collection of the remarkable land shells of the island more honor, had made for them a case of this wood. Unobserved for a month, the shells were found drenched with the turpentiny resin exhaling from the wood. Shells covered with a rough epidermis seemed to have attracted the oil less. *Craspedopoma* and the smooth fresh water shells had especially suffered; semi-fossils full of sand had escaped; all others, whether recent or semi-fossil, had suffered to such an extent that the cardboard to which they were attached was in many cases soaked. This occurred, however, only when the affixed shells offered the needful point of attraction and condensation.

## DECISIONS OF THE COURTS.

### United States Circuit Court.---District of Massachusetts.

PATENT RUBBER DENTAL PLATES.—THE GOODYEAR DENTAL VULCANITE COMPANY *et al.* *vs.* DANIEL H. SMITH.

[In equity.—Before Shepley, Judge.—Decided May 8, 1874.]

This is the famous patent which covers the manufacture of dental plates of rubber. It has for a long time been obstinately resisted by the dental profession, as the holders of the patent impose a high tariff upon practitioners who use it. Nearly all dentists find it necessary to employ the rubber plates, and the patent monopoly is considered burdensome and unjust. It will be seen that the Court again sustains the patent, and this decision will stand, unless reversed on appeal to the Supreme Court of the United States.

The original letters patent of the United States were issued June 7, 1864, to John A. Cummings for improvement in artificial gums and palates. The bill in equity in this case is filed against the defendant, alleging infringement of the letters patent which, upon a surrender of that patent in accordance with law, were reissued to the Dental Vulcanite Company, the assignees of the title in and to the letters patent, upon the 21st of March, 1865. This reissued patent, in the opinion of Judge Shepley, is for a new article of manufacture, consisting of a plate of hard rubber or vulcanite with teeth, or teeth and gums, secured thereto in the manner described in the patent. The patent is not for a process or art, but for the new product resulting from the manipulation by the described new process. It is one of those products, as will be seen by examination of the specifications describing the process of manufacture, in which the process so inheres that the described product can only be made by the described process. The patent is not for a dental plate of vulcanite or hard rubber alone; it is not the substitution of the old material, vulcanite, in place of the gold and other materials which have been before used in the same way; it is not, as claimed by defendant, for a dental plate of hard rubber vulcanized in molds in the manner described in the patent; but it is for a set of artificial teeth as a new article of manufacture, consisting of a plate of hard rubber or vulcanite, with teeth, or teeth and gums, secured thereto in the manner described in the patent, by imbedding the teeth and pins in the vulcanizable compound, so that it shall surround the teeth and pins while the compound is in a soft state before it is vulcanized, so that when the compound is vulcanized the teeth are firmly secured by the pins imbedded in the vulcanite, and there is a tight joint between the vulcanite and the teeth. This manufacture was a new manufacture, new as to the thing made, new as to the process of making it, considering that process as a whole. The invention is not like that of a machine, but is one in which the process by which it is made is a part of the substance of the thing made, the manufacture, and a characteristic feature of its construction. It is evident from an examination of the very brief and imperfect description of the invention given by Cummings in his caveat filed as early as May 14, 1852, that he fully appreciated the fact that the importance of his invention consisted not merely in the substitution of a material "rigid enough for the purposes of mastication, and pliable enough to yield a little to the mouth," in place of the "hard, unyielding" metals previously used, and not merely in the substitution of a material light and inexpensive in place of the expensive and heavy materials before used for the plate, but also in the additional fact, which he states, that "by this improvement the teeth can be easily baked into the gums, which form one piece with the plate." This statement at that early period sufficiently suggests that he fully appreciated the advantages of the material which he used, and which was capable of being so used in the process as to ensure that cleanliness and purity resulting from the absolutely perfect joint formed between the teeth and the plate, and the consequent absence of any crevices for the retention of food.

Upon a careful review of all the evidence in the record, I have no hesitation in coming to the conclusion that the invention of Dr. Cummings was a new and useful manufacture, that nothing appears in evidence to show that he was not the original and first inventor of the thing claimed by him, that the reissued patent in suit is a good and valid patent, and that the defendant has infringed the same, as alleged in the bill.

Decree for complainant for injunction and account, as prayed for in the bill.

## NEW BOOKS AND PUBLICATIONS.

TABLES FOR QUALITATIVE CHEMICAL ANALYSIS. With an Introductory Chapter on the Course of Analysis. By Professor Heinrich Will, of Giessen, Germany. Edited by Charles F. Himes, Ph. D., Professor of Natural Science, Dickinson College, Carlisle, Pa. Price $1.50. Philadelphia: Henry Carey Baird, 406 Walnut street.

A concise statement of the characteristic results of all the tests in ordinary use for the purpose of qualitative analysis, which deserves, both on account of its authorship and the reputation of its editor, a place in every scientific library. It will be found useful to students as a manual, as well as for constant reference by experts in the laboratory.

AMERICAN NEWSPAPER DIRECTORY, containing Accurate Lists of all the Newspapers and Periodicals published in the United States and Territories, and in the Dominion of Canada and British Colonies of North America. New York: George P. Rowell & Co., Publishers, 41 Park Row.

The value of this elaborate volume is well known to the whole newspaper press and the advertisers of the country; and the new issue is the most complete manual of the subject yet published. It appears that there are published in the United States 654 daily and 5,626 semi-weekly, tri-weekly, and weekly journals; making, together with 1,517 monthly and quarterly publications, 7,200 issues open to advertisers. In the British Possessions, there are 46 daily, 348 weekly, etc., and 51 monthly, papers and magazines issued, being a total for the English-speaking portions of North America of 7,784. Most of this large number are separately described in detail; so that advertisers can find, in the pages of the *Directory*, the fullest information as to the circulation, politics, etc., of the various claimants for the title of "the best means of publicity."

THEORY OF ARCHES. By Professor W. Allan, formerly of Washington and Lee University, Lexington, Va. No. 11 of Science Series. Price 50 cents. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

These handbooks are uniformly excellent and valuable.

THE CONSTRUCTION OF MILL DAMS, comprising also the Building of Race and Reservoir Embankments and Head Gates, the Measurement of Streams, etc. Illustrated. Springfield, Ohio: James Leffel & Co., Authors and Publishers.

This thoroughly practical treatise will be accepted as an authority by all persons using water power or occupied in constructing apparatus for that purpose. The authors have dealt with all the difficult circumstances amid which dams have to be built, and the information, derived from practical experience, has been gathered from all parts of the country, its compilation having taken more than three years. Messrs. Leffel are the manufacturers of the well known Leffel turbine, and are also editors of the *Leffel Mechanical News*, a journal devoted to the flour mill and water power interests.

### Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

*From May 8 to May 21, 1874, inclusive.*

BALE TIE.—S. Parmly *et al.*, New Orleans, La.
BURNING PETROLEUM.—O. Sweeney (of Philadelphia, Pa.), Liverpool, Eng
BUTTONS, ETC.—R. H. Isbell, New Milford, Conn.
CENTRIFUGAL MACHINE.—S. S. Hepworth, New York city, *et al.*
COOLING DRINKS.—C. L. Ridgway, Boston, Mass.
DOG COLLAR.—W. T. Mersereau, Orange, N. J.
ELECTROMAGNETIC ANNUNCIATOR.—L. Finger, Boston, Mass.
FURNACE.—J. M. Ayer, Chicago, Ill.
GAME CARDS.—M. H. Cowell, Buffalo, N. Y.
IRONING MACHINE.—G. W. Cottingham, St. Mary's, Texas.
MAKING MAGNESIA HYDRATE.—C. H. Phillips, New York city.
PAPER PULP BOX.—S. Wheeler *et al.*, Albany, N. Y.
PLANE.—J. F. Baldwin, Boston, Mass.
PORTABLE FORGE.—D. W. C. Baxter, Philadelphia, Pa.
ROCK DRILL.—J. B. Waring, New York city.
ROTARY ENGINE.—A. C. Gallahue, Morrisania, N. Y.
SEWING AND MACHINE.—F. Curtis, Boston, Mass.
SEWING MACHINE FEED.—D. M. Smith, Lynn, Mass.
SHIP, ETC.—J. T. Parlour (of Brooklyn, N. Y.), London, England.
STEAM AND OTHER ENGINES.—W. Wallace, Brooklyn, N. Y.
STEAM INJECTOR.—Tube Works Company, Boston, Mass.
STOPPER FOR DRAWING LIQUIDS.—E. R. Wilbur, New York city.
SUSPENDING CROCKERY IN KILNS.—B. Jackson, Geddes, N. Y.
TELEGRAPH SIGNAL.—W. A. Camp (of New York city), London, England.
TICKET PUNCH.—Canceling Punch Company, Buffalo, N. Y.
TORPEDO BOAT.—J. L. Lay, Buffalo, N. Y.
TOY PISTOL.—C. B. Stephens, Plainfield, Conn., *et al.*
WIRE TUBING AND MACHINE.—H. O. Lothrop, Milford, Mass.

## Recent American and Foreign Patents.

### Improved Car Coupling.

John E. Stevenson, Wilton, Iowa.—A block is pivoted to the upper part of the drawhead, from which pivot it is suspended and swings in the cavity. A spring is attached to the pivot of the block, which serves to force the block downward. The pin is supported on the shoulder of the block, and the end of the link strikes the block and allows the pin to drop. The inner surface of the lower part of the drawhead is provided with stops, which receive the end of the link where it is supported by the block when the cars differ in hight. The drawhead is so constructed that the coupling pin may be supported when in the upper part by inclining it forward, the pin mortise allowing sufficient play for that purpose, while the end rests on a shoulder.

### Improved Cotton Press.

William B. Hollowell, Nashville, Tenn.—This is a powerful hand press, adapted to be constructed and used on plantations without very skilled labor. The essential features of this invention are a lever and windlass for forcing the follower down by a vertically moving follower stem. The operation is accomplished by several movements of the lever, each one forcing it a certain distance, thus dividing the labor and increasing the power, so that the bales may be made as small and dense as by the ordinary power presses.

### Improved Press.

John Gramelspacher, Jasper, Indiana.—This invention consists of a brake lever pivoted at the middle in the top of the follower stem, and having a fulcrum on each side of it on a rod working up and down through a guiding and supporting beam. The rod also works through a griping pawl, which allows it to descend freely, but gripes and holds it against rising, so that the fulcrum of one side descends while the other is holding the lever for pressing the follower down. This causes the follower to be forced down quickly by the vibrations of the levers.

### Improved Sewing Machine Table.

Michael W. Murphy, Louisville, Ky.—This invention consists in supporting the hinged portion of the table by a section of the subjacent case. It is believed to be cheaper than the ordinary folding enclosing top.

### Improved Composition for Cleaning and Polishing Metals.

Hosea Burrill, Lynn, Mass.—This is a composition for cleaning and polishing knives, forks, and all articles of cutlery, as well as all other articles for which it may be adapted, as surgical instruments, arms, and military equipments. It consists of emery, pulverized coal ashes, sawdust, and soap, molded into cakes, which become hard by exposure.

### Improved Door Alarm.

Abraham Neviling, Glen Hope, Pa.—This is an improved door alarm, which in addition to striking a bell when the door is opened, as an ordinary or day alarm, may be set to sound a continuous alarm when the door is opened, and thus serve as a night alarm.

### Improved Hay Knife.

Harrison R. Brown, Rochelle, Ill.—This invention is a hay knife having a triangular blade with smooth cutting edges, standing at an angle to the handle, and having a reversible stirrup attached by means of a tube surrounding the handle.

### Improved Sash Balance.

William D. Goodnow, Rutland, Vt.—This invention consists in a case let into the top bar of the lower sash, flush with its surface, and provided with a pivoted bar, inclined block, and knob, whereby the cord that enters the weight grooves may be cramped, so as to connect and balance the sashes.

### Improved Cattle Poke.

Warren L. Battle, of Geneva, Ga.—This cattle poke consists of a wood or metal bow, fitting and secured close to the head by a face and nose strap around the neck of the animal. The lower ends of the bow are connected together by a couple of pins, from the lower of which hangs a long curved rod of wood, whose upper end rises above and behind the upper pin. This causes the lower end, which is curved forward to some extent, to project still farther forward, so as to catch in the fence when the animal tries to jump. The pivot allows the rod to lie on the ground while the animal feeds, and said rod rises high enough above the ground when the animal holds his head up to clear it, so that he can walk about freely.

### Improved Hand Corn Planter.

James Riebe, Cedar Lake, Ind.—A box is divided into two small compartments, and a seed bag is made long so as to come up under the arms of the operator. The lower end of the bag is attached to a short tube, which is secured in the upper part of the inner compartment of the box. From this point the corn passes into a cavity in a sliding bar, which fits into and slides up and down in the outer compartment of the box. A brush acts as a cut-off to prevent any more corn than enough to fill the cavity in said dropping slide from being carried out by said slide in its downward movement. The size of the dropping cavity of the slide is adjusted according to the amount of seed required for a hill by a plate, the upper part of which extends up along the inner side of the slide. The lower part of the plate is bent twice at right angles, so as to pass through the cavity of the slide, and extends down along the outer side of the lower end of the said slide. The plate is secured in place, when adjusted, by a clamping screw. To the dropping slide is pivoted a rod, to which is attached a block of such a size that when the dropping slide is pushed downward the block will push back a spring and allow the corn to drop into the ground.

### Improved Lifting Jack.

Charles D. Aylsworth, Afton, N. Y.—In operating with the jack, the lever rests upon the ground, and its long end is lifted. The jack is raised in aising the axle of the wagon, the fulcrum being the floor or surface of the ground. When the lever is turned up, the weight is directly over the lower end of the lever, and the latter, with the jack, is maintained in an upright position. In bringing the lever to this position, its short end and a bar act as the members of a toggle joint, and with constantly increasing power, until the bearing points are in line with each other.

### Improved Follower for Brine Barrels.

George Enoch Webber, Hinckley, O.—The object of this invention is to construct, for the purpose of holding meat, fish, vegetables, and other articles under brine, a follower which may be readily and securely adjusted in higher or lower position in the barrel. The invention consists of a follower which is attached to the side of the barrel by slotted arms with spike ends, which arms are guided by suitable pins and carried forward and back by being pivoted with their inside ends to a collar applied to and turned by a central shaft of the follower.

### Improved Step Ladder.

Charles F. Barnard, New York city.—The side boards of the step ladder are connected with each other by steps, which are hinged to one side, so that the pivots of the said hinges may be a little below the under surface of the steps. The other ends of the steps are hinged to the other side. The arrangement is such that all the screws that hold the hinges enter across the grain of the wood, and thus take a firmer hold. The legs are pivoted, near their upper ends, to the outer sides of the stiles, and are made of such a length as to hold the ladder in proper position when extended. Their lower ends may be spread apart to brace the ladder when extended. To the legs are pivoted bars, which are made with a bend near said lower ends, and which are slotted longitudinally to receive a screw attached to the sides, the said slots being made so narrow that the heads of the said screws cannot pass through. In the bars, at the upper edge of the forward ends of their slots, is formed a notch to receive the screws, and thus lock the legs in place when extended. To the legs are pivoted braces, which, when the ladder is extended, cross each other, and their lower ends are secured to the legs by pivoted catches, the heads of which pass through slots in the plates, and, when turned one quarter around, securely lock said braces and legs together. These catches are so formed that they may be conveniently turned to fasten and unfasten the braces. To the inner surface of one of the sides, just below one of the steps, is attached a plate, which is bent at right angles, so as to lie along the under side of said step, and its end edge is notched to receive a screw, so that it may be secured by a hand nut. By this construction, the sides and steps of the step ladder will be held rigidly in place when said ladder is extended.

### Improved Car Coupling.

John Stevens, New York city, and George J. Cave, Elizabeth, N. J., assignors to George J. Cave.—Two convex grooved jaws receive a link. Said jaws are connected, at the inner end, to a cross bar of a rod which slides forward and back, and has a long coiled spring on it to throw the jaws forward, and allow them to be pushed back out of the way of the drawhead of the car to be coupled on. Said rod also has a short strong coiled spring on it to ease the shock on the drawhead when the cars couple. The drawhead is arranged to go back a little when the cars meet. The spring latch for engaging the link by its hook is curved at the front, so that the link will force it up, pass under it, and couple automatically when the cars meet. Over the front end of the latch is a lever, to raise it up for uncoupling. To this lever a spring catch is provided, which is thrown back by the lever when pressed down against it, and springs forward after the lever has passed, and locks it to lock the coupling latch. It leaves the latch unlocked in case it is wanted to allow the cars to uncouple if one is thrown off the track. The jaws are curved outward considerably near the outer ends, to receive the link from either side of the center, as it will be presented when the cars are on a curved track.

### Improved Isinglass in the Liquid Form.

Isaac Stanwood, Gloucester, Mass.—In preparing this liquid isinglass the sounds are steeped in the usual way, but the scum, instead of being taken off, is stirred in. The isinglass is then carefully strained through sieves and cloths. The effect of the scum upon the isinglass, when treated in this way, is to make it more limber than when it is skimmed off in the old way. In soaking the sounds, washing soda is added to each barrel of the cold water in which they are soaked, which removes the oil and gives the isinglass a better color and quality. The soda solution, after standing several hours, is poured off and thrown away; the sounds are then steeped in new clear water, after which the liquid is strained, has a small quantity of alcohol added to it, and is poured, while still hot, into tin cans, which are then sealed airtight.

### Improved Dumping Car.

John E. Bemis, Chicago, Ill.—This invention consists of a movable platform, which is supported and firmly attached to trucks in such a manner that by turning a longitudinal rod with spiral shoulders the connection of platform and trucks is separated, and sliding cog wheel segments thrown into gear with pinion driven in connection with the truck axles. The motion of the trucks in either direction carries the platform sidewise till it tips by the weight of the load thereon for unloading, being carried back over the trucks by moving them in opposite directions, and locked automatically thereon by suitable mechanism, which releases the sliding segments and bolts.

### Improved Steam Radiator.

Charles S. Smith, Westfield, Mass., assignor to the Novelty Steam Heating Company, same place.—The radiators are made in sections, each section consisting of two horizontal tubes connected at their ends by two short tubes. Upon the upper end of the outer side of the end tube of each lower section is formed a rabbet, into which fits a lug formed upon the lower end of the outer side of the end tube of each upper section; so that when the said upper section has been screwed down upon a nipple, the free ends of said sections may be secured to each other by a screw passing through the lug of the upper section, and screwing into the tube of the lower section.

### Improved Hand Power Circular Saw.

Ole T. Gronner, Baltimore, Md.—This invention consists in combining the parts of a hand power circular saw frame so that the same is rendered readily portable, can be quickly thrown into working condition, and requires but little actuating force.

### Improved Mortising Machine.

Harbert K. Forbis, Danville, Ky., assignor to himself and John W. Proctor, same place.—The mortising tool mandrel is fitted in bearings on a bar pivoted on the slide and pivoted near the other end by a slotted hole. The bar is pivoted at the rear on a stud, so as to have an endwise movement, to accommodate the movements at the other end on the slide, which works in a straight way parallel to the edge of the work, and thus causes the tool to cut the mortise the same depth throughout its length. The work table frame is pivoted to the tool frame, and are slotted, to be held to the latter at different points by a clamp screw.

### Improved Cutting Pliers.

Van Allen Pugsley, New York city.—This invention consists in an improved cutting pliers formed of two parts or handles, having enlargements formed upon them at the bases of their jaws. A circular recess and a slot are made in the enlargement of the one part, and a cylindrical projection and a slot in the enlargement of the other part, and the parts are kept in place upon each other by a guard bar or plate.

### Improved Nut Lock.

Loftus Sykes and Joseph Sykes, Philadelphia, Pa.—This invention relates to improved means for preventing the nuts of bolts from turning off by means of jar or concussion, more especially designed for fish plates at rail joints. When the nut is screwed down, the blocks are tightly compressed between the ends of strips of rubber, one end of the blocks being in the V shaped grooves of the nut. The other ends are held by ratchet teeth, which effectually prevent a backward movement of the nut; and a rib on the washer being fast in a groove of the fish plate, the connection is rendered permanent and safe.

### Improved Cutter Bar Machine for Harvesters.

William M. and George H. Howe, Lansing, Minn.—This invention consists in providing a harvester wheel with studs and spokes arranged alternately, and entering near opposite edges of the rim, and combining therewith a bar and oppositely inclined plate.

### Improved Tobacco Bag Attachment.

James Wright Chambers, Baltimore, Md.—This invention consists in a tobacco bag attachment formed of a metallic case having centrally apertured circular bottom with upper and lower outwardly obliqued flange, to receive an elastic stopper and allow the edge of bag to be conveniently tied.

### Improved Hydrant.

Joseph V. Miskelly, Baltimore, Md.—This invention consists in combining the parts of a hydrant, so that not only is all drainage water excluded, but the working elements are easily and convenien·ly reached for examination or repair.

### Improved Cutter Head for Moldings.

William Smith, Baltimore, Md.—This invention relates to molding cutters for bringing piano legs or other woodwork into some definite shape. The invention consists in combining, with the cutter shanks, the faces, and the flanges of stock, a series of plates and bolts for fastening the molding cutters to their stocks.

### Improved Lard Lamp.

Charles A. Gabe, Sr., and Charles A. Gabe, Jr., Boonsboro, Md.—This invention relates to that class of lamps which are adapted to the burning of lard, and consists in a new and improved arrangement by means of which the lard is better reduced to a condition to be affected by capillary attraction and the manipulation of the wick facilitated.

### Process of Making Calendering Rollers from Paper Pulp.

John O'Neil, West New Brighton, N. Y.—Ths lis a novel method of manufacturing calendering rolls of paper pulp and other stock, whereby the operation of forming the roller is expedited, and a more perfect article is produced. The invention consists in molding the mass around a heated core and simultaneously applying external pressure to the same.

### Improved Apparatus for Evaporating and Cooling Liquids.

Archibald Rogers, Hyde Park, N. Y.—This is an improved device for evaporating liquids, so constructed as to bring a very large heated surface in contact with the liquid to be evaporated, and which may be used with equal facility as a cooler for cooling liquids. The steam is introduced through a hollow hub, and passes through large pipes and out of smaller tubes radially attached to them. It thus enters a large drum, whence it escapes through a hollow hub. The water of condensation, as it forms, flows out of the pipes into the drum, where it is received upon a spout, and flows out through the hub. By shutting off the steam and forcing cold air or water through the device, it may be used as a cooler.

### Improved Sawing Machine.

Winfield S. Gerrish, Hersey, Mich.—The object of this invention is to furnish a crosscut sawing machine which may be worked by one man with great rapidity, saving time and hands thereby. The invention consists of a crosscut saw which moves in a suitable stirrup, and connects by two curved plates with the rear of a carriage sliding on the supporting frame. A wheel with curved cams or wings is rotated by a hand crank, and acts on elastic rollers of the sliding carriage, producing thereby the rapid reciprocating motion of the sliding carriage and saw.

### Improved Measuring Can.

Marshall M. Barney and S. L. Daily, Leon, Iowa.—Liquid is admitted from the cask to one of the chambers of the measure while being discharged from the other, by means of valves so arranged as to open the inlet orifice and close the discharge orifice simultaneously, and *vice versa*. The vent openings are closed and opened, as required, by a float which rises and falls with the liquid in either chamber.

### Improved Machine for Bending Wood.

Barnabas A. Higgins, New Portland, Me.—This is an improved machine for forming the tops of shovel and fork handles, etc., which forms the tops rapidly, and at the same time so gently as not to break or split the handle, and will hold said tops in perfect shape until seasoned. The wood, being previously steamed, is by suitable mechanism forced into forms.

### Improved Still for Refining Oils.

Cornelius J. Cronin, Rouseville, Pa.—This is an improved still, in which the process of evaporating and distilling of crude oil or petroleum may be carried on with a considerable saving of fuel, and with greater rapidity, and also the formation of sediment on the bottom of the still be effectually prevented. The cleaning of the still is greatly facilitated, and not required as frequently as in the common stills in use. The still is provided with end chambers extending below the bottom of the still, into which the sediments are carried by a lateral traveling piece with adjustable scrapers moving along a longitudinal guide screw turned by reciprocating gear.

### Improved Carriage Curtain Knob.

Aaron T. Rice, Reaville, N. J.—This invention relates to the construction of carriage curtain knobs, and consists in a cross piece and spiral spring, and grooved button on the shank. When it is desired to turn the button, it is forced on the spring by pressure, and over a shoulder, which disengages grooves on the button from a cross piece, and allows it to be turned in either direction. When released, the spring reacts and throws the button outward: and when it is turned for fastening the curtain, the groove engages with a cross, and the button is securely held in position. When it is turned for unfastening, or given a quarter of a revolution, another groove engages with the cross piece, and the button is held in that position.

### Improved Washing Machine.

Thomas Stumm, Ada, O.—By suitable construction, by sliding a rubbing board up or down, a presser board will be adjusted to leave more or less space between it and the dasher board, as the quantity of clothes to be washed may require. The clothes rest upon a curved perforated board while being operated upon, which slides back and forth beneath the said clothes as the frame is oscillated upon its shaft. In using the machine, the frame and its attachments are lowered into the suds box, and the clothes are placed in the space between the presser board and the dasher board, and the frame is oscillated, alternately pressing the suds from the clothes and allowing them to be again saturated. When the clothes have been sufficiently washed, the frame and its attachments are raised out of the suds and the water is pressed out of them. Suitable mechanism then furnishes a powerful leverage for pressing the water out of the clothes, and enables it to be done so thoroughly that said clothes may be hung upon the line directly from the machine.

### Improved Combined Stock Feed Boiler and Trough.

Henry H. Smith, Smithborough, Ill.—A trough is attached to each side of the boiler. These troughs communicate with the boiler by means of apertures, which are closed by valves. The apertures are long slots at the bottom of the troughs, so arranged that the cooked meal or food, which is in a semi-fluid state, may flow from the boiler into the troughs, and thus come within reach of the stock.

### Improved Washing Machine.

James King, Suckasunny, N. J.—The tub of the machine is made with a flat bottom, vertical ends, and rear side and inclined forward side. The beater, which, when swung forward, raises the clothes from the bottom of the box, is rectangular. A corrugated angle block is fitted into the angle at the bottom of the inclined forward side of the box, and against it the lower horizontal bar of the beater strikes when swung forward. The rubber board is corrugated, and upon the lower parts of the end edges are formed pivots which enter grooves in the box, so that the said rubbing board can be removed and inserted at will. When washing, the corrugated board is turned back, and is secured in place by a button. The corrugated board and the beater, when swung forward, form a triangular space, into which the clothes are compressed by the forward movement of the beater, to fall back into the water, and be again saturated as the beater moves back. The beater may be operated from either side of the machine.

### Improved Wrought Iron Grating.

Daniel D. Boyce, New York city.—This is an improved grating to cover openings in the sidewalk in front of stores and other places where they will be walked upon, which shall be so constructed as to prevent people from slipping upon them. The invention consists in an improved wrought iron grating, having the upper edges of its bars roughened by having projections and depressions formed upon them.

### Improved Temporary Binder.

Charles W. Baird, Rye, N. Y.—This consists of two flanged strips—one on each side of the papers or pamphlets filed, or on the covers when the papers or pamphlets are bound—and two or more metallic fastening strips or wires. The flanges of these strips turn over on and hold the back. The broad portion of the angle strips rests on the papers when the file is being filled. The papers as well as the strips are perforated to allow the fastenings to pass through, when the ends are bent down to keep the angle strips securely fastened to the papers or covers.

### Improved Churn Cover.

David M. Pease, Concord, Ohio.—This churn cover is locked on its seat by means of a set screw or spring, and is provided with a flaring cup to receive a dasher rod. It prevents spattering of the cream.

### Improved Skirt Protector.

Richard H. Gardner, Troy, N. Y.—Rubber cloth, leather, or other material is attached so as to inclose the extreme edge of the skirt, and envelopes a cord, which gives a broad bearing surface and adds to the durability of the device. The upper edge of the protector is stitched to the skirt or skirt lining.

### Improved Manufacture of Jewelry.

Charles A. Gamwell, Providence, R. I., assignor to American Ename Company, same place.—This invention consists in producing the body of the jewelry of wood, clay, horn, *papier mache*, or other cheap plastic material, and preparing the outer surface of the same by sizing, and varnishing in bronze, gold, silver, aniline, or other colors, or producing by the use of emery, fine sand, or other material, and a second sizing, a frosted gold, silver, or other colored surface and finished appearance of the goods. Varied and neat effects are thus obtained by very simple means, especially as, by painting and varnishing the bronzed or other surfaces in aniline and other colors, any desired shade may be produced.

### Improved Shirt Bosom.

Jonathan Ramsey, Jr., Middletown, Conn., assignor to himself and Middletown Shirt Company, same place.—This is an improved shirt bosom for shirts opening at the back, which is made of one continuous piece, and folded into regular plaits, so as to produce a neat outside appearance, retain its stiffness, and save material thereby. The invention consists of a shirt bosom folded of one piece, with side plaits and re-enforced middle plaits overlapping narrower plaits at the under side, and secured to the shirt by the stitching that defines the middle plait, and at each side of the bosom.

### Improved Shingle Machine.

Spencer B. Peugh, Salem, Ind.—The shingle blocks are cut from the log in the size of the shingles required, firmly attached to a block fastening frame, and fed, by the motion of the carriage, to the saw. Each trip of the carriage cuts off a shingle from each block. The inclination of the block is then changed for the next trip by a lever, so that shingles with alternating butt and point ends are cut from the blocks. The regular size of the shingles is then produced from the sections so cut by ripping them to proper width by a smaller saw.

### Improved Extension Table Slide.

Wilhelm Valentin, College Point, N. Y.—The rails are provided with small rectangular recesses along the edges, and to the middle of each rail are screwed metallic bands in such a manner that the outer edges of the same project over the recesses, while the space between their inner edges forms a groove. The connection of the rails is produced by one or more L-shaped guide plates, which are screwed to both sides of the rails, running with their projecting parts along the band, and serving also as stops for the rails when extending the table. The guide plates form also the bearings for small rollers, which run, with their conical ends, in similar recesses of plates.

### Improved Bush for Mill Spindles.

Edward Deeds, Brighton, Iowa.—The bush is made with recesses, in which are fitted the boxing pieces, the faces of which bear against the spindle and support it. On each of the sides of these pieces is a rib, forming the bearing points of the sides, which come in contact with the sides of the recesses in the bush. A wedge-shaped piece is placed in the back of the recess, in rear of each of the box pieces. Set screws pass through the upper ends of these pieces, by turning which screws the boxes are forced up to the spindle, while at the same time they readily adjust themselves to the spindle. By this arrangement, the boxing is adjusted to the spindle-bearing in an accurate manner, while any looseness caused from friction and wear is easily taken up by turning the set screws.

### Improved Machine for Making Metallic Shoe Shanks.

John Hyslop, Jr., Abington, assignor to himself and Otis M. Holbrook Franklin, Mass.—This invention consists of a movable die for cutting the shank off the metal strip and shaping the edges, contrived also in suitable form on the bottom end to form one of the dies for producing the middle bend, and also the reverse bend, and combined with a stationary counterpart die. The cutting, shaping, and bending may thus all be accomplished at one operation, considerably simplifying and cheapening the machine and facilitating the work. There is also a peculiar arrangement of dischargers in connection with the cutting dies for throwing off the waste pieces. The invention also consists of a novel arrangement of dischargers in combination with the stationary bending die, for throwing the completed shanks off from it.

### Improved Dish Washer.

John M. McKesson, Lincoln, Neb.—A lever is connected to a rod by a block having a hole through which the rod passes, and a slotted key wrench and locking spring, the slot of the key wrench being somewhat narrower than the rod, the rod being notched in the sides to allow the key wrench to slide on it, and the spring having a notch which engages the rod when the wrench is slipped on and holds the wrench from slipping off. The key wrench holds the rod so that the lever will lift a basket and let it fall; and it also serves for turning the basket forward and backward, at the same time the lever is worked, to increase the action of the water. When the dishes have been sufficiently washed, the cover and lever are taken off and the key wrench is again applied, and is used for a handle for lifting the basket out of the washing vessel.

### Improved Buggy Top.

Joinville F. Fowler, Carrollton, Ohio.—This top folds neatly and easily together, and carries the back into such shape between the stays that it is not exposed to the dust and wear by hanging over the body of the carriage. The invention consists of two bow sections or frames, which are pivoted to the main supporting stays, and folded toward the same. Horizontal jointed stays stiffen them in upright position, while inclined side stays, pivoted to the main stays, and gearing, by mutilated end pinions, with the rear top stays, similarly pivoted thereto, carry the top up or down on raising or lowering the main stays for instant adjustment, and support the same strongly and firmly thereon.

## Answers to Correspondents.

W. A. A. will find directions for molding rubber on p. 283, vol. 29.—R. T. T. will find full directions for lacquering on p. 362, vol. 30.—D. T. is informed that we have repeatedly cautioned our readers against being deceived by mineral rod men.—B. F. T. will find directions for enameling cooking utensils on p. 157, vol. 27.—D. S. Jr. will find a full description of an induction coil on p. 264, vol. 25.—W. U. L. will find an explanation of an ice boat sailing faster than the wind on p. 43, vol. 28.—J. M. will find rules for proportioning safety valves on p. 363, vol. 29.—G. W. B. will find directions for repairing meerschaum on p. 202, vol. 27.—J. McD., who asks as to fulminating powder, must send his address.—C. H. C. will find an answer as to transparent colors on p. 290 of this issue.—W. C. will find directions for cleaning brass on p. 102, vol. 25. For dyeing cotton goods, see p. 405, vol. 29.—J. O'C. on the circle squaring question is right, and the "Professor" wrong.—J. B. H. will find a recipe for grafting wax on p. 346, vol. 24.

J. A. L. says: I have an engine of 24 inches stroke, with a direct acting slide valve, which cuts off at 16 inches. I wish to change it so as to make it cut off at 20 inches or at full stroke. How can I do it? A. More data would be required to enable us to answer this question. Your best plan will be to refer the matter to an engineer.

H. G. D. asks: 1. Have tubular grates, carrying a current of water from the pump to boiler through them, ever been in use or been patented? A. Yes. 2. If a tube carries a current of water from the pump of an engine through the firebox to the boiler, and the current should cease by stopping the pump, would the water divide or be driven out of the tube by the great heat, the pressure of the boiler being on the tube to the check valve below the fire? A. The tubes would soon be filled with steam.

D. asks: Why does chloral hydrate decompose the cork of the bottle? A. We have kept a large quantity of chloral for several years in a glass-stoppered bottle, which is the proper plan. With cork, it forms by decomposition certain substitution products which gradually destroy the cork.

J. B. R. asks: 1. Is there any practical method of getting an electric light of even moderate intensity without using carbon points? If there be, will you tell me where I can find a description of it? A. See description of Mr. A. Lodiguin's electric lamp, p. 387, vol. 29. 2. Can frictional electricity be induced in sufficient quantity to create light? A. Yes, but only with considerable expense and complicated apparatus, and even then the experiment is not free from danger.

A. A. asks: 1. When a person is poisoned by arsenic, what parts of the body are first and most affected, and how does this poison operate? A. It first affects the stomach, producing nausea, pain, burnings, vomitings, etc. Besides these local effects, there are others of a general character, such as general suffering, heat, and effect upon the pulse and respiration. 2. Does arsenic operate on the body in the same way that quicksilver does? A. Quicksilver is not a poison at all. It was formerly frequently administered as a purge.

J. O. R. asks: Is there any mode of intensifying one pole of a battery in relation to the other? For example, I would like to increase the attraction of the negative pole, without changing the positive. A. This cannot be done.

Y. L. asks: How can I distil water for making sensitized paper with? A. The water derived from melted ice will be sufficiently pure if you filter it.

C. S. P. says: 1. I tried making ink as per formula on p. 160, vol. 27. A druggist tells me there is no such thing as sulphate of indigo: so I dissolved indigo with sulphuric acid. Although I have used much more indigo than recommended and as little acid as possible, my ink is very pale when first used. What can I do to bring up the color? A. Your mistake was in the character and amount of the acid which you employed. Rub up in a porcelain mortar 1 oz. of indigo with 6 ozs. of fuming oil of vitriol. Ordinary oil of vitriol may also be employed to dissolve indigo, but more than double the quantity of such acid is required, and it must be heated to 130° or 140°. If a sufficient amount of acid be employed, almost the whole of the indigo may be dissolved; and if the liquid be allowed to stand for a few hours, it will remain clear on being diluted. It is then filtered, and the filtrate will be an intense blue. 2 What is white copperas, as per p. 202, vol. 29? A. Copperas, when heated moderately, parts with six sevenths of its water of crystallization and becomes grayish white This is probably what you mean, and is the *ferri sulphas exsiccata* of the pharmacopœia.

R. L. asks: 1. What amount of water must I put in aquafortis for washing down brick walls? A. Four gallons of water to one of aquafortis. 2. How can I color cement to make it black? A. Try lampblack. As to power of engine, see our recent issues.

J. E. B. says: I have a small stationary engine, 2x4 inches. The cylinder heads are ¼ inch thick, and the crank shaft is ⅝ and 1-16 inch in diameter. The steam chest and cover are held on by four ¼ inch bolts. The steam chest is about 2x3 inches, the cover being 3-16 inch thick. Would the above engine bear 120 lbs. steam and give power enough to drive a small road steamer by gearing from crank shaft to driving shaft? A. The engine is rather light for such work; but if it is well built, it might answer.

J. J. asks: Can two boilers of different size and style be set beside each other, connected by the water pipe and steam pipe, and have the water always at at the same level in each? For instance, take one boiler of 50 inches diameter with 30 three inch tubes, and one boiler 44 inches diameter with 2 ten inch flues. Will the boiler which generates steam most rapidly force the water from itself to the other? A. The arrangement might possibly be made by very careful management, but it would be very dangerous, and should on no account be permitted.

B. R. asks: How can I propel a boat for hunting wild geese (boat is 12 feet long) without causing disturbance enough to scare the geese before getting within gunshot? A. Use a propeller about 10 inches in diameter at least. It would be necessary to hang it under the boat, so as to get sufficient immersion. If you build such a boat, we are sure that our readers will be interested in hearing of the result.

S. H. P. says: 1. Two locomotives that will pull 20,000 lbs. each are hitched together and started in opposite directions. What is the strain on the shackle between them? A. 20,000 lbs. 2. Which engine will pull the greatest load, one with 4 drivers with 18 tuns on drivers, or one with the 18 tuns on 2 drivers? A. If the weight is properly distributed in each case, there will be no difference in the tractive force. 3. Will an engine weigh any more pulling than not pulling, providing she pulls on an exact level with her cylinders? A. No.

R. & W. T. asks: Is there any way to render paper permanently translucent or transparent without the use of grease or acid? A. We know of no way of doing this.

T. asks for a recipe for covering the inside of iron water pan in a house furnace. By the evaporation of water by heated air, oxidation is carried on very rapidly, and the pan becomes caked and filled with rust, which, if the water happens to be impure, emits a foul odor. A preparation that could be laid on the inside of the iron pan, and not be itself affected by the action of heat or water, would be of widespread benefit. A. The lining which is generally used and answers these requirements is a lining of porcelain. See p. 157, vol. 27.

M. says: In your answer to R. J. H., No. 21, you say: "Electricity is a motion transmitted from particle to particle of the wire." This might seem probable where only an ordinary Morse circuit is worked, but when a wire is duplexed, that is, worked with Stearn's duplex instruments, in opposite directions at same time, how is it possible? A. Various theories have been advanced; but the fact of the matter is that until the exact nature of electricity is known, all such questions as yours will have to remain unanswered.

C. E. T. says: A mirror displayed one morning an unusual phenomenon. Its surface was embellished with a crystalization of some volatile substance, which was deposited on over half its area, and which resembled the frost on the window panes. There are no sinks or drains from which gases might arise in the room. Several rooms in the building contain similar mirrors, but only mine shows signs of the deposit. A. The surfaces of some specimens of glass are more hygroscopic than others, and it might have been due to the condensation upon such a surface, the form of the apparent crystallization having been determined by some structural peculiarity of the glass.

E. J. W. asks: 1. In your opinion how long would a plate of pure cast zinc, one fourth inch thick, last if exposed to the elements? A. Very many years. 2. Is the coating of oxide formed by the atmosphere a perfect protection from the elements? A. It is generally regarded as excellent, but we have no authority for stating that it is perfect. 3. Is the oxide soluble or insoluble in water? If insoluble, will it oxidize deeper after the coating has once formed? A. Some samples of oxide of zinc are sensibly soluble in water, others are not, according to the method of their production. However, water never dissolves more than a millionth part of its weight. 4. Has pure zinc ever been known to rust? A. It oxidizes when exposed to a moist atmosphere. 5. When exposed to the elements, which is the most enduring, silver or zinc? A. Silver is not oxidized at any temperature either in a dry or moist atmosphere; zinc is. 6. Will pure zinc ever change in color after it has become exposed to the atmosphere and become fully oxidized? A. It should not do so.

H. L. asks: What is indigo, chemically? A. Indigo consists of a number of substances: 1st, mineral matters of various percentages; 2d, indigo glue; 3d, indigo brown; 4th, indigo red; 5th, indigo blue, or indigotine, $C_{16}H_{10}N_2O_2$, the peculiar dye material for which the indigo is valued.

E. asks: What is the best battery for using on the animal organism, as in cases of poisoning? A. Batteries alone are not used for medical purposes. You had better use a small coil.

J. A. R. asks: Will the lye from wood ashes lose any of its soap-making properties if left several days before using? A. No, especially if not exposed to the air.

T. O. T. asks: Can you tell me of some simple method of exhausting the air in a small chamber 6 inches by 6, fitted with two airtight faucets, one on each side? How can I compress into the same chamber two or more atmospheres? A. There is no simpler method than that of using an exhausting and condensing air syringe.

W. P. B. asks: 1. Where can I send and get samples of the different woods? A. Not offered for sale; collected and prepared by private collectors. 2. Can you tell me a good work on fossils? A. Dana's "Manual of Geology" contains the best general account of fossils, and the volumes devoted to palæontology, of the various geological surveys of the States and Territories, the best particular descriptions. 3. Can you name any work on derivative woods? A. None having this title. 4. Can you give me the address of Dr. I. I. Hayes, the arctic explorer? A. We believe it is Philadelphia, Pa. 5. For what and how is gun cotton used? A. Gun cotton is advantageously used in blasting, being exploded by the electric spark. Also as a substitute in some cases for fulminating mercury in gun caps, when mixed with chlorate of potassa. 6. Was the steamship President, which was wrecked in 1841, an American or an English vessel? A. American. 7. Are the lumps and bogs in wet places the result of deposit? If not, what causes produce such formations? A. Deposition of silt, and the accumulation of vegetable growth in suitable places. 8. Can you name a work on the stuffing of birds and animals? A. See the instructions published by Smithsonian Institution. 9. In putting up alcoholic specimens, is pure alcohol used? A. Yes.

N. A. S. asks: How can I bleach wood tar? A. Wash repeatedly with caustic soda, water, and oil of vitriol.

M. F. J. asks: Can you give me a recipe for dissolving copper wire in some kind of acid? A. Dissolve 1 lb. of copper in 2¼ lbs. of strong nitric acid, which has been previously mixed with 3½ lbs. of water. On crystalizing out the resulting body, you should obtain nearly 3 lbs of nitrate of copper.

C. M. asks: Is there any substance which can be poured into a type metal mold, get hard, and have the same color as ivory? A. To liquid chloride of zinc of 50° to 60° Baumé, add 3 per cent of sal ammoniac then add zinc white until the mass is of proper consistence. This cement may be run into molds, and when hard becomes as firm as marble.

J. F. B. says: 1. I have contended with many friends in Nevada that the liability to frost at any time during summer, near the streams, is mainly due to the lands being saturated with snow water, and not unfrequently overflown. I find by experiment that the water flowing down these valleys always maintains its level from one side of the valley to the other, no matter how wide; and I also find that there are veins below the surface of the lowlands which convey the water from the streams or main channels to all points in the valleys, according to its level in the streams. If we dig for water, a half mile or more from the stream, we are always sure to find it when reaching the level with the main stream, and this water will rise and fall as the stream rises and falls; and these streams are exceedingly crooked, consequently the water passes off slowly, very frequently overflowing its banks. Now I argue that, if these streams are straightened, the water would pass off more rapidly and not fill their channels by four or five feet, thus leaving the lands high and dry, allowing them to become naturally warmed by the heat of the summer's sun; while the frosts, with the damp and chilly nights, would disappear, and the lands become more adapted to the cultivation of tender plants; but at present, these lands, rich with alluvium, are always during the summer months saturated to their surfaces with snow water; and farming is not a success in consequence of frosts. I am speaking more particularly of the valley of the Humboldt; and I also maintain that these lands, drained as aforesaid and warmed by the genial rays of the sun, would not be frozen by the influence of the surface irrigation. Are those ideas in accordance with scientific principles? A. Your ideas seem entirely reasonable. 2. In drinking anything hot, we naturally suck wind into the mouth and swallow; does this wind assist in filling the stomach? If so, then we cheat ourselves of half our meals. A. The wind goes into the trachea, not into the œsophagus. 3. If the dead were each incased in an airtight sarcophagus, and buried, would not the process meet the demands of those who are becoming alarmed at the present system of burial? A. No. 4. Is there any book or series of books published which contains the constitution and codes of all the different States in the Union? A. We know of no book of this kind.

B. L. asks: What ingredients shall I use with lime to color a new brick wall before tuckpointing it? I want the color of the best red brick, to retain its color and not wash off in a wet climate. Can such a composition be made without lime? A. Take a light colored cement and stain it with Spanish brown or Venetian red, or with a little of each, to produce a color to suit; if too dark, mix with lime to make it lighter, and apply as a wash. But this will give a rough application suitable for rear or side walls only, and hardly fine enough for front.

J. P. S. says: 1. I am running light machinery with rented power; the main shaft is driven by a 40 horse engine and makes two hundred revolutions per minute. I use a three inch belt from a 20 inch pulley on main shaft to a 15 inch on my countershaft, and I have plenty of power. What size of engine would I require to drive my countershaft? A. If you are using all the power transmitted by the belt, it would be well to put in at least a three horse engine; an answer of this kind must, however, be very indefinite, as an actual test is the only sure guide. 2. What is the new steam hammer at Woolwich, England, used for? A. For forging guns and armor plates. 3. Is there any kind of acid that I could soak garden peas in to kill the bugs and not destroy the growth of the peas? A. We do not know of any. 4. How can I soften bone so as to cut it easily, and so that it will get hard again? A. We do not think that it can be done with ordinary bones.

R. D. B. asks: 1. Is there a saving of steam by just opening the throttle valve enough to let the engine run at full speed, or is it better to open it wide? The engine has a governor. A. If the governor controls the speed of the engine just as well with the throttle wide open, there will be little, if any, difference. 2 How can I make a red or brown paint for steam pipes, that will not burn off? A. There is a very good material for such purposes called black varnish, made from petroleum, which can be purchased ready for use.

B. asks: What is the cost of building a first class Pullman palace car? Has a car already been built at a cost exceeding $50,000? A. We believe the average price ranges from $30,000 to $35,000. The most expensive car of which we have heard costs about $50-000.

W. J. R. says: 1. I have always had a taste for machinery and mechanical engineering; I have studied several books pertaining directly to these subjects, as well as understanding geometry quite thoroughly, and algebra as far as cubic equations. I am now trying to get into a machine shop as an apprentice, believing that the theoretical knowledge I can gain from books, backed by the practical, obtained in the shop, will fit me much better for a mechanical engineer than the former alone. Would you advise me to do as I propose? If not, what course do you think I should pursue? A. We think that your plan is a very good one. 2. What are the best works to perfect me as a mechanical engineer? A. We can recommend all Bourne's works on the steam engine. You should also have a good work on physics, such as Ganot's or Deschanel's, and a reliable treatise on workshop practice, such as Knight's "Mechanician and Constructor," or the "Machinist's and Millwright's Assistant." You will also need a work on drawing.

T. H. C. asks: Can you give me the actual number of pounds of power which constitute a horse power? A. The horse power of an engine or a machine is a unit, originally adopted by James Watt, and now generally accepted by engineers. It is the amount of work required to raise 33,000 pounds one foot high in one minute, or, as it is commonly stated, a horse power is 33,000 foot pounds. 2. Is there any given number of pounds, tested by dynamometer, that will equal the actual power of the horse? A. A. See p. 320, vol. 28.

G. D. R. asks: 1. Would there be a gain in power in making a three cylinder steam engine, by putting the three cylinders equidistant in a circle and attaching the piston rods to the same crank? A. Such an engine is manufactured in England, and has been described in our columns. See p. 291, vol. 29. 2. Is there any simple test for detecting adulteration of linseed oil? A. It should have a specific gravity of 0·9395, at 55° Fah.

V. says: Let there be given two boilers, A and B. A has two cylinders attached to it, the diameter of each of which is 6 inches. B has one, of which the diameter is 8·486 inches. All other things being the same, would a combination of the power of the steam that issues from the cylinders of boiler A be less, equal to, or greater than the power of the steam that issues from the cylinder of boiler B? The areas of the two cylinders of the boiler, A, taken together, are just equal to the area of the cylinder of boiler B. A. If you mean to ask which will use the most steam for a given power, the single or the double engine, we would say the latter.

B. F. W. says: A friend of mine built a mill with an overshot wheel 18½ feet in diameter; and instead of running the water over it in the ordinary way, it comes to the top of the wheel and makes a half turn, thus running backward or toward the flume instead of running from it. Is there not a loss of power in running it in this way, by suddenly changing the course of the water? If so, how much? A. There is a loss of power corresponding to the loss of velocity occasioned by the turn.

G. D. F. asks: How can I raise a quarter ounce weight half an inch high, by mercury or alcohol put in a bottle or a tube? A. We do not get a very clear idea of what you mean. If you intend to have the weight suspended by a cord over a pulley, some mercury or alcohol can be attached to the other end of the cord, to raise it. By means of a bent tube, the weight placed in one leg can be raised by the preponderance of mercury or alcohol in the other leg.

N. O. B. asks: 1. Has the magnet ever pointed due north? How much does it vary now? A. The variation differs, and is constantly changing at different points of the earth's surface. There are points in which there is no variation. 2. Is there any person who makes a business of making poetry, and where can I find him? A. We think that the editor of nearly any paper devoted to general literature can give you the address of a number of such persons. 3. Is there any pump that will pump water enough to drive itself? A. No.

W. D. S. sends an insect which has excited considerable curiosity, as to its origin and what it eventually turns into. It was first seen in a small stream of clear water, which runs only in wet seasons. The insect looked like bright red blood; but on close inspection it proved to be a small worm. The worms accumulated until there was a mass which sparkled and glistened in the sun. I cleaned out the stream, but the next day another mass had accumulated. They are constantly in motion in the water; and when out of it and left dry, they soon die. I send a sample in a bottle. A. The insect is a specimen of *canthocamptus*, a genus of *entomostraca*, of the order *copepoda*, and family *cyclopidæ*. Characteristics: Foot jaws small, simple; inferior antennæ, simple; ovary single. Four species, one aquatic, three marine. *Canthocamptus minutus*: Thorax and abdomen not distinctly separate, consisting of ten segments successively diminishing in size, the last terminating in two short lobes, from which issue two long filaments, slightly serrate on their edges; antennæ short, seven-jointed in the male, nine in the female; inferior antennæ simple, two-jointed, the first joint with a small lateral joint, terminated by four retæ; feet, five pairs. Common in ditches, color reddish, length about 0·66 inch. "Micographic Dictionary," Griffith & Henfrey. Dr. Parnell states that the Lock Leven trout owes its superior sweetness and richness of flavor to its food, which consists of small shellfish and *entomostraca*. These animals abound in both fresh and salt water. The ova are furnished with thick capsules, and imbedded in a dark opaque substance, presenting a minutely cellular appearance, and occupying the interspace between the body of the animal and the back of the shell. This is called the ephippium. The shell is often beautifully transparent, sometimes spotted with pigment; it consists of a substance known as chitine, impregnated with a variable amount of carbonate of lime, which produces a copious effervescence on addition of a small quantity of acid; and when boiled it turns red, like the lobster. Sometimes it consists of two valves united at the back, and resembling the bivalve shell of a mussel; others are simply folded at the back, so as to appear like a bivalve, but are really not so; or they consist of a number of rings or segments (*c. minutus*, for instance). All the *entomostraca* are best preserved in a solution of chloride of lime.—(Hogg's "Microscope," pp. 557, 558, 553.) Not useful for a coloring matter.

W. F. M. asks: Why is it that in some steam engines the eccentrics are set in such a manner that, when the full throw of one is up, that of the other is down; and in others again, when the throw of one is up, that of the other is half way? A. When the eccentrics are set with centers opposite, generally one is for moving the valve when the engine is going ahead, and the other is for the backing motion. When the center of the eccentric is 90° away from the other, the second eccentric ordinarily moves the cut-off valve.

J. H. asks: What are the objections to the caloric engine? A. It is too large and heavy, on account of the low pressure generally employed.

W. B. asks: What is used to fill and make cast iron smooth before painting? A. It is generally sufficient to give one or two coats of red lead.

R. F. B. says: I wish to build a sail boat for use on a small pond, where there are some spots of low water. Which will be the best, a centerboard or a keel boat, and of what dimensions shall I make it? I want it about 16 feet long and to be a swift runner. How shall it be rigged and of what shall it be built? A. We would recommend a center board boat, cat-rigged, from 6 to 7 feet beam.

J. L. K. asks: Which runs the easier, a wagon with 4 foot wheels or one with 3 foot wheels? A. The former.

C. W. K. asks: How can I calculate rolling friction, for instance, the resistance to the movement of a car wheel on the track? Is there any work which treats on this subject? A. It must be determined by experiment. See Morin's "Mechanics," Clarke's "Railway Practice," Pambour's "Treatise on the Locomotive," Colburn's "Locomotive Engineering," and the scientific periodicals.

R. J. J.—You do not send sufficient data. The best waterwheels utilize about 75 per cent of the power applied by the water.

E. W. A. asks: Why is the name live oak applied to the tree of that name? A. The name of live oak was no doubt applied to this tree on account of its great durability, as the following quotation from Downing's "Landscape Gardening" (6th edition, p. 136) shows: "The live oak (*quercus virens*). This fine species will not thrive north of Virginia. Its imperishable timber is the most valuable in our forests; and, at the South, it is a fine park tree, when cultivated growing about 40 feet high, with, however, a rather wide and low head. The thick oval leaves are evergreen, and it is much to be regretted that this noble tree will not bear our northern winters."

C. R. P. asks: What is the power of a steam engine with cylinder 16 inches in diameter and 24 inches stroke, with steam at 30 lbs. per square inch, slides cutting off at 8 inches, and running at 75 revolutions per minute? A. As we have frequently pointed out in former replies, questions of this nature cannot be answered with any degree of certainty, unless further data are given, that can only be determined by experiment. For instance, in the present case, although the pressure of steam in the boiler is 30 lbs., we can only guess at the initial pressure in the cylinder; and although the point of cutting-off is given, we cannot decide, except by experiment, whether wire-drawing also takes place. Lastly, we can only estimate the back pressure. If the case is of much importance, you had better call in an engineer.

T. J. says: I have a small bath boiler, 10 × 36 inches, to run an engine 1½x3 inches; the fire is below one end and the heat goes up around the boiler about half way. A coal fire will run the engine slowly, but a wood fire increases the speed to about double that of the coal. I would like to know how to fix it so as to run the engine with a coal fire. It can be done by bricking the boiler in and exposing almost all of the surface to the fire; but that is not practicable in this case, as the boiler is in the third story. The engine exhausts into the chimney and is about 5 feet from the boiler. A. We do not understand whether or not you are troubled about the draft. If not, it might be well to raise your grate. If the draft is bad, probably there is something wrong with the chimney, or the manner of connection.

P. S. asks: 1. What can I saturate or paint a cubic foot of 1¼ inch boards with, to make it much harder and durable for iron to rub against? A. Timber impregnated with corrosive sublimate, resinous matters, or creosote is said to be harder than before. 2. Will it do to have a cistern sunk in the cellar of a house for holding the water from the roof, without damaging the water? Of course, I will have a drain for the over plus. A. Such cisterns are very common. 3. Is the water from felt roofs fit for drinking and cooking purposes? A. Yes. 4. Which is the cheapest and best for a siphon to be used for water for drinking and cooking purposes? A. Galvanized iron will answer very well.

C. McC. says: I am running an engine in a mine; the boilers are 2,500 feet from the engine. We have lately covered our steam pipe from boilers to engine; it takes the same pressure at boilers to do the work as before we covered pipe. J. C. thinks I had ought to run with less steam on account of the pipe being covered. I claim that it makes no difference as to pressure, but that steam can be made and kept up with less fuel on account of less condensation. Which is right? A. You do not send enough details. As a general rule, the loss of pressure is less with covered pipes than in the case where they are exposed.

A. D. P. asks: Is there any compound for removing scale in boilers, which it will be prudent to use under any and all circumstances? We are obliged to use water from various localities, and the impurities with which we have to contend are, of course, constantly changing. A. We do not know of anything of so general a preventive character.

W. C. says: 1. I have a small boiler that leaks badly under the firebox. What would be the best remedy to stop it? The boiler is 6x6¾ inches, and is connected with a small cylinder, 1x2¾ inches stroke. A. A rivet or patch, if the sheet is cracked; caulking, if the joint leaks. 2. I have constructed a telescope like that described on p. 7, vol. 30, and I use a double convex lens for the eyepiece. Would a plano-convex lens magnify more? A. No.

W. S. W. asks: 1. What is the correct definition of sound? A. Sound is a peculiar sensation excited in the organ of hearing by the vibratory motion of bodies, when this motion is transmitted to the ear through an elastic medium. 2. If there were no ear, would there be any sound? A. Not as we understand it. 3. Is not sound produced only in the ear and nowhere else? A. Yes. 4. About what size are the pieces of skin which are grafted? A. See p. 312, vol. 30. 5. Is the function of the spleen known positively? A. We believe not.

W. T. W. asks: Which is the proper way to put a burr on a bolt, with the flat side towards the head, or the beveled edges toward the head? A. So that the convexity is toward the head.

W. P. S. asks: Can you tell me what course of study in mechanical engineering is necessary after leaving college, and on what terms are learners taken into machine shops and engineering works? What time is necessary to learn the trade? A. If you go into a machine shop, the pay will be merely nominal, say fifty cents a day. Many young men pursue this course with very good results.

S. P. B. asks: Upon what conditions are road steamers permitted to run on common roads, in the States where they are now being used? A. We believe that in general matters of this kind are settled by the township or county authorities.

J. H. O'K. says: A friend of mine has a 15 horse engine of about 3 feet 6 inches stroke and 6 inches bow; the engine itself runs well enough, but it "whoops" in the exhaust so much that it can be heard for nearly a mile. I contend that, if you reduce the exhaust pipe to one half its diameter and dispense with a bell which is on the top of pipe, it will avoid all "whooping." Am I right? If not, what will prevent it, as it annoys me and my neighbors very much? A. It seems probable that your plan would stop the noise, which, however, seems to give indications of a very perfect exhaust. It might increase the back pressure slightly, to make such a change as you propose.

F. D. says: 1. In the cab of a locomotive that had the vacuum brake, I saw something shaped like two long-neck squashes, joined together at the top. The fireman says that there is an arrangement inside such that, when steam is let on, it draws the air out and forms a vacuum. What is that arrangement, and is it patented? Is it as economical as a vacuum pump would be in the use of steam? A. It works on the principle of the ejector condenser, or the steam siphon. Probably it is not as economical as an ordinary pump, but it is more convenient. 2. Would not an engine fitted for steam run if the exhaust pipe were kept in a vacuum and the supply pipe opened into the air, without using steam? A. Yes.

P. W. D. asks: What kind of wire gauze is used for miners' lamps? A. Usually brass gauze, made of No. 20 wire, with 36 meshes to the inch.

F. H. D. asks: If it takes a certain amount of steam to drive a piston six inches, will it take as much again to drive it twelve inches, with the same pressure upon it? What is the proportion of steam between a long stroke and short stroke of piston with the same pressure upon each? A. If, as we understand your question, the full pressure of steam is admitted in each case, it will take as much more steam in the second case as the length of the second cylinder exceeds that of the first.

P. D. R. asks: 1. Why will a spoon in a glass jar or tumbler prevent its being cracked when hot water is poured in? A. Before we attempt to give an explanation, we desire to satisfy ourselves of the fact, whether or no a tumbler, that will break if hot water is poured into it when there is no spoon present, will not break when the spoon is in it. But in attempting to make the experiment we encountered the following dilemma: If the tumbler does not break without a spoon, when hot water is poured in, what use is there of trying the experiment with a spoon. If it does break, without the spoon, our tumbler is gone, and we cannot try what might have happened with the spoon. It is evident that one and the same tumbler must be used; it will not do to compare different tumblers. If our correspondent will get over this difficulty and prove the fact, we shall repeat the experiments and work out the explanation. 2. What metals transmit heat and cold the quickest? A. Silver, gold, and copper.

A. P., of Vienna, Austria, says, in reply to A. M., who asks how to find the weight of a person's head without cutting it off: I put the person (of course naked) on a balance and get the weight of the whole body. Call this P. Have a cask large enough for a person to sit in, still leaving space over the person's head within the basin. Have a perpendicular line drawn on one side of the basin, and mark it with a scale so that you can tell, by experiment, how many cubic feet of water you have in the cask. Put water into the cask up to half its hight, and mark the place on the scale. Let the person sit in the water so deep that his head will be just out of water; mark again the place on the scale, and the difference of the two places will show exactly the cubic volume of the body without head; let us call this v. Let the person plunge entirely into the water, so that the head also is under water, and mark again the place on the scale. The difference of the number marked the first time and this number will show the cubic volume of the entire person including the head; let us call this V. Now, of course, different volumes of the body being taken, their weights must be in proportion to their cubic volume, and therefore $V : (V-v) :: P : x$, where V is the cubic volume of entire person and v the cubic volume of person exclusive of the head; therefore, $V-v$ = the cubic volume of the head, and P = the weight of the entire person: and therefore x, that is the weight of the head, is very easily found.

W. D. M. says that A. L. can make artificial honey as follows: To 10 lbs. sugar, add 3 lbs. water, 40 grains cream of tartar, 10 drops essence peppermint, and 3 lbs. strained honey. First dissolve the sugar in water, and take off the scum; then dissolve the cream of tartar in a little warm water, which you will add with some little stirring; then add the honey; heat to a boiling point, and stir for a few minutes.

C. C. G. says, in reply to J. W. T. S., whose chickens suffer from cholera: Put assafœtida into their drinking water, and I think you will have no further trouble with chicken cholera.

H. A. says: In explanation of the difficulty of blowing a disk of paper from a similar disk placed on the end of a tube as illustrated in a recent number of your journal, I send the following solution, suggested by an article in the *Popular Science Monthly*, entitled "The Atmosphere as an Anvil." In blowing through the tube, the force exerted on the paper disk is confined to the area of the internal diameter of the tube, the actual increase of power given by the breath being comparatively small. This column of air, in order to displace the paper, must move a column in front, and equal to the area of the paper. The disk of card is of use only to steady the paper, so as to keep it in a perpendicular position and to keep the forces exerted in parallel lines. The stronger and more sudden the blast through the tube, the closer will be the adherence of the paper to the card.

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

O. D. R.—It consists of carbonate of lime, carbonate of magnesia, carbonate of iron, and silica.—D. B.—It is sulphuret of iron.—M. S. No 1 is black oxide of manganese. If this was found at the place where your letter was written, it is interesting as being the first found in Virginia, and showing another of the few localities in the United States where manganese is found. If there is a quantity of the ore you should have it fully analyzed and reported upon. No. 2 is galena or sulphuret of lead.—W. J. C.—Shall be glad to report on the character of the specimens you send, and, if truly valuable, to say so.—R. D.—They are garnets of different colors and varieties.—H. B. R.—Send on your specimens.—J. H. C.—It is galena or sulphuret of lead.—F. B.—No. 1 is hepatic pyrites. No. 2 is iron pyrites.—D. P. S.—The specimen contains some magnetic oxide of iron disseminated through a quartzose matrix, but no silver was found on assay.—J. M. H. writes from New Iberia, La., and sends some specimens found on Petit Anse Island, where the Louisiana salt mines are situated. The topography and formation of the island is rather curious, being a succession of hills and valleys, rising suddenly from an endless salt marsh which surrounds it. The specimens were taken from a deep run through one of the hills. The lead-looking particles in the sandstone exist in considerable quantity. They have excited much curiosity. A. The bright crystals of black color and metallic luster are rhombohedral crystals of specular iron ore. Much of it is attractable by the magnet, and can be picked out from the sand by running a strong magnet through it. Some of it contains a certain percentage of titanium. The minute crystals are delicately tinted pink crystals of quartz.

C. H. F. asks: What is slater's cement composed of?—T. M. P. asks: How can I construct a simple and cheap dry house for drying fruit on a small scale?—O. J. T. asks: 1. How can I case-harden breech actions of breech loading guns, to give them the clouded appearance? 2. How can I color twist and laminated steel shot gun barrels to make them show the twist, as we see in imported ones?—S. H. R. asks: From whom did the negroes spring, and what causes their black color?—R. P. asks: How can I make paper impenetrable to linseed oil?—B. F. B. says: There is a problem which some one has found in a work published many years since which is as follows: "A man at the center of a circle 560 yards in diameter, starts in pursuit of a horse running around its circumference at the rate of one mile in two minutes; the man goes at the rate of one mile in six minutes, and runs directly towards the horse in whatever direction he may be. Required the distance each will run before the man catches the horse and what figure the man will describe." I hardly think it admits of a solution under the above conditions; but were they reversed, that is, if the man were running at the rate of one mile in two minutes, and the horse one mile in six minutes, what would the answer be?

COMMUNICATIONS RECEIVED.

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

On the Vienna Exposition. By A. D.

On the Sun's Attraction. By H. B. and by A. L. L.

On Light Freight Cars. By H. S. B.

On the Madstone. By R. D. S.

Also enquiries and answers from the following:

W. E. L.—J, T. W.—M. E.—G. W. H.—P. J. K.—E. G. B.

Correspondents in different parts of the country ask: Who furnishes plans and machinery for steam laundries? Who supplies cotton seed hullers, decorticators, and oil presses? Where can a subscriber obtain a cider press? Who sells chestnut hoops for casks? Who makes wire sifters and baskets? Who makes the best metallic self-packing for pistons, with brass rings, etc.? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

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

[OFFICIAL.]

# Index of Inventions

FOR WHICH

## Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

## May 19, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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|---|---|
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| Ball car, G. Smith | 151,168 |
| Bale tie, F. L. Bates | 151,000 |
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| Balloon, J. Hartness | 151,124 |
| Bath, vapor, C. A. Munro | 151,149 |
| Bed bottom, J. V. Taylor | 151,062 |
| Bedstead, folding cot, W. Wright | 150,993 |
| Bedstead, wardrobe, Harrison *et al.* | 151,020 |
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Sad iron, N. B. Lindley ... 150,967
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Vehicle end gate, J. C. Hawker ... 151,023
Vehicle running gear, A. M. Worden ... 151,069
Vehicle spring, J. Curtis ... 151,097
Vehicle spring, A. L. & L. A. Davis ... 151,009
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Vehicle wheel, W. F. Morton ... 151,148
Vehicle wheels, spoke for, C. W. Latham ... 151,141
Vessels, center board for, J. T. Hatfield ... 151,022
Watch case spring, J. Harwood ... 151,021
Water traps, making, Butler & Elton ... 151,088
Water wheel & pressure regulator, J. E. La Blanc ... 150,963
Wheelbarrow wheel and axle, W. C. Barr ... 151,073
Whiffletree, H. M. Kelly ... 151,022
Whiffletree, staple, M. Hinman ... 151,026
Windmill, T. Jefferson ... 151,132
Wood grinder, R. F. Barker ... 150,932

## 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:

29,618.—PRINTING PRESS.—J. E. Priest. August 12.
29,699.—INSECT DESTROYING APPARATUS.—A. Isaacson. August 5.
29,727.—SHAPING AND MOLDING MACHINE.—H. D. Stover. August 5.
29,728.—PLANING MACHINE.—H. D. Stover. August 5.

## EXTENSIONS GRANTED.

28,378.—FIRE ESCAPE.—L. King.
28,389.—RUBBER HOSE.—T. J. Mayall.
28,402.—ICE CREAM FREEZER.—C. W. Packer.

## DESIGNS PATENTED.

7,435.—CARPET.—R. Allan, Yonkers, N. Y.
7,436.—TOY WAGON.—L. Althof, Hoboken, N. J., et al.
7,437.—GAME TABLE.—J. M. Brunswick, Cincinnati, Ohio.
7,438 to 7,443.—CARPETS.—A. Heald, Philadelphia, Pa.
7,444.—BOILER STAND.—F. Lancaster, New York city.
7,445.—OMNIBUSES.—C. M. Murch, Cincinnati, Ohio.
7,446.—FORK HANDLES, ETC.—C. Osborne, North Attleborough, Mass.
7,447.—HANDLES.—G. W. Plummer, Newark, N. J.
7,448.—FENCE.—S. Turnbach, Bloomsburg, Pa.
7,449.—PIPE MOUTH PIECE.—W. Demuth, New York city.
7,450.—COOK STOVE.—J. R. Rose et al., Philadelphia, Pa.
7,451.—HEATING STOVE.—J. R. Rose et al., Phila., Pa.

## TRADE MARKS REGISTERED.

1,795.—COSMETICS.—J. A. Pozzoni, St. Louis, Mo.
1,796.—GREEN COLORS.—W. H. Swift & Co., Boston, Ms.
1,797.—CHEWING TOBACCO.—Allen et al., Cincinnati, Ohio.
1,798 & 1,799.—PLASTERS.—L. W. Warner & Co., N. Y. city.

## SCHEDULE OF PATENT FEES.

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

## CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA.

MAY 19 to MAY 28, 1874.

3,447.—P. Mutter, G. Black, and W. W. Sims, Hamilton, Wentworth county, Ont. Improvement in clothes pin, called "Mutter's Adjustable Wire Clothes Pin." May 19, 1874.

3,448.—S. W. France, Hamilton, Wentworth county, Ont. Improvement in boiler attachment for cooking stoves, called "France's Stove Boiler Attachment." May 19, 1874.

3,449.—T. Miller, New York city, U. S. Improvements on a fire extinguishing system of water pipes for high buildings, called "Miller's Fire Extinguishing Water Pipe and Fire Escape Attachment for Buildings." May 19, 1874.

3,450.—A. R. Williams and J. S. Edwards, Marshalltown, Marshall county, Iowa. Improvements in kiln for burning bricks, tiles, earthenware, and other commodities, or drying the same, and the mode of setting the material to be burnt or dried, called "Williams' Furnace Kiln." May 19, 1874.

3,451.—J. F. Baldwin, Boston, Suffolk county, Mass., U. S., and C. H. Hardy, Hingham, Plymouth county, Mass. Improvements on planes, called "The Baldwin and Hardy Improved Metallic Plane." May 19, 1874.

3,452.—J. F. Baldwin, Boston, Suffolk county, Mass., U. S., and C. H. Hardy, Hingham, Plymouth county, Mass. Improvement on planes, called "The Baldwin and Hardy Improved Metallic Planes." May 19, 1874.

3,453.—C. L. Morehouse and R. Fitzgerald, Cleveland, Cuyahoga county, O. Improvements on lubricating grease compounds, called "Morehouse & Fitzgerald's Grease Compound." May 19, 1874.

3,454.—D. Bickford, New York city, U. S. Improvements on family knitting machines, called "Dana Bickford's New and Improved Family Knitting Machine." May 19, 1874.

3,455.—C. F. Wilson and S. H. Miller, New York city, U. S. Improvements on dies for cutting and cupping or drawing metal or other materials, called "Wilson & Miller's Improvement on Dies for Cutting and Cupping Sheet Metal." May 19, 1874.

3,456.—J. Briggs, Toronto, York county, Ont., and W. S. Finch, same place. Improvements on spring bottoms for seats and beds, called "Briggs & Finch's Elliptical Spring Seat and Bed Bottom." May 19, 1874.

3,457.—J. Briggs and W. S. Finch, Toronto, York county, Ont. Improvements in ventilating cars and buildings, called "Briggs & Finch's System of Ventilation." May 19, 1874.

3,458.—G. G. May, Troy, Orleans county, Vt., U. S. Improvements on milk pans, called "May's Milk Pan." May 19, 1874.

3,459.—S. H. Newcomb, Port Williams, Kings county, N. S. Improvements on folding standards for fixed or revolving stools and tables, called "Newcomb's Folding Stool and Table Standard." May 19, 1874.

3,460.—J. B. Smith, Sunapee, Sullivan county, N. H., and J. D. Sleeper, Coaticook, Stanstead county, P. Q. Improvements on machines for making clothes pins, called "Smith's Clothes Pin Machine." May 19, 1874.

3,461.—F. E. Smith, Montpelier, Washington county, Vt., U. S. Improvements on washing machines, called "Smith's Improved Washer." May 19, 1874.

3,462.—S. C. Gardner, Mansfield, Tolland county, Conn., U. S. Improvements on vehicle wheels, called "Gardner's Vehicle Wheel." May 19, 1874.

3,463.—R. L. Walker, Boston, Suffolk county, Mass., U. S. Improvements in railway car windows, called "Walker's Improved Car Window." May 19, 1874.

3,464.—T. H. Carruthers, Cincinnati, Hamilton county, O., U. S. Improvements on horse shoe bars, called "Carruther's Horse Shoe Bar." May 19, 1874.

3,465.—A. O. Abbott, Adrian, Lenawee county, Mich., U. S. Improvements on hub borers, called "Abbott's Little Giant Hub Borer." May 19, 1874.

3,466.—G. C. Bovey, Chillicothe, Ross county, O., U. S. Improvements on brick machines, called "Bovey's Queen City Brick Machine." May 19, 1874.

3,467.—I. A. Singer, New York city, U. S. Improvements on chest protectors, called "Singer's Graduated Chest Protector." May 19, 1874.

3,468.—J. W. McGlashan, Montreal, P. Q. Improvements on machinery for manufacturing drain pipes from cement, clay, etc., called "McGlashan's Drain Pipe Apparatus." May 19, 1874.

3,469.—D. Ashworth, Wappinger's Falls, Dutchess county, New York city, U. S. Improvements on hose and pipe couplings, called "Ashworth's Hose Coupling." May 19, 1874.

3,470.—J. McGuirl and H. McGuirl, Merrickville, Grenville county, Ont. Improvements in metallic molds for casting plow points, called "McGuirl's Shell Mold for Casting Plow Points." May 19, 1974.

3,471.—M. Moore, Sarnia, Lambton county, Ont. Improvements in machines or apparatus for preserving fruits, vegetables, fish, or meats in sealed cans or jars, called "Moore's Improved Preserving Apparatus." May 19, 1874.

3,491.—W. W. Allmand, East Boston, Suffolk county Mass., U. S. Improvements on machines for refitting valve seats, called "Allmand's Valve Seat Refitting Machine." May 28, 1874.

3,492.—M. Reeves, Harriston, Ont. Improvements on car couplings, called "Reeves' Self Acting Coupler." May 28, 1874.

3,493.—W. T. Rickard, Toronto, York county, Ont. Improvements in the construction of machines for washing, concentrating, and amalgamating ores of precious metals, called "Rickard's Amalgamator." May 28, 1874.

3,494.—R. Bustin, St. John, N. B. Machine for hanging wall paper, called "Bustin's Improved Paper Hanger." May 28 1874.

3,495.—A. H. Malcom, Dartmouth, N. S. Improvements on railway car couplings, called "A. H. Malcom's Self-Connecting Car Coupling." May 28 1874.

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PROSPECTUS

OF THE

SCIENTIFIC AMERICAN.

THE BEST MECHANICAL PAPER IN THE WORLD.

*TWENTY-NINTH YEAR.*

VOLUME XXX.—NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the third day of January, 1874, a new volume commences. It will continue to be the aim of the publishers to render the contents of the coming year more attractive and useful than any of its predecessors.

*To the Mechanic and Manufacturer!*

No person engaged in any of the mechanical pursuits should think of doing without the SCIENTIFIC AMERICAN. Every number contains from six to ten engravings of new machines and inventions which cannot be foun in any other publication.

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SCIENTIFIC AMERICAN

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

Vol. XXX.—No 26. [NEW SERIES.] NEW YORK, JUNE 27, 1874. $3 per Annum IN ADVANCE

## THE CLOCK TOWER AT DELHI, INDIA.

The city of Delhi is one of the oldest in all the provinces of Hindostan, and the sanguinary fighting under its walls in the days of the Sepoy mutiny, is still fresh in the memory of most of our readers. Since the establishment of a large depot of the East Indian Railway there, many improvements in the streets and buildings of the ancient city have been made. Of these additions, the most noticeable from a distance is the new clock tower, which stands in the center of the Chandnee Chowk, opposite the own hall. Of this a photograph is given in "Professional Papers of Indian Engineering," and from the London *Builder* we extract the accompanying engraving.

This building is erected on an appropriate site at the crossing of four streets, and stands 110 feet high, exclusive of the gilt vane and finial. The lowest story is about 20 feet square externally. The materials used in its construction are brick, red and yellow sandstone, and white marble. The capitals surmounting the main corner pillars are 4 feet 2 inches wide at top, and 4 feet 6 inches deep; they are carved out of solid blocks of white sandstone, and each of them weighs about two tons.

The dials of the clock are sufficiently elevated to be visible from the East Indian Railway station, and from other prominent points in the city. The clock is constructed to work five bells, placed in the open canopy above it; these give out a different peal for each quarter, the largest bell striking the hours.

The building was completed in 18 months, at a cost, including clock and bells, of $14,000, the whole of which amount was provided from the municipal funds of Delhi.

The tower was designed and built by Mr. E. J. Martin, Executive Engineer of the Rajpootana State Railway.

### Railways without Switches, Turnouts, or Crossings.

Mr. Charles Jordan, Newport, England, proposes to stop one extensive source of railway accidents in what is certainly a thorough manner. He proposes to make the up and down main lines without the usual switches, turnouts, and crossings, the lines being continuous from end to end, and to work such road by transferring a train or trains at stations, or where shunting is necessary, or at junctions with other railways, from the main line to the adjacent siding, by lifting the train bodily from one line to the other. The lifting will only be an inch or two, and the hydraulic apparatus as now constructed will make nothing of the weight, while as to time, Mr. Jordan calculates that a few minutes will suffice to transfer a train from one road to another without disturbing a single passenger. The whole work of a station, as regards the hydraulic apparatus, may be done by one, or, at large stations, two lads. The time saved in switching will be very great, and the risk of collision reduced.

### Reproduction of Photo-Negatives.

The sensitive compound I have hitherto employed for coating the plates is made up of dextrin, 4 grammes; ordinary white sugar, 5 grammes; bichromate of ammonia, 2 grammes; water, 100 grammes; glycerin, according to the condition of the atmosphere, 2 to 8 drops.

A new, well cleaned, patent plate is coated with the sensitive chromium solution; and after the superfluous liquid has been allowed to flow off at one of the corners, the plate is dried in the dark by being placed upon a lithographic stone or metal plate, a period of ten minutes being sufficient for the purpose, with a temperature of 120° to 160° Fah.

The film being perfectly dry, the plate, still warm, is put under a negative and printed in the shade for ten or fifteen minutes. As soon as it comes out of the printing frame the plate is again slightly warmed; the brush is dipped into the graphite and applied over the surface of the image, which should be just slightly visible. The application of the powder is carried on in a shaded corner of an ordinary room illuminated by daylight. You must not press hardly upon the film with the brush, but move the same over the surface as lightly as possible; nor will it do to hurry the operation.

In proportion as the film cools so the image appears. By carefully breathing or, better still, blowing upon the film, you will be able to accelerate the process, and when the picture has attained sufficient vigor you take off the superfluous graphite powder with a clean brush.

A normal collodion is now applied; such as I use is composed of: Alcohol, 500 parts; ether, 500 parts; pyroxyline, 15 to 20 parts.

When this film has set and hardened, the margins are cut round with a knife, and the plate put into a porcelain dish of cold water. In three minutes the picture will be free from the glass, and the film may be employed in this position or reversed with a soft brush, and taken out of the water adhering either to the same glass plate or to another. A gentle stream of water falling upon the film

TOWER AND CLOCK AT DELHI, INDIA.

will remove any chromium salts still remaining in it, and will also press down the loose film uniformly upon the glass surface. Finally, the plate is allowed to dry in a perpendicular position. Further treatment of the plate with varnish follows as a matter of course.

The image upon the collodion film is very thin; but you need be under no apprehension of its tearing while in the water, when it may be easily manipulated. I have to do with films of this kind measuring three feet square.—*J. B. Obernetter.*

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NEW ANTIDOTE FOR ARSENIC.—The only antidote for arsenic heretofore known has been hydrated peroxide of iron, which must be freshly made by mixing carbonate of soda or potash with a solution of either sulphate (copperas) of iron or muriate. A French experimenter, M. Carl, says that sugar mixed with magnesia serves as an antidote for arsenious acid.

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IN Europe the multiplication of photo prints is extensively done by mechanical means, with printing ink, and the copies, equal or superior to silver prints, are supplied at half the cost of the latter.


# Scientific American.

MUNN & CO., Editors and Proprietors.

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VOLUME XXX, No. 26. [NEW SERIES.] *Twenty-ninth Year.*

NEW YORK, SATURDAY, JUNE 27, 1874.


**Contents:**

(Illustrated articles are marked with an asterisk.)



## THE END OF VOLUME XXX.

The thirtieth volume of the present series of the SCIENTIFIC AMERICAN closes with the present issue, and, completed, joins its predecessors as another milestone, recording the progress made by mankind in the path of Science during the six months which have just passed. It is hardly necessary to point out that, in the pages now finished, it has been our endeavor, as it will be in those to come, to popularize scientific knowledge, and to make the same generally available to the masses; not aiming to supply information valuable alone to the engineer, to the chemist, or indeed exclusively to any profession or calling, but rather to glean from the whole broad field of Science and Art the richest sheaves of genius, and to present, winnowed therefrom, the kernels of wisdom, unmixed with the chaff of technicality and abstruseness. That such a course has met the public approval, our increasing circulation and the many letters of which we are constantly in receipt, offering us pleasant wishes of encouragement, are the best and most flattering evidence.

In glancing back over the contents of the past volume, we feel that we may confidently assert that in no other periodical now extant is there to be found a wider range of topics, treated in popular and readable form, the perusal of which will add more largely to the stock of valuable knowledge of any reader.

In the pages now closed we have presented 258 illustrated subjects, in many cases with not merely a single cut, but with a series of engravings. These embrace the most recent mechanical inventions, patented in this country and abroad—new steam engines and boilers—new weapons of war—new tools for every variety of industrial employment—new household implements—new machinery of every kind for especial purposes—illustrations of new scientific experiments—views of new buildings, bridges, and monuments—pictures of rare and new plants, fossils, and animals—of queer freaks of Nature in the animal and mineral world—lucid diagrams, explanatory of mathematical demonstrations, and new theories of natural phenomena.

As for miscellaneous information, we would refer the reader to the columns of fine type, attached to this number, which form the index, in order to gain an idea of the number and variety of the matters he has examined.

No great discoveries have been made during the past six months; but the progress of Science has been uniform, and stopping, as we now do, for a momentary breathing spell, we can look back and see a notable advance. Professor Thurston has sent us a large amount of important and valuable news regarding the behavior of metals under stress, and how to test them—facts of the liveliest interest to every engineer and mechanic. Professor Orton has continued his letters, telling us about the little known resources of Central South America. In astronomy, we have presented our monthly notes, regarding positions of planets, times of phenomena, etc.; abstracts of Professor Proctor's excellent lectures during his late visit to this country, and also an account of Professor Wright's discovery of the cause of the zodiacal light. We have also noted the discovery of new planets and comets, announced the donation of $700,000 by Mr. James Lick, of San Francisco, for a gigantic telescope, and illustrated an ingenious plan for the manufacture of that great instrument, the device of Mr. Daniel Chapman. Our abstracts from the proceedings of the British Association, the French Academy of Sciences, and our own scientific associations, have been very full and accurate, while reducing the new topics discussed for ready comprehension by every one. Engineering subjects have been so extensively treated that it is hardly possible to particularize. We have illustrated the 1,000 foot tower proposed for the coming centennial, called attention to new processes of tunnel boring, bridge building, and railroad construction, mentioned some important works in hydraulic engineering in the West, and, in a multiplicity of articles from the pens of expert writers, considered topics of a timely and lively interest to the profession. Chemical matters have received their full share of attention, and so also the important subjects of electricity and magnetism, in which notable advances have been made.

With the end of this volume many subscriptions expire, which we hope to see speedily renewed. In accordance with our rule, the paper is not sent after the subscribed-for term has expired; so that those who have failed to remark the notice on the wrappers of the copies received lately will be warned, by the cessation of our visits, that the time has come for them once more to express their appreciation of our efforts by sending us their substantial support.

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## HOW TO ATTAIN HIGH TEMPERATURES.

In his recent interesting address before the *Société des Ingénieurs Civils*, M. Jordan spoke at some length of the methods now adopted of attaining high temperatures in metallurgical operations, and of the bearing of chemical principles and recent discoveries upon the subject. The learned engineer speaks of the "duel," as he terms it, between the fire on the one hand and the refractory materials used in the arts on the other, and recognizes the serious difficulties which impede the effort to utilize high temperatures, when it is possible to attain them.

The Siemens regenerative furnace and its modifications represent the most successful means yet in general use for producing extremely high temperatures, and the difficulty most frequently met is that of finding fire brick or other material capable of withstanding the heat of the ignited gases We have known of instances in which the lining of steel-melting furnaces has been melted down like wax before this tremendous heat. Assuming, however, that we may expect to find sufficiently refractory materials to permit the utilization of still higher temperatures, the problem, to determine how to reach a higher limit, presents itself.

Under ordinary conditions, we cannot much exceed the temperature of a steel melting furnace, since dissociation occurs at a temperature supposed to be in the neighborhood of 4,500° Fah., for oxygen and hydrogen; consequently all combustion must be checked at some lower point on the scale, so long as no external force aids that of chemical affinity. The temperature of dissociation of carbonic acid is even lower than that for hydrogen and oxygen, and is shown to be not far from 2,500° Fah. Finally the presence of nitrogen in atmospheric air reduces the maximum temperature attainable, by furnishing a mass of gas which, while itself adding nothing to the supply of heat, abstracts (from the heat supplied by combustion of carbon and hydrogen) the larger amount required for its own elevation to the temperature of the furnace.

Elevation of the limit to increase of temperature of furnaces may be obtained by elevating the temperature of dissociation, and this, it has been found, may be done by producing combustion under pressures exceeding that of the atmosphere. Mr. Bessemer, the well known inventor who so nearly antedated our countryman Kelly in the invention of the pneumatic process of manufacture of iron and steel, which is generally known as the Bessemer process, has patented a method of increasing the pressure under which such operations occur. In the ordinary pneumatic process, this increase of pressure occurs to some extent in consequence of the small area of the opening by which the gases leave the converter, and it is stated that the pressure within the converter sometimes becomes double that of the external atmosphere. We may doubt if the increase ever becomes so great as this; yet there can be no doubt that it is sufficiently great to have an important influence in elevating the limit of dissociation and in giving the very high temperature which holds nearly pure iron within the converter in a condition of fluidity never observed elsewhere.

It is readily seen that the conclusions of M. Jordan, in the address to which we alluded above, are justified both by Science and by practical experience. He advises: The choice of a combustible which may be consumed in a bath of metal furnishing a non-volatile residue without injuring (*sans dénaturer*) the metal, and the adoption of a form of furnace which, heated by gas or otherwise, may be worked with an internal pressure of several atmospheres. He refers to the marvelous discoveries, recently made, relative to temperature and pressure on the surface of the sun and other heavenly bodies as affording illustrations of the possibilities in the direction of attaining high temperatures.

The problem presented is as interesting and attractive as it is important; and the inventor of new methods or of perfected apparatus, and the discoverer of more refractory materials than those now used, will aid greatly in its solution. Powerful intellects and ingenious minds are at work upon it; and we hope that our readers will be able to find in our columns evidence that the ingenuity which has made our people famous as a nation of mechanics, and the growth of Science which is gradually becoming so noticeable among us, have assisted to a valuable extent in effecting so important an advance in this direction. Any improvement or discovery which assists in the production and the economical application of high temperatures aids every branch of industry, and promotes our material welfare in an inconceivable number of ways.

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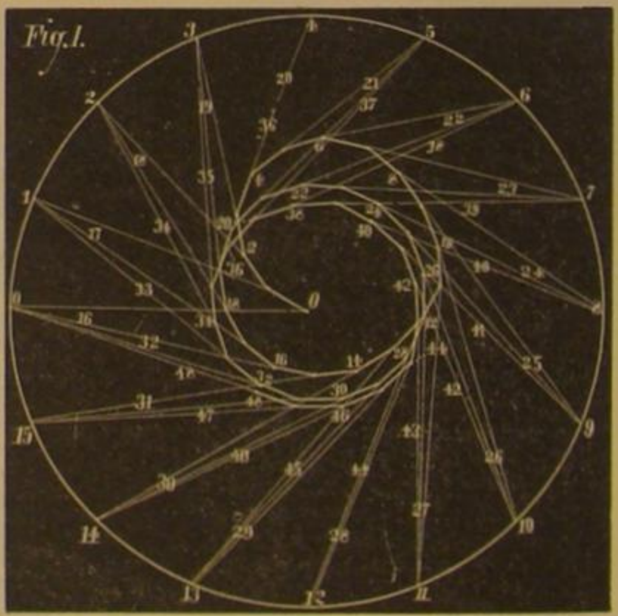
## A CURIOUS PROBLEM.

In our queries of last week's issue a correspondent, B. F. B., says: "There is a problem, which some one has found in a work published many years since, which is as follows 'A man, at the center of a circle 560 yards in diameter, starts in pursuit of a horse running around its circumference at the rate of one mile in two minutes; the man goes at the rate of one mile in six minutes, and runs directly toward the horse, in whatever direction he may be. Required the distance each will run before the man catches the horse, and what figure the man will describe.' I hardly think it admits of a solution under the above conditions; but were they reversed, that is, if the man were running at the rate of one mile in two minutes, and the horse one mile in six minutes, what would the answer be?"

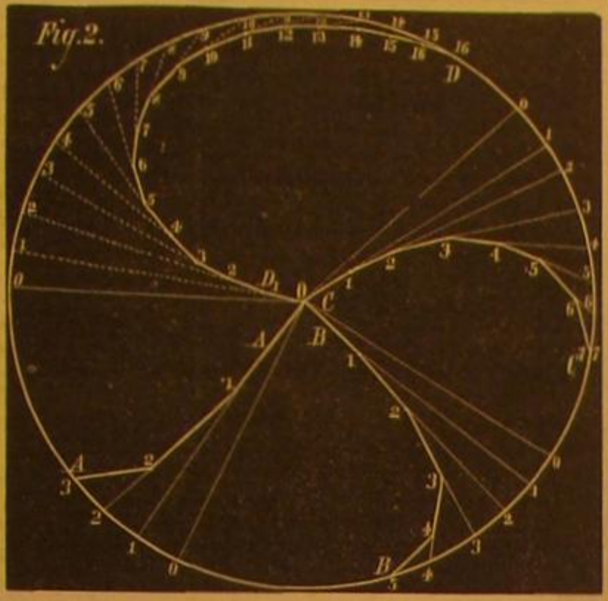
This problem gives rise to an interesting investigation of a curve, which at first sight appears to be similar to the spiral of Archimedes, but on further examination proves to be totally different. The spiral of Archimedes is the track of a point which moves with uniform velocity along the radius from the center to the circumference, while, at the same time, the end of the radius travels round the circumference. In this problem, however, the point moving from the center does not move uniformly in the direction of the radius, but more and more obliquely toward a uniformly progressing point in the circumference, giving rise to an intricate application of the differential calculus, which finally proves that the man will never reach the horse, but that the curve described by him will, after three revolutions of the horse, be nearly identical with a circle, the circumference of which he will approach more and more, and of which the radius is one third of that in which the horse moves. The most interesting fact revealed, however, is that, if the velocity of the man is half that of the horse, he will, after two revolutions, be near the circumference of a circle of half the radius of the outer one; and when he moves with one fourth the velocity he will, after four revolutions, be very near a circle of one fourth the size, and so on.

In order not to burden our readers with extended calculations in the field of the higher algebra, we have solved the problem in the graphic method. In our first figure we hav




divided the circumference of the circle into sixteen equal parts, 0, 1, 2, 3, 4, etc., and taken one third of such a part and set it out on the radius from the center, 0 to 1. While the horse has moved along the circumference from 0 to 1, the man will have traveled from the center 0 to 1; while the horse is traveling from 1 to 2, the man will have traveled along the line 1, 2, 2; while the horse travels from 2 to 3, the man will travel in the direction 2, 3, 3, and so on; the only difference between our engraving and the reality being that the short lines representing the road traveled by the man will be slightly curved, instead of straight as we have represented them. By making these lines smaller, we may come sufficiently near to the reality, but the final result will not essentially differ. If the reader follows the different tracings for three revolutions, as represented here, he will see that finally the man will walk in a circle one third the size of that in which the horse moves, and will constantly see the horse in a direction tangential to the circle in which he walks; and therefore he never can reach it if he always moves directly toward the horse.

It is quite otherwise when the problem is reversed, and the man walks three times as fast as the horse. This is represented in Fig. 2, in which the track of the horse is divided into spaces each equal to $\frac{1}{16}$ part of the circumference. At A A, each part of the man's track is made equal to three times that length; and it is seen that, before the horse has accomplished three of these divisions, or one sixteenth of the circumference, the man will have overtaken him along the line, 0, 1, 2, 3. At B B, the case is represented that the man walks twice as fast as the horse; the engraving shows that,



before the horse has accomplished five divisions or one tenth of the circumference, he will be overtaken. At C C, we represent the case that the man walks one and a half times as fast as the horse, the distances from the center, 0, 1, 2, 3, being one and a half times the corresponding $\frac{1}{16}$ part of the circumference. It is seen here that the horse will have been overtaken when he has passed over seven spaces, or $\frac{1}{2}$ of the circumference. Finally, at D D, we have represented the interesting case that the man walks exactly as fast as the horse; it is seen that, after going through sixteen spaces, or $\frac{1}{2}$ of the circumference, the man will move very nearly in the circumference, but always nearly one space ($\frac{1}{16}$ of the circumference) behind the horse, without being able ever to reach him. All that he then can do is to stop and let the horse overtake him.

## SOURCES OF EDIBLE STARCH.

Besides the well known cereals, the number of plants producing starch, in root, stem, or fruit, in quantity sufficient to make their cultivation profitable, is very large. The number made use of in supplying the starches of commerce is comparatively small. Not more than a dozen contribute largely, and the excellence of these is clearly due in great measure to long cultivation. With the increasing demand for farinaceous foods, and the development of agriculture in tropical countries, where starch producing plants chiefly flourish, many other starch yielders will doubtless be brought under cultivation, with as marked an improvement in their quality and productive value, we may expect, as the cereals have shown, or, more notably, the potato.

Possibly the effect upon the cultivators may be equally important. The cereals have been to a great extent both the occasion and the means of raising agriculture to its high position in temperate climes. In like manner the development of tropical and sub tropical communities must come largely through habits of industry and thrift acquired in systematic agriculture, in which the starch-producing plants must play the same part the cereals have in colder regions.

The arrow root of the West Indies (*maranta arundinacea*) furnishes the standard quality and the common name for farinaceous products. Starch is starch the world over, and its composition is the same, whatever its source. The commercial starches are more or less impure, more or less flavored by the elements with which they are associated in Nature, and which are not perfectly eliminated in the process of manufacture. There is a difference also in the size of the granules, but this requires the microscope to determine. Arrow roots contain about 25 per cent of starch, which is extracted by a process of grinding, rasping and washing the pulp with water.

Owing to careful preparation and the purity of the water used, Bermuda arrow root has the name of being the purest and best in market; but an equally fine quality is now furnished from other localities, St. Vincent taking the lead both in quantity and quality. In Bermuda, as in most of the West India islands, the amount produced has greatly decreased of late years, the cultivation of early vegetables for our city markets offering larger profits.

In the Bahamas and other West India islands, and in Florida, a starch much resembling true arrowroot is obtained from the roots and stems of certain species of zamia. In Florida they are called *conti* roots, and the farina prepared from them *conti*. In the shops it is known as Florida arrow root. Another West Indian starch, called *tous le mois*, characterized by the relative coarseness of the granules, comes from several species of *canna*, one of which, *canna edulis*, has been largely introduced into Australia, where it yields an excellent quality of starch.

A great number of starch-yielding plants are employed for local use in South America; but for exportation the West Indian *maranta* and the native *manihots* are chiefly cultivated. There are two species of the latter (*manihot utilissima*), otherwise known as cassava root, being bitter and poisonous, the other (*m. opi*) sweet, and largely used as an esculent, simply boiled. Both have been extensively introduced into other parts of tropic America, the East Indies, and the coast of Africa. The tubers of the bitter species, which is most extensively cultivated, sometimes attain the length of three feet and weigh thirty pounds, the milky juice being removed by pressing and the poisonous principle expelled by the action of heat. When heated in a moist state, the starch is partly cooked, forming small, hard, irregular masses, the tapioca of commerce. Like the potato, the manihot has developed a large number of varieties under cultivation, differing as potatoes do in quality and period of maturing, some coming to perfection in six months, others requiring a year or more. Farina of manihot, both in its crude state and made into thin cakes, is very largely eaten in Venezuela and Brazil, where the manihot is most cultivated, the single province of Santa Catharina having as many as 14,000 establishments for its manufacture.

The bulbous root of another poisonous South American plant, a climber, furnishes the starch called *jocatupé*, said to have important medicinal properties. Only a small quantity is produced.

The African arrow roots are of various origin. The Cape Verde islands export a considerable quantity, chiefly extracted from the Brazilian cassava root. St. Thomas, Angola, and Mozambique also yield a small amount. In Liberia, Sierra Leone, and other African colonies, especially Cape Colony and Natal, the true arrow root (maranta) has been largely introduced, and the prepared starch is beginning to be exported in noticeable quantity. Madagascar and the Mauritius likewise yield a small amount.

In 1840 the maranta was brought to Madras, and shortly afterwards to several other East Indian countries, where it thrives abundantly, developing in from twelve to fifteen months. With good irrigation, a year suffices to secure the maximum yield of starch, 16 per cent. More recently the same plant, together with the manihot, has been introduced into Ceylon, where after much persuasion the natives have been induced to cultivate them. Now the amount produced not only supplies the large local demand, but allows of considerable exportation.

What is known as *tikor*, or East Indian arrowroot, comes from the roots of a native plant, the narrow-leaved turmeric (*curcuma angustifolia*), which abounds in Ticor, Benares and Madras. A large part of the diet of the inhabitants of Trevancore is the starch of another plant of this genus, while still another answers the same purpose in Berar. In Chittagong, a wild ginger plant, growing everywhere in such profusion that it is almost a nuisance, has a root loaded with starch of a good quality. The supply of the root is inexhaustible; and with a little trouble in digging and preparation, it might be made to furnish a vast quantity of cheap and nutritious food. Other less known plants supply a large amount of starch for local use in India, notably a wild arrow root which grows in the jungles. The starch is of excellent quality. In many other parts, the natives also lay under tribute for the same purpose the young roots of the Palmyra palm, which are rich in starch. At Goa, a farina is prepared from the wild palm, and in Mysore from the sago palm of Assam (*carryota urens*) which yields a sago little if at all inferior to that of the true sago palms of the Malay countries. Less nutritious and palatable sagos are also obtained from the Talipat palm in Ceylon, and the *Phœnix farinifera* which grows on the Coromandel coast.

The most generous of starch producers, however, are the true sago palms, of which two species (*sagus konigii* and *sagus lævis*) are chiefly cultivated. Though most abundant in the eastern parts of the Malay archipelago, these palms are found throughout the Moluccas, New Guinea, Borneo and the neighboring islands, and as far north as the Philippines. The yield is immense, three trees affording more food matter than an acre of wheat, or six times as much as an acre of potatoes. As the trees propagate themselves by lateral shoots as well as by seeds, a sago plantation is perpetual. Wallace shows that ten days' labor or its equivalent in money will put a man in possession of sago cakes, the principal if not the sole food of the natives, enough for a year's subsistence. A single tree contains from twenty-five to thirty bushels of pith, which, with a little breaking-up, will yield from six to eight hundredweight of fine starch.

Upwards of 20,000 tuns of sago pith are annually converted into commercial sago by the Chinese at Singapore. The finer quality, known as pearl sago, is prepared in great quantities by the Chinese of Malacca, something like 250,000 hundredweights being sent therefrom to England alone. The manufacture of tapioca is also largely carried on at Singapore and at Penang, 75,000 hundredweight being sent to England annually from the former port, and 10,000 from the latter.

Japan sago is made from the pith of a fern palm (*cycas revoluta*), which yields a large quantity of sago-like starch.

Another starch-yielding plant, now extensively cultivated in the East, is the *tacca pinnatifida*, known throughout the South Sea islands as *pia*. The tuberous roots resemble potatoes, and are largely eaten in China and Cochin China. When raw, the tubers are intensely bitter and acrid, but these objectionable qualities are removed by cooking. The starch is of fine quality, much valued for invalids, and the yield is liberal—30 per cent. The South Sea tacca grows on high sandy banks near the sea, and yields a starch equal to Bermuda arrow root, when carefully prepared.

In other Pacific islands, certain species of aurum are also utilized for starch, the one most extensively cultivated (*aurum esculentum*) being known as *taro*. The natives of Tahiti distinguish thirteen varieties, doubtless the result of artificial selection. The tubers, which weigh from two to four pounds, each yield as much as 33 per cent of starch, combined with a blistering bitter principle which is destroyed by heat. Our familiar Indian turnip, with its acrid flavor belongs to the same family of plants.

Among the other starch-producing plants, extensively cultivated for food in tropical countries, and which are destined to add immensely to the food supply of colder climates, are yams, bread fruit, and bananas, including the variety known as plantains. The last fairly rival the sago palm in affording the maximum amount of food for the minimum amount of labor. The yield to the acre is, in bulk, forty-four times that of potatoes, and the proportion of starch is somewhat greater. The fruit is also richer in other elements of nutrition, so that the meal prepared by drying and grinding the plantain core resembles the flour of wheat in food value. It is easily digested, and in British Guiana is largely employed as food for children and invalids. The cost of preparing plantain meal cannot be great, and the supply might be unlimited. The proportion of starch is 17 per cent; in bread fruit it is about the same; in yams it rises to 25 per cent, but is hard to extract, owing to the woody character of the roots.

## FAILURE OF PATENT EXTENSION SCHEMES.

We are glad to be able to state that the Senate Committee have agreed to report adversely upon the application of the sewing machine monopolists, for extensions of the Wilson, Aikens and Felthausen, and Wickersham sewing machine patents.

Adverse reports are also announced on the Tanner car brake, Rollin White pistol, and Atwood car wheel.

The following cases were deferred until next session: Norman Wiard's boiler attachment to prevent boiler explosions, and Butterworth's patent burglar-proof safe.

## SCIENTIFIC AND PRACTICAL INFORMATION.

### RESPIRATION OF PLANTS.

Vegetables, it is well known, exhale carbonic acid in the dark. M. Deherain states the curious fact that if a certain mass of vegetables thus acting be compared with a like mass of cold blooded animals, the exhaling energy will be found to be the same in both cases. This is another of those odd coincidences which seem to level the distinction between the two great organic kingdoms.

### DIFFUSION BETWEEN MOIST AND DRY AIR THROUGH POROUS EARTH.

If a partition of porous earth separates two gases of different densities, an unequal diffusion takes place across the dividing body; the current of denser gas is more abundant than the other. M. Dufour has recently investigated the question as to what takes place when two masses of air of the same temperature, but containing unequal quantities of water, are substituted for the gas. He finds that there is still unequal diffusion, and that the most abundant current passes from the dry over to the moist atmosphere. This diffusion depends on the tensions of the aqueous vapor on the two sides of the porous partition.

### GAS LIGHTING BY ELECTRICITY.

A new pneumatic gas lighting apparatus, now being introduced by Mr. Asahel Wheeler, of Boston, Mass., was recently tested at Providence, R. I., with satisfactory results. A current of compressed air is transmitted from a central engine to diaphragms at the burners, the moving of which turns on the gas, which is then lit by an electric spark. Forty lights were kindled and extinguished simultaneously with great rapidity. It is stated that by this device all the street lamps in a city may be lit by the movement of a single lever, at any certain point.

### BEER.

The National Brewers' Congress recently met in Boston, Mass., and from the report of the proceedings, we glean the following statistics of the industry in this country. A steady increase in the consumption of beer of a million barrels per annum shows that, the more people drink, the more the appetite for drink increases. The capital invested is stated as $89,108,230; 1,113,853 acres of land are required to produce the barley, and are cultivated by 33,753 men; 40,099 acres are devoted to hop culture, requiring the work of 8,020 people; and 3,566 hands are employed in the malthouses.

### MILK FROM SWITZERLAND.

The American process of condensing milk, invented by the late Gail Borden, of Texas, has been everywhere copied in Europe. Large works have been erected in Switzerland, and cows that feed in the finest Alpine pastures now furnish excellent milk for the city of New York. The agents are Messrs. Dudley & Co., 153 Chambers street.

EVERY condition in life has its advantages and its peculiar sources of happiness. It is not the houses and the streets which make the city, but those who frequent them; it is not the fields which make the country, but those who cultivate them. He is wisest who best utilizes his circumstances, or, to translate it, his surroundings; and happiness, if we deserve it, will find us, wherever our lot may be cast.

In the proposed railway up Mount Vesuvius, the engine, which is fixed at the bottom of the plane, sets two drums in motion, round which the metallic cable is wound, by means of which the trains are drawn up and let down simultaneously.

A railway train lately arrived at Algiers, Africa, from Oran six hours behind time, the cause of the delay being that the rails were covered with a thick layer of locusts.

## IMPROVED WIND WHEEL AND WATER ELEVATOR.

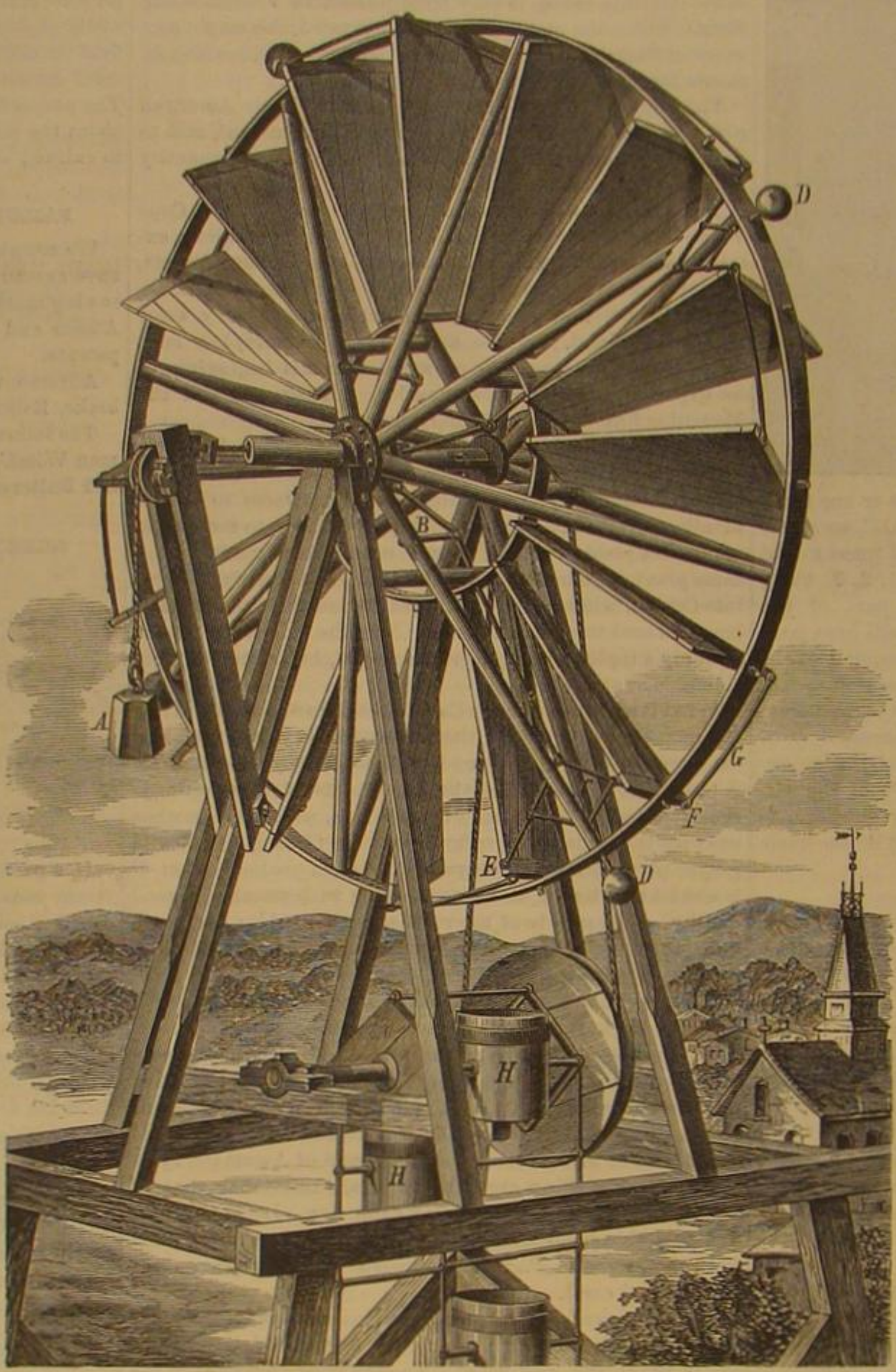
Irregularity of motion, oscillation of turning table and vane, unavoidable use of small wheels on the main shaft preventing the transmission of quick motion when the same is needed, liability to get out of repair, and excessive cost, are objections to the employment of wind power, which the inventor of the device herewith illustrated claims to have overcome. The fans are centrally pivoted to two circles, which constitute portions of the frame of the wheel, and the bearings for the main axle rest upon stationary posts. A is a weight attached to a rod which traverses the shaft and is pivoted in a sleeve which slides back and forth between the arms. To the sleeve are attached jointed rods which are connected with guides, at B, so that, as the sleeve passes back and forth, the rods are given an inward and outward motion. Near the outer extremity of the latter are placed systems of small rods, C, jointed together to form parallelograms, operating on the principle of lazy tongs. From each of these extend three arms, one passing through the outer circle and carrying a ball, D; the second pivoted to the inside corner of one fan, at E, and the third similarly secured to the outer corner of the other adjacent fan, at F. The rods, G, connect these fans with those next to them, so that one shifting rod, with its lazy tongs, governs a set of four fans, which move through the same space at the same time.

In order to stop the windmill, the weight, A, is removed, when the balls tend to bring the portions of the lazy tongs to a position at right angles with the shifting rods, and hence the fans, to a right angle with the wheel. The fans, it is stated, move with equal facility in strong or light winds, no greater force being required to operate them than is necessary to overcome the friction of the different bearings. The power is, besides, through its application diagonally across from the inside corner of one fan to the outside corner of the other, transmitted to the best advantage. For large wheels, we are informed, hydraulic pressure is used to equalize the motion.

The water elevator consists of a series of buckets, H, which are pivoted, a little above their centers, between every two links of an endless chain or band which passes over two pulleys, one at the bottom and the other above the well. The bottom of the bucket swings in, and a projection thereon takes against the upper shaft as the vessel is carried over. This causes the latter to empty, with little splash, into the conduit provided, in which the water is conducted to any desired point.

It will be seen that the construction of the apparatus denotes considerable strength, as it is built on the plan of a wagon wheel, the fans serving as spokes. The inventor states that it is almost impossible to blow it to pieces.

The machine, combined with a pump and also with the elevator described, was exhibited at the Kansas State Fair, last fall, and received five first premiums, and also commendatory notice from the State Board of Agriculture.



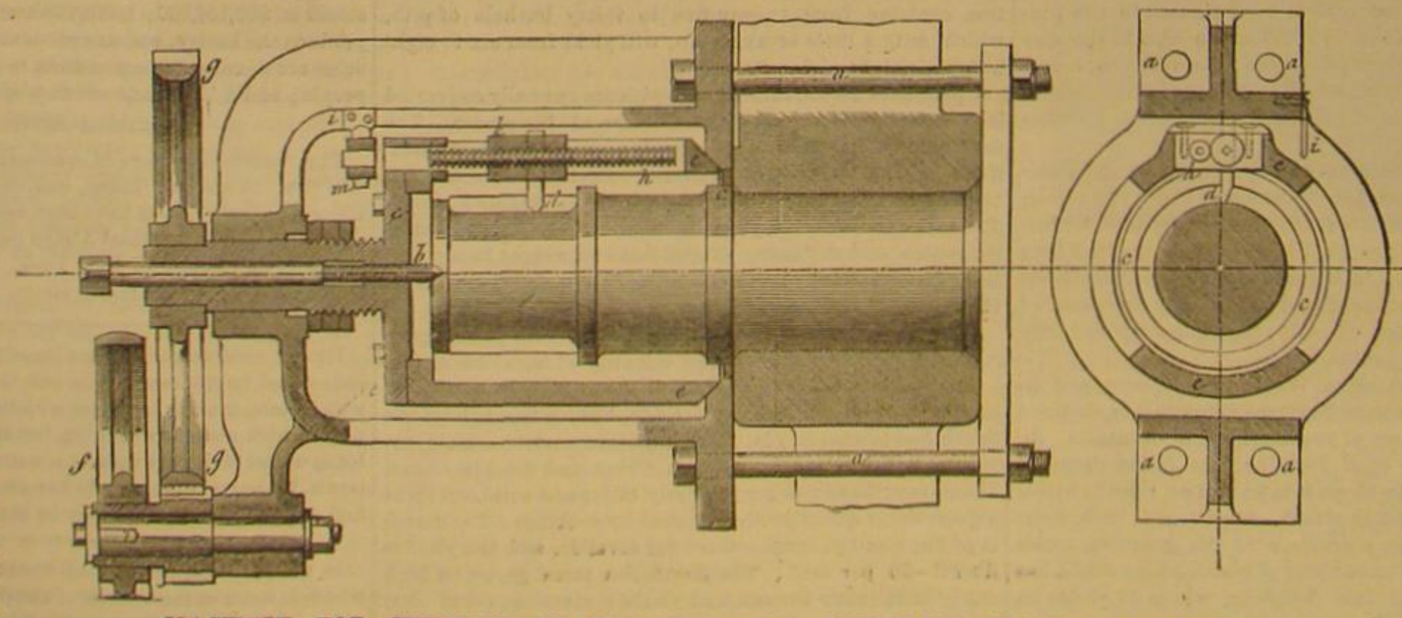

IMPROVED WIND WHEEL AND WATER ELEVATOR.

Patented March 17, 1874. For information pertaining to manufacturing or royalty, or relating to purchase of wheels, address the inventor, Mr. J. N. Dietz, Salina, Saline county, Kansas.

## MACHINE FOR TURNING CRANK PINS AND JOURNALS OF LOCOMOTIVES.

In this apparatus, for the engraving of which we are indebted to the Belgian *Bulletin du Musée*, the tool is fixed immediately against the pin or journal by four strong screw bolts, *a*, and is set in motion by the driving pulley, *f*, to which a belt is carried; centering on one side is effected by the point, *b*, and on the other, by the ring of the pin and the annular piece, *c*.

The tool, *d*, which acts on the cylindrical surface, is placed on the circumference of a tool carrier, *e*, which is rotated by the pulley, *f*, through the cog wheel, *g*. The advance motion of the tool, parallel to the axis of the pin, is gained by means of a screw, *h*, at the rear extremity of which is fixed a wheel, *m*. Each time that this wheel strikes a shoulder, *i*, the screw turns, and the support, *k*, advances with the tool. The working of the apparatus is readily understood from the illustration.



MACHINE FOR TURNING CRANK PINS AND JOURNALS OF LOCOMOTIVES.

### Treatment of Gold Fish.

Seth Green says this as to the proper care and treatment of gold fish: Never take the fish in your hand. If the aquarium needs cleaning, make a net of mosquito netting and take the fish out in it. There are many gold fish killed by handling. Keep your aquarium clean, so that the water looks as clear as crystal. Watch the fish a little, and you will find out when they are all right. Feed them all they will eat and anything they will eat—worms, meat, fish wafer, or fish spawn. Take great care that you take all that they do not eat out of the aquarium; any decayed meat or vegetable in water has the same smell to fish that it has to you in air. If your gold fish die, it is attributable, as a rule, to one of three causes—handling, starvation, or bad water.

### Asiatic Handsaws.

Handsaws in America and England have the teeth pointed from the handle, while in Asiatic countries and in Greece they are made with teeth pointed the other way. The latter must be operated by pulling them, the former by pushing. In delicate work, and where very fine small saws are used, the Eastern saw is the best. The Orientals differ from us in setting the teeth of the saw also. They turn a group of a dozen one way, and the next group the other, while we alternate, one on one side, the next on the other.

### Improvements in Bleaching.

M. Pierre Isidore David, a French chemist, has invented the following processes:

Chlorine in the gaseous state is produced in a closed receptacle by one of the ordinary methods, for example, by the action of an acid on chloride of lime diluted with water, and is conveyed by a tube into a chamber containing the articles to be bleached, the sides of such chamber being constructed of a transparent material in order to permit the entrance of light, which assists considerably the process of decolorization. After an interval, varying with the nature of the articles to be bleached, he sends into the chamber a rapid current of carbonic acid gas, obtained by any of the well known processes. The apparatus in which the carbonic acid is generated communicates, however, with a vessel containing liquid ammonia, the fumes of which combine with the carbonic acid, and are conveyed into the chamber, where the two gases neutralize the hydrochloric acid, and accelerate the decolorization of the materials contained therein. The ammonia should be contained in a vessel of such a shape that the evaporation surface of the liquid can be augmented or diminished according to the quantity of chlorine employed.

In the second process, permanganate is obtained by the action of peroxide or binoxide of manganese on lime aided by heat, preferably in the following manner: One part by weight of peroxide of manganese and three parts of quick lime in powder are mixed together and submitted to a red heat for about three hours. When the heat has been continued for one hour, however, a rapid current of carbonic acid is passed through the mixture and continued till the completion of the process, the object being to superoxidize the compound. The permanganate of lime thus prepared is placed in a closed receptacle, which communicates by a tube with the bleaching chamber, commercial sulphuric acid is gradually added, and "ozonized oxygen" is evolved. In order to accelerate the evolution of this gas, the inventor adds a vegetable acid in quantity equal to the oil of vitriol, acetic acid being preferably used.

In the third process, M. David employs phosphorus and acetic acid. The production of ozone by means of phosphorus in a moist atmosphere is well known, but the quantity thus obtained is very small. By causing air which has been previously forced through acetic acid to bubble through the water containing the phosphorus, the patentee has discovered that the quantity of ozone is considerably increased. The ozone is conveyed to the bleaching chamber in the same manner as before described, the air being forced through the liquids by means of a fan or any other of the well known methods of obtaining a current either by pressure or exhaust.

The fourth process consists in the use of chalk, alum, and sulphuric acid. A saturated solution of alum is prepared at a temperature of 140-160° Fah., into which powdered chalk is thrown, about equal in weight to the alum employed; sulphuric acid is then added, and the gas evolved is conveyed by a tube to the bleaching chamber, where it effects the desired object.

It will be seen that in three of the four processes chlorine is dispensed with, and the formation of hydrochloric acid avoided. When the articles are removed from the bleaching chamber, it is desirable to expose them for a time to the action of the atmosphere in order to remove the characteristic smell of ozone. These processes are claimed by M. David to be applicable to the decolorization of raw or worked materials, especially those which from their shape or nature do not admit of immersion in liquid; they are also specially adapted to the bleaching of books, papers, and engravings. Oils and fatty matters may be decolorized by them; alcoholic liquids may be "improved" or "aged," as it is called, by the oxidizing properties of the ozone; fermentation may be arrested and unpleasant flavors removed; and they may be speedily converted into vinegar or acetic acid. M. David asserts that his processes will be found more economical than those at present adopted.

## EFFECTS OF AIR PRESSURE ON ANIMAL LIFE.

A series of brilliant and remarkable experiments have recently been conducted in France by M. P. Bert, having for their object the determination of the influence of changes in barometric pressure, either augmentations or diminutions, upon animals. The author, in submitting the results of his investigation, states that both men and inferior animals which live on elevated land are submitted to a pressure the weakness of which, in proportion to that at the sea level, cannot be without its effect upon their organizations. Important cities, in fact, exist at altitudes above 9,600 feet, and the high plateaus of Anahuac, Mexico, are populated by thousands. There are, besides, industrial pursuits which require workmen to labor in a strongly compressed atmosphere in submerged caissons, as are employed in bridge building, in the operation of sinking wells, in the descent of diving bells, and in pearl, coral, and sponge fishing.

In describing the discoveries of M. Bert, to the experimental demonstration of which we shall shortly pass, it is necessary first to remind the reader that the actual tension of the oxygen in the air which we breathe is equal to one fifth that of the atmosphere, since the gas constitutes 0·21 of the composition of the latter. Now this tension may be increased by compressing the air, so that air containing 42 per cent of oxygen will correspond to ordinary air at two atmospheres pressure, and so on, relatively, upwards. Inversely the tension of a semi atmosphere, equal to 14·8 inches of mercury, will be 10·5; of one third atmosphere, 7, and thus down.

The researches of M. Bert show that the atmospheric pressure never acts by any mechanical or physical influence, as has been heretofore supposed, but solely by causing the tension of the oxygen to vary, and hence the conditions of the combinations of that gas with animal blood and tissues. When the pressure decreases, animals and vegetables are menaced with death by simple suffocation, due to a privation of oxygen. When the opposite state of affairs occurs, death likewise supervenes, due to the poisonous effect of the excess of oxygen.

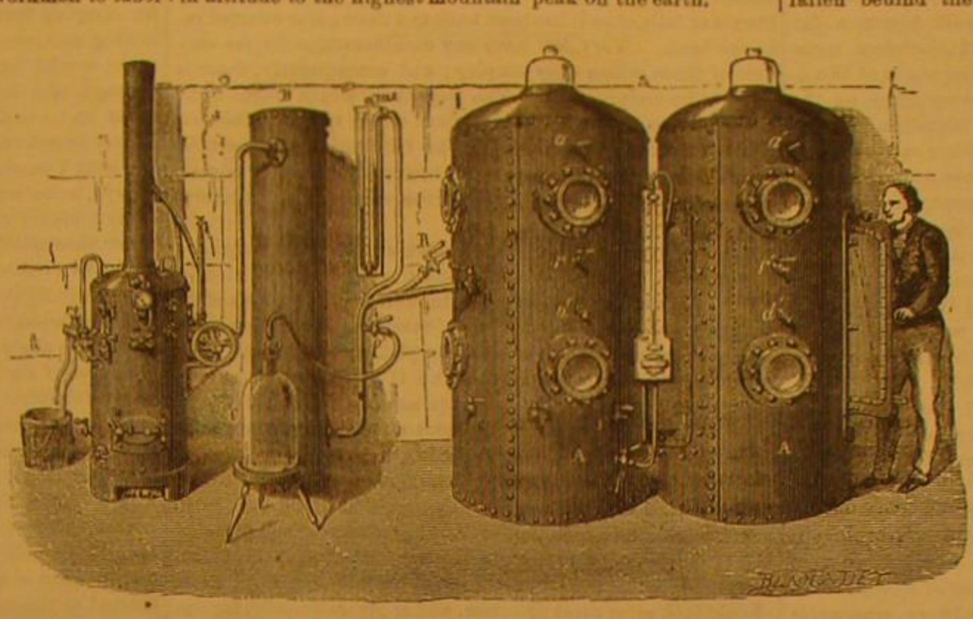
In the following description, the experiments upon the results of diminution of pressure are detailed, and in a succeeding article we shall notice the investigations bearing upon the effects of opposite conditions. In order to experiment upon large animals, M. Bert, constructed the apparatus represented in Fig. 1. A A' are large cylinders containing heavy glass windows. B is another cylinder, in which a vacuum is formed. C is a bell glass in which, by means of B, a vacuum may be instantly produced. R R' are cocks communicating with the cylinders; *r*, *d*, and *s* are other cocks for removing blood, etc. At *a a'* are the thermometers, and at *m m'*, manometers. The boiler shown at the left operates a steam air pump, which, in connection with the apparatus, produces low pressures of air in the cylinders.

In order to determine the gases in the blood, a dog was fixed on a sort of semi-circular frame (Fig. 2), which fitted exactly into one of the cylinders. The carotid artery being exposed, a tube was conducted therefrom and carried to the exterior of the cylinder. By suitable devices the blood could be drawn at any moment without causing coagulation or allowing the surrounding atmosphere to enter the artery. The drawing was done by the operator outside, by means of a graduated syringe, and the gases were removed from the fluid by a peculiar pump.

From numerous analyses thus conducted, it appeared that below a pressure of 21·4 inches there was an increasing diminution of the oxygen in the blood. From 20 volumes of oxygen to 100 volumes of blood at the above barometric hight, the decrease proceeded as follows: 17·5 inches, 16 volumes; 13·6 inches, 12 volumes; 9·7 inches, 10 volumes; 6·4 inches, 7 volumes. In other words, below 11·7 inches the arterial blood is poorer in oxygen than ordinary venous blood.

A very striking experiment showed clearly that the suffocating effects were due to the preponderating influence of the tension of the oxygen and not to the almost null results of barometric pressure. A sparrow was placed under a bell glass, in which a gradual depression was produced. The bird appeared very ill at 9·7 inches, and fell apparently dying at 7·8 inches. Normal pressure was then re-established by admitting oxygen. The bird recovering, further depression was proceeded with, when the same effects did not take place until from 7·02 to 5·8 inches. Oxygen again admitted caused a second revival, and, finally, it was shown that the diminution might be carried to 2·7 inches without killing the animal.

Not content with thus proving the truth of his theories upon lower animals, M. Bert, in order to determine the sensations experienced, entered the cylinder himself. At a pressure of 17·5 inches, he experienced the sickness known as *mal de montagne* accompanied by nausea and weakness, the pulse increasing from 60 to 85 beats. At this moment he admitted and breathed an artificial atmosphere containing 75 per cent of oxygen. Instantaneously the illness disappeared, and the pulse returned to its normal condition. The investigator remained in the cylinder without inconvenience when the barometer marked 9·7 inches. This corresponds to a hight of 28,820 feet, a point above that at which Glaisher, in his celebrated ascent, fell senseless, and equal in altitude to the highest mountain peak on the earth.

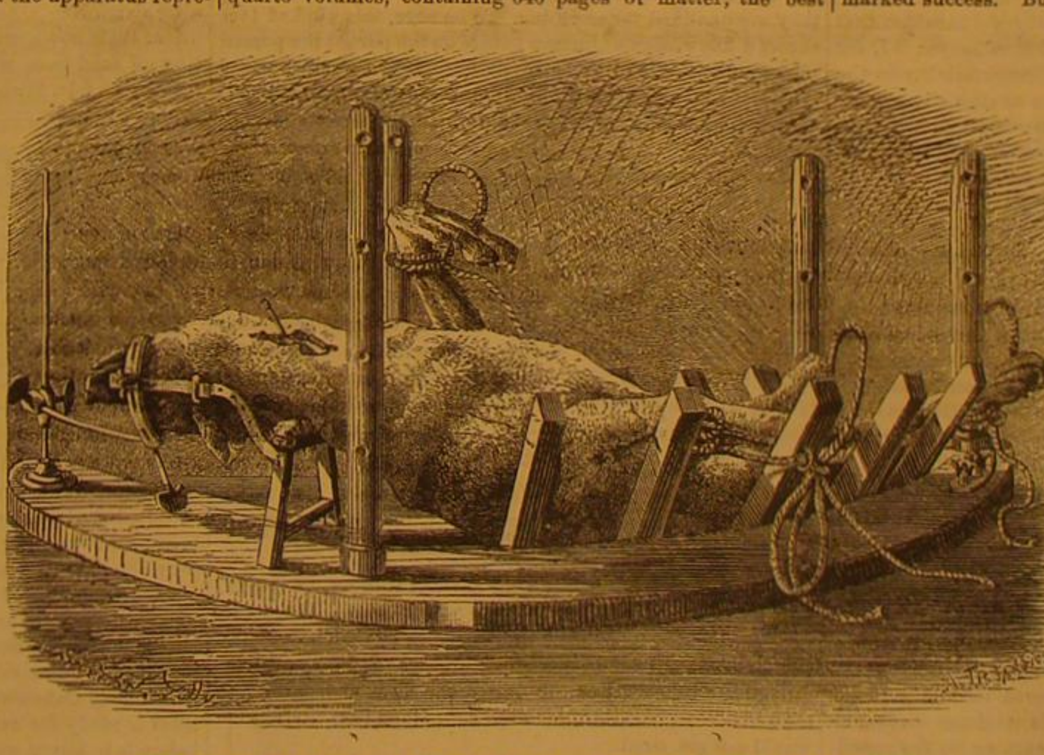


BERT'S APPARATUS FOR NOTING EFFECTS OF AIR PRESSURE.

It would appear, therefore, that, through M. Bert's discoveries, explorers will be enabled to ascend elevations hitherto deemed inaccessible, and aeronauts to penetrate regions of our atmosphere where life, under ordinary conditions, cannot exist.

### European Ordnance.

The United States Government, being in quest of a system of rifled ordnance, sent a naval mission to Europe four years ago to inspect the chief gun factories in the principal countries in Europe, and to report upon the systems of ordnance in course of manufacture. This has resulted in two quarto volumes, containing 640 pages of matter, the best



MODE OF PLACING ANIMALS IN BERT'S AIR CYLINDER.

half of which is devoted to the ordnance produced in Great Britain and the remainder to the Continent. Considerable discrimination has been shown in selecting salient points for detail, and much impartiality in describing the merits of the various systems, both of construction and of rifling, etc. Admitted to the principal factories of Europe, the American naval mission made good use of eyes and ears, and the result is a compilation of varied information which only needs an index—strange omission—to prove of great service both to the manufacturer and to the artillerist.

Amongst the factories visited in England: Woolwich, the London Ordnance Works, Whitworth's, Jarrow, Barrow-in-Furness, and Low Moor are duly honored, the system of construction at the Royal Arsenal and by Messrs. Vavasseur being carefully detailed; while the treatment of the ore at Jarrow and Low Moor, etc., is carefully described, as well as the production of steel by Firth and by Whitworth. Our gunpowder factories, dockyards, iron plate rolling, torpedoes, and naval organization are not forgotten. Our own naval men may learn from their United States brethren some important facts connected with their own weapons, which have hitherto been shut up in the archives of the War Department. It is, however, when the naval mission passes to foreign ordnance factories that interest is chiefly awakened. Little is known in this country of foreign ordnance, except that nearly every country in Europe has obtained Woolwich guns and projectiles for experimental comparison with their own, and they one and all have rejected both the construction and the rifling in favor among English soldiers. Holland does, it is true, import Armstrong (Woolwich) guns and projectiles for its few ships of war; but its army adopts the French breech loader. For a time the Austrian naval armament was divided between Krupp's breech loaders and Armstrong's (Woolwich) muzzle loaders, but the short life of the latter has led to its being discarded. France, which has fallen behind the race of ordnance construction, gave the Woolwich system a patient and exhaustive trial, with the like result. Italy is striving manfully to work out a system of its own. Russia and Germany have given themselves over unreservedly to the Krupp system.

All heavy ordnance are now built with steel barrels, this material being found best capable of withstanding erosion from the powder and indentation by the shot. But much divergency occurs in the mode of supporting the barrel by exterior layers of metal. Woolwich obtains support by coiling, round the steel barrel, bars of wrought iron. Vavasseur supports the barrel by shrinking on hoops of steel, so regulated that the first layer of hoops shall not come into serious operation until the elasticity of the barrel has been developed. Krupp, who has been gradually assimilating his construction to that of Vavasseur, first by abandoning block steel for the breech, and then abandoning it for the chase, still makes the barrel much thicker at the inner end than is found desirable in this country, and so shrinks on the outer hoops as to cripple the elastic action of the barrel. The French have adopted a system of construction which would be tolerable enough in conversion of old cast iron guns into rifled ordnance of an inferior order, but is without any merit but cheapness in new pieces. A steel half barrel is imbedded in cast iron, and further supported by steel hoops over the powder chamber. By this means the elasticity of the steel half of the barrel is crushed, and a joint with cast iron formed in the interior. The idea was, probably, taken from Parsons' system of converting old smooth-bore cast iron guns into rifled ordnance, which was tried in France with most marked success. But if so, we can hardly think the new plan an improvement on Parsons' method of inserting a full length steel barrel into the old cast iron bore, and supporting the powder chamber by steel jackets in contact with the barrel.

The Palliser conversion differs from the Parsons, chiefly in employing a barrel of wrought iron, a material too soft to endure large charges or the hammering of loose heavy projectiles. But the strangest system of converting cast iron smooth bores into rifled ordnance is that adopted in Holland, of lining the bore with bronze, a soft material quite incapable of withstanding the heat and rush of gases evolved in the combustion of large charges.

Belgium employs a cast iron barrel, supported, from breech to trunnions, by two tiers of steel rings or hoops. But as this country has no navy, it does not require very heavy ordnance, and its experience in this direction is not so great.

Next to the material and system of construction, the question of breech *versus* muzzle loader demands attention. Recent experiments have shown that an enlarged powder chamber, in permitting a reduction in length of the cartridge and thus placing all the powder more nearly equidistant to the point of ignition, improves the combustion, and adds largely to the velocity and striking force of the projectile. This enlargement of the diameter of the cartridge beyond that of the bore can only be attained by breech loading. The plan of closing the breech originally adopted in this country, having proved very faulty, the principle was discredited, and the system abandoned. But wherever the naval mission of the United States went on the Continent, they found breech loading in favor, so that of all the considerable States of Europe, England, stands alone in its use of muzzle loaders.

The difficulty of preventing the escape of gas at the breech naturally increases with the amount of gunpowder and weight of shot employed. But it would appear that the Broadwell ring [an American invention], now generally in use with the heavier breech loaders on the Continent, and in a modified form used by Vavasseur in this country, appears effectual to that end. Krupp's breech closing arrangement is free from all the objections which led to our discarding the Armstrong system, and deserves the commendation given it by the naval mission.

The real difficulty in ordnance lies, however, in the projectile. To contrive a projectile which can be driven most rapidly out of the gun, without wriggling in the bore, with its center coincident with the axis of the piece, and with the minimum of strain upon itself and the gun, while receiving the impress of a rotation proportionate to its length, has exercised many minds. Though the lead-coated projectile of Krupp has many excellences, high velocity or great penetration cannot be amongst the number, inasmuch as the drag through the barrel resists high speed, and the peeling off the lead coat in passing through armor impedes perforation. Vavasseur's copper-ringed projectile would compare favorably in both these aspects. And either would ensure a far steadier passage through the barrel, and therefore more equable powder pressures,than the balancing studs of Woolwich. France appears to have adopted copper rings on the projectiles for its new breech loaders. Objection may be taken to the overhang, unsupported at either end of these shot; but as the ring bites the grooves above as well as below, there is none of that balancing movement which is present wherever a windage shot touches the bore only at the two studs beneath and is free all round its body. If the long iron bearing and centering devices, employed in muzzle loaders by Vavasseur, Scott, Lancaster, and Whitworth,could be efficiently employed in breech loaders, we should expect higher velocities and better penetration than from any compression system of rifling. The difficulty is not insurmountable of preventing these windaged projectiles overshooting their seat when loading from the breech. Withworth has breech loaders on his system, but of small caliber, where the difficulties are small, and we can hardly accept this evidence as alone decisive in favor of the employment of windaged shot in breech loading ordnance.

The dispassionate tone adopted by the naval mission of the United States in describing the ordnance of Europe lends weight to their impartial descriptions and very reasonable recommendations; so that, whether we adopt their conclusions or not, we cannot but listen respectfully to their suggestions. The sum of their recommendations is that the Vavasseur system of construction is the best in Europe; the Parsons system of conversion, most suitable for old guns. Breech loading cannon being universal except in England, the breech closing arrangement of Krupp, with the Broadwell ring for "gas check," is regarded as best for adoption, while projectiles should have the copper rings of Vavasseur.

The Woolwich system is honored in being made the standard of comparison with that of the civilized world, with the result, however, of being declared inferior to the Vavasseur and Krupp; and the concluding paragraph of this extensive report is reserved for a condemnation of the studded projectile in favor at Woolwich, which is the chief offending cause that has landed us in such artillery difficulties that Rear Admiral Sherard Osborn, C. B., F. R. S., says: "I, for one, do not desire to take any share of responsibility in the great gun *fiasco*, which, I fear, awaits us on the commencement of a war with a first class naval power."—*Iron.*

### The Education of Artisans.

Since the application of steam as a motive power for the production of almost every commodity required by man,everything seems to be wanted in a hurry; and for smart, intelligent workman of every craft, a continually increasing demand is plainly observable. But in nearly every calling thoroughness has been hitherto sacrificed to the impatience of customers, and we seem to become the more pressing the quicker we are served. The consequence is that the mechanical arts are cut up into branches, and the artisan, who should know all about his business,is made a mere expert at one particular part. Whatever a workman is quickest at like a machine, that he is kept to; and as long as he earns a living by that one thing, it is ten to one if he ever seeks to know any more. Were he compelled to turn his hand to other parts of his business, he would have to occupy in a useful way, in order to qualify himself for the performance of task by which he earned much brain work, he is the more easily led into idle pastimes, in which he often indulges to excess. His comparative prosperity makes him consequential. If he were made his daily bread. But this being secured to him without to feel that on the completeness of his abilities depended the bread which he is in the habit of earning by the repetition of a mere mechanical performance, which through constant practice becomes of no trouble to him, his mind would receive a new stimulant with each different job, and study would be the result.

Being thus compelled to see for information, his mind would be led into the parts of true knowledge in the search, and, once fairly started on that road, he would not be long until he could discern sound argument from bombast. There is much talk at present about technical education; but before the attainment of it will bear any fruit, the system of parceling out must be changed. When a boy is apprenticed to the tailoring trade, if he proves any way smart at making a vest, he never will get the chance of making trousers; and if he be quick at the latter, he will never be asked to put a stitch in a coat. What is the use of teaching the theory of any trade in schools with such a practice in existence?

In the building trade, we have masons or stonecutters who are not expected to set the stone they have wrought; wallers who turn no arches; bricklayers who dress or set no stones; and hundreds who could not read a drawing or get out a mold by which to work. Among those who are called joiners, we have men who make sashes they could not hang, and who never saw a "mouse" in their lives. We have "fixers" who, as a rule, make nothing they put up; and "framers" who would not be able to perceive the same angle in two different positions. We have "staircase hands" who affect to despise everything else connected with the construction of a building, and who, as a rule, look upon themselves as gods of wood, although they never made a circular headed sash in the whole course of their existence. Well planned houses suffer in their erection through this practice; for the "bench hand," who has been kept for a number of years at what he can do quickest, is often necessitated to turn in with a crowd of "fixers" and scrape away as best he can.

Considering the present system, it would appear that, with most builders, profit alone is the *alpha* and *omega* of every undertaking. It looks as if they do not care whether a house stands or falls,after it has been built and their gains counted into the bank. Very few have any considerations for the welfare of those whom they employ; and consequently, there is little or no reciprocation. The workshop, which ought to be conducted on the principle of a school where technical instruction is imparted, as well as for the fabrication of an article which brings a profit, is very often superintended by a man chosen more for his driving qualities than for his information.

It is seldom that a man capable of imparting what he knows is met with in such positions, and the generality of men in charge are cross and intemperate in their language, instead of being kind and considerate. As to receiving instruction, men are left very much to themselves to pick up that which they would sooner and better understand if explained by a man competent to do so. The language used by the generality of foremen, too, is very often the most abusive and sometimes revolting, such as no man aspiring to are spectable position in society should be heard giving utterance to. The susceptible dull youth of one and-twenty is sneered at if he chance to ask the foreman a question concerning his work, and mulcted out of money, or wheeled into paying for beer, for the information which he receives from his older fellow. Capitalists should look after these practices, and apply a remendy, for one or two hours' prefatory instruction or forethought often saves a great amount of labor. Those who cannot see before them lose much time groping their way, and obviously the loss is to the employer. It is often said that the workers are not expected to be thinkers. In fact, the remark is frequently made: "You are paid for working, sir, not for thinking," addressed as a reprimand to those who gave such a reason for being caught, as the man in charge might suppose, wasting the employer's time. This is, too, without the least inquiry concerning the truth of the assertion. The result of this system is that men who would otherwise seek to become intelligent and useful in a general sense, lay down their minds to become expert at one or two things, and in many cases sharp only at what is called "shaping," that is, by their bustling about and wielding their tools juggler fashion,making people believe they are qualified for anything. To be sure, this kind of tact shows a knowledge of human nature on the part of the person who employs it, and the present system is the chief cause that leads many to resort to it; but also shows the weakness, superficiality, perhaps vanity, of those who are the victims.

If it were the practice that the foreman was bound to call his apprentices and men together once or twice a week, say for an hour, or even half an hour, at a time, and give them a lecture during working hours upon some technical subject, hundreds would be very thankful, and willing to subscribe to the expense. After working hours, very many working men do not like attending lecture halls for such a purpose, and they would be more at home in a class got up specially for themselves, and particularly when it would be taught where every practical appliance necessary for demonstration was close at hand.—*The American Builder.*

## Correspondence.

### Horse vs. Steam Power.

*To the Editor of the Scientific American:*

I see that, on page 346 of your current volume, W. F. W. asks which is most efficient, a two horse steam engine or two horses weighing 2,000 lbs., when used in an endless railway power. The answer to this query states that usually an engine of one horse power will do more work in the same time than one horse could do, with the advantage that the engine would not get tired.

I desire to state that, from numerous statistics from English and French authorities for a century past, together with over thirty years' experience in the application and use of animal power as a substitute for manual labor, and numerous and exhaustive trials with all motors, especially horses and steam power, I am satisfied beyond a possibility of doubt that any two good work horses, of two thousand pounds weight, can walk eight hours each day at the rate of about $1\frac{1}{4}$ miles per hour upon a moving plane at an inclination of from 13° to 15°, without fatigue or injury,for six days per week for their natural working life; and this, upon a well designed and constructed endless railway power, will cause them to exert an average constant power equal to about 82,500 foot pounds per minute, or equal to $2\frac{1}{2}$ horse power; from which must be deducted for friction of such power (by actual results) from 11 to 15 per cent, which reduces the force transmitted and utilized to, say, 77,550 foot pounds per minute, or 38,775 foot pounds per minute for each horse, or 1·175 horse power net, transmitted. These data are partially taken from the reports of trials by the United States Agricultural Society and the New York State Agricultural Society during the past ten years.

In regard to small steam engines, I have always allowed and deducted (for their own friction) 25, 30,35 or 50 per cent from their rated power for six, four, two, and one horse steam engines respectively; and a long experience has confirmed in my mind the correctness of this reduction. With poorly designed and poorly constructed horse powers or steam engines, the results would be lessened, while almost invariably the expenses of operating them would be enhanced in a like ratio.

Albany, N. Y. HORACE L. EMERY.

### The Mississippi River.

*To the Editor of the Scientific American:*

Having noticed within the past year a number of schemes to relieve the shipping of the bar at the mouth of the Mississippi river, I intend to bring before the government a plan for carrying vessels, not over but through the bar, in the following manner: I would build a propeller to draw as much water as the largest ship that will be required to be towed through the bar. She should be as short as possible, in order to be easily manipulated and not require too much ballast to get the required draft. In or near the bottom of her hold,I would place a sufficient number of immense force pumps, to be worked by steam. I would have five iron discharge pipes, of nine inches diameter, to discharge their water through the steamer's cutwater, one above the other, well down below the mud line. The two lowest pipes are to point slightly down in order that the water will pass under the boat when she is in motion. The pipes are to come flush with the outside of the boat and to be reduced to a diameter of six inches at the point of discharge, to give the water velocity. Then I would have three seven inch discharge pipes, contracted to five inches at the mouth, on each bow, one above the other, well down under the boat and pointing down and forward at an angle of 30°. Then I would have a row of seven inch discharge pipes about 10 or perhaps 15 feet apart, along the whole length of the boat on each side, well down under her sides and pointing down and forward at an angle of 30°. Those pipes are to be contracted at the mouth to five inches diameter. I propose also one six inch pipe to discharge its water down through or alongside the keel, well forward under the bow. The feed or suction pipes are to take the water as near the surface as possible, in order to use clear water.

I believe such a boat would tow any ship or steamer through the bar at the mouth of the Mississippi river with perfect ease and safety. She would have a perfect volcano under her, constantly bursting up through the mud and sand and leaving behind her an immense channel. And as she would be constantly tearing the bar to pieces, the ebb and flow of the river would in a great measure remove the bar altogether. I think there is no plan by which the obstructions can be so cheaply overcome, as one such boat will do all the towing both in and out of the river.

A powerful force pump put on board of the steamers running above New Orleans, to throw a powerful stream or two under their bows, would be a great assistance to them in getting off sand bars, where they often get stuck fast.

Presque Isle, Mich. SIDNEY COOK.

### Prices of Gas.

The following are the current rates for gas paid by consumers, per 1,000 feet:

| | | | |
|---|---|---|---|
| Albany | $2.50 | Rochester | $3.50 |
| Baltimore | $2.75 | St. Louis | $3.25 |
| Boston | $2.50 | Syracuse | $3.25 |
| Chicago | $3.37½ | Troy | $3.25 |
| Cleveland | $2.50 | Washington | $3.56 |
| Concord | $3.20 | Hamilton | $3.00 |
| Harlem | $3.00 | Kingston | $3.50 |
| Lowell | $2.75 | London, Canada | $3.00 |
| Manchester | $2.70 | Montreal | $2.60 |
| New York | $2.75 | Quebec | $2.80 |
| New Orleans | $3.00 | Toronto | $2.50 |
| Oswego | $3.50 | | |

A writer in the Boston *Cultivator* finds that most of the so-called strained honey sold in bottles is composed as follows: Cane or other sugar is melted in a decoction of slippery elm bark in water. Some manufacturers use, instead of elm, a solution of gum arabic and starch, to give it consistency and save sugar; but this last does not resemble honey so much when dropped, as it lacks the stringy appearance. These mixtures,with or without the addition of a little cheap Cuban honey, are flavored with essence, and the mess is ready for sale. The only true way to obtain real honey is to buy it with the comb.

TO DESTROY MOLES.—Bryan Tyson, Washington City, gives the following method for making pills to destroy moles: Make a stiff dough of corn meal, mixing with it a small quantity of arsenic. Make a hole with a finger in the runways, drop in a lump of dough about the size of a marble, and then cover over with a lump of earth to exclude the light. After the first rain, go over the field again and deposit in all freshly made roads. I once concluded to plant a piece of sandy bottom land in sweet potatoes; but as it was much infested by moles, my success depended on first exterminating them. A few doses of arsenic given in the way described brought about the desired result, and it was a very rare circumstance to see the track of a mole in this piece of ground during the entire summer.

CHARGES FOR MACHINE TOOLS A QUARTER OF A CENTURY AGO.—The following is interesting as showing the cost of work done on machine tools twenty-five years ago. We give the charge per day for use of tools: Large boring mill, $17.50; medium boring mill, $12; large punching machine, $25; heavy lathe, $15; small lathe, $5.50; large drill, $8; medium drill, $4.50; large planer, $7.37½; medium size planer, $5.33⅓; forge (with smith and helper), $10; small forge (with smith and helper), $5. Machinists received from $1.95 to $2.15, and boiler makers, from $1.75 to $1.90.

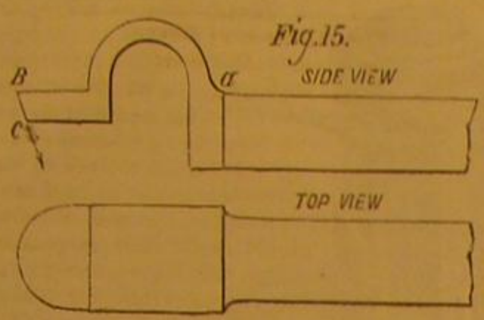
## PRACTICAL MECHANISM.

NUMBER III.

BY JOSHUA ROSE.

THE SPRING TOOL.

Fig. 15 is a spring tool, which is specially adapted to finishing sweeps or curves, and may be used on either wrought or cast iron, or brass; the only difference in shape required to fit it for such various uses is to give it less top rake for cast than for wrought iron, and less for brass than for either. The fulcrum off which it springs is at the point, *a*, because that is the weakest part (since the cutting edge, B, is at a leverage to *a*); the line of spring of the edge, B, is therefore in the direction of the dotted line, C, which is away from its cut, so that it will give way to the metal rather than spring into it, which causes it to recede from the harder and spring into the softer parts of the metal, rendering its use unadvisable except for finishing curves, which it will do more smoothly and cleanly than any other tool, especially when necessity compels it to be held far out from the tool post.



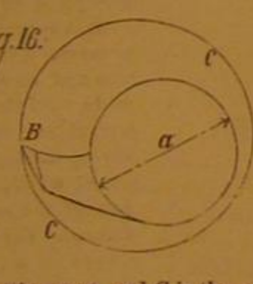

BORING TOOLS.

Standard bits and reamers have superseded the use of boring tools for all special and many other purposes, but there are numerous cases where a boring tool cannot be dispensed with, especially in repairing shops and for promiscuous work.

The boring tool is very subservient to spring in consequence of its cutting edge being in most instances far out from the tool post, and also from the slightness of the body of the tool when used to bore holes of a comparatively small diameter.

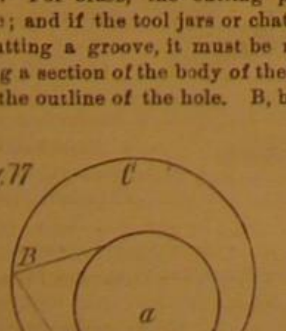
It should, when used for wrought iron, always be placed so that its cutting edge is a little below the center of the hole, in which case the bottom of the body of the tool is liable, in small holes, to bear against the bottom of the hole, unless the cutting part is made to be a little below the center of the body of the tool, rendering it rather difficult to grind on the top face; it is not, however, imperatively necessary to grind it there, since it can be sharpened by grinding the side faces; and the advantage gained by being enabled to get, into a given sized hole, a stouter tool than otherwise could be done, and, as a result, to take deeper and more nearly parallel cuts (for these tools generally spring off their cut at the back end of the hole, leaving it taper unless several light cuts are taken out) more than compensates for the extra wear of the tool, consequent upon being able to grind it upon one part only.

Fig. 16 represents a section of a boring tool, as above described, for use on wrought iron. *a* is a section of the body of the tool; B is the cutting part, and C is the outline of the hole to be bored.

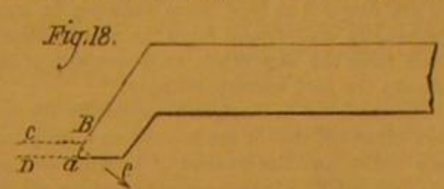



Very little bottom rake need be given to the tool, so that, when it springs from the pressure of the cut, it cannot enter the cut deeper than is intended, because of the side rake coming into contact with the side of the hole. It may, however, possess a maximum of top rake.

Boring tools for cast iron require less top and more side rake, and to be placed at the center of the work or even a little above the center. For brass, the cutting point, B, should have no top rake; and if the tool jars or chatters, as frequently occurs in cutting a groove, it must be made as shown in Fig. 17, *a* being a section of the body of the tool, B, the cutting part, and C the outline of the hole. B, being the lowest point of the top face, possesses negative top rake, and a corresponding tendency to scrape rather than cut keenly. The point, B, should always be above the center of the hole, so that, in springing, it will spring away from and not into its cut. Less top rake is required, if the point, B, of the cutting edge is ground so as to be used for screw cutting than if for taking plain cuts.




When the skin of the metal to be cut is unusually hard, as frequently occurs in cast iron, the shape of the cutting part of the boring tool must be such that its point will enter the cut first, so that it cuts the inside and softer metal. The hard outside metal will then break off with the shaving without requiring to be cut by the tool edge, while the angle of the cut will keep the tool point into its cut from the pressure required to break the shaving. A tool of this description is represented in Fig. 18. *a* is the point of the tool, and from *a* to B is the cutting edge; the dotted lines, *c* and D, represent the depth of the cut, *c* being the inside skin of the metal, supposed to be hard.




The angle at which the cutting edge stands to the cut causes the pressure, due to the bending and fracturing of the shaving, to be in the direction of *e*, which keeps the tool point into its cut; while the resistance of the tool point to this force, reacting upon the cut, from *a* to B, causes the hard skin to break away.

When a cut is being taken which is not sufficient to clean up or true the work, less top rake must be given, as a very keen tool loses its edge more quickly than one less keen. The reason for taking the rake off the top of a tool is that, if it were taken off the bottom, the cutting edge would not be so well supported by the metal, and would have a tendency to scrape, which rule applies both to inside and outside cuts. For brass work, top rake is never applied, because it would cause the tool to jar and cut roughly, bottom rake alone being sufficient to give a tool for brass the requisite keenness.

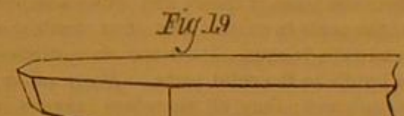


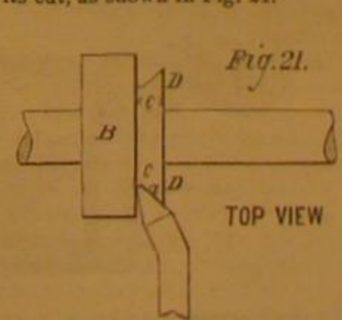

Fig. 19 shows a front tool for brass, concerning which nothing requires to be said, except that it cannot be made too hard, and that the top face must have negative rake when the tool point is held far out from the tool post.

SIDE TOOLS.

Side tools for iron are subject to all the principles already explained as governing the shapes of front tools, and differ from them only in the fact that the cutting end of the tool is bent around to enable the cutting edge on one side to cut a face on the work which stands at right angles with the straight cut. A front tool is used to take the straight cut nearly up to the shoulder, then a side tool is introduced to take out the corner and cut the side face.

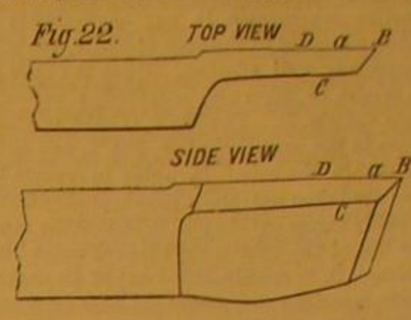

A side tool, whose cutting end is bent to the left, as in Fig. 20, is called a left-handed side tool, and one which is bent to the right, a right-handed side tool. The cutting edges, *a* and B, should form an acute angle, so that, when the point of the tool is cutting out a corner, either the point only or one edge is cutting at a time, for if both of the edges cut at once, the strain upon the tool causes it to spring in.

The form of side tool shown in Fig. 20 is that most desirable for all work where it can be got in: and in the event of a side face being very hard, it possesses the advantage that the point of the tool may be made to enter the cut first, and, cutting beneath the hard skin, fracture it off without cutting it, the pressure of the shaving on the tool keeping the latter to its cut, as shown in Fig. 21.

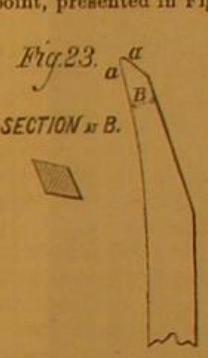



*a* is the cutting part of the tool; B is a shaft with a collar on it; *c* is the side cut being taken off the collar, and D is the face, supposed to be hard. The cut is here shown as being commenced from the largest diameter of the collar, and being fed inwards so that the point of the tool may cut well beneath the hard face, D, and so that the pressure of the cut on the tool may keep it to its cut, as already explained, but the tool will cut equally as advantageously if the cut is commenced at the smallest diameter of the collar and fed outwards, if the skin, D, is not unusually hard.

For cutting down side faces where there is but little room for the tool to pass, the tool shown in Fig. 22 is used, *a* being the cutting edge. Not much clearance is required on the side of this tool, the keenness being given to it by grinding away the edge, C, so that the top face, from C to *a*, is an inclined plane, *a* being the apex. This tool should be so placed that the point, B, cuts a little the deepest, and the cutting edge at the point, D, is clear of the cut, the only consideration with reference to it is how much rake to give it on the face, from C to *a*, which should be less for cast iron than for wrought iron, and more when the metal is soft than when it is hard. Its spring does not affect it to any degree, since it springs vertically and in a line with the face of the cut, and not laterally and into it.




The best form of side tool for cutting brass is the diamond point, presented in Fig. 23, *a a* being the cutting edges. It requires but little side rake upon either the top or side face, and, when held far out from the tool post, should have the rake taken off the top to prevent it from springing. In grinding it, grind only the end (rounding off the corner slightly), so as to preserve the bend upon the end of the tool, which is placed there to give it clearance. It will take a parallel cut equally as well as a side one, and for small work can be used to advantage for both purposes.



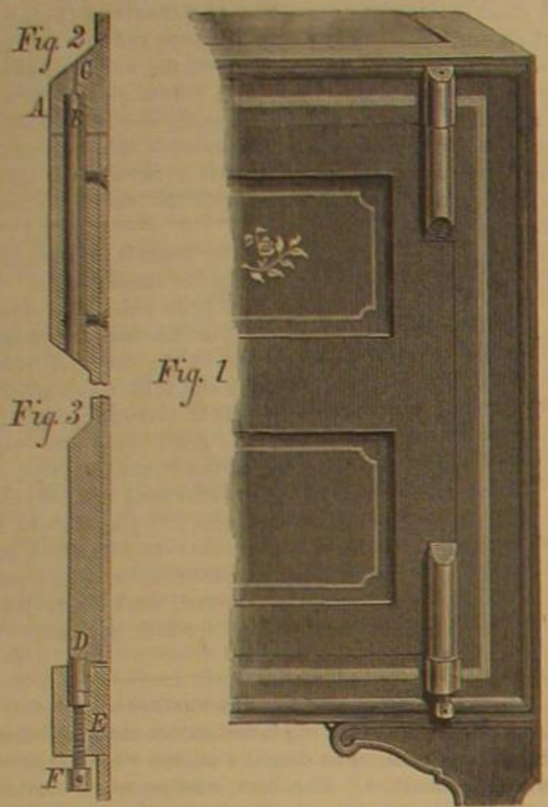

## Vibrations of Liquid Surfaces.

Barthélemy has subjected to investigation the undulations which are produced upon liquid surfaces when these are thrown into vibration. The best results were obtained when the vessel of liquid was placed upon the resonant case of a tuning fork. Similar results were also obtained upon the sounding board of a piano. In this way the surface of the liquid assumed a fixed condition of elevation and depression, the result of uniform vibration over its entire area. Rectangular vessels give two sets of brilliant lines parallel to each side, formed by the ridges of the waves. Between these are less luminous lines produced by the hollows. Bright points are formed at the intersections of both. As the movement dies away, the lines parallel to the shorter sides disappear first, leaving those parallel to the longer; though sometimes components of both are left, forming zigzags diagonally across the surface. From his experiments Barthélemy deduces the following laws: 1st, the breadth of the undulations is inversely as the number of vibrations; and 2d, the distance between two lines produced by the same fork is independent of the density of the liquid. The figures given by circular masses of liquid consist of equidistant circular lines intersected by radii equally equidistant, thus giving trapezoidal forms with curvilinear bases. If the fork touches the vessel, a cross of no vibration appears, corresponding to the nodal lines of this vessel. As the vibration ceases, two opposite sectors disappear and the two alternate ones remain. By placing sand on the surface of the mercury and then covering it with water, circular lines are formed and also the cross of no vibration, the sand gathering in heaps at the vibrating parts. Triangular vessels give lines perpendicular to the sides, forming brilliant hexagons, the centers of which are the angles of fainter hexagons, having the radii of the first set for sides. As the motion lessens, only one set of lines persists, and the surface is covered with rectilinear waves perpendicular to one of the bases. Elliptical vessels give figures of exceeding beauty, the lines having reference to the two axes of the ellipse. The author calls attention to the general character of these wave surfaces. In the basin of a fountain, in the waves of the sea, these forms are recognized. Even in the sand on the sea bottom they can be traced. Certain lines thus made gave on measurement 2·6 vibrations per second. They may be seen 300 feet from the beach and at a depth of 25 or 30 feet. So, out of the water, the sand on the beach was found to have taken these forms, thus suggesting that the air itself was capable of similar vibration. So also clouds are arranged often in parallel bands, being being then considered a precursor of fine weather. Even in geology, the author thinks certain regular and equidistant foldings of stratified rocks evidence of analogous vibrations. The ventral segments of a liquid vein, M. Barthélemy thinks, are produced by the vibration of the liquid mass upon which it falls reacting upon it. And he makes an ingenious application of these facts to account for the phenomena of stratification produced by electric discharges in rarefied media.—*An. Chim. Phys.—American Journal of Science and Arts.*

L. P. S. says "I have run a piece of machinery in rawhide boxes for fourteen years without oil; it is good yet and runs at 4,500 per minute. I put it in while soft, and let it remain until dry." [We are glad to receive notes of this kind, giving results of actual practice. Nearly every one of our readers could send some information that would be valuable.]

## STEVENS' IMPROVED HINGE.

The invention represented in our engraving is a hinge, which is shown applied to the door of a safe, for which purpose it is especially well adapted. Upon the casing or body of the safe is cast, or otherwise attached, a socket, A, into which passes the pin, B. The latter is held in place by the screws shown in the sectional view, Fig. 2, and which have their heads within the safe. In order to remove the door, these screws are taken out; and a punch, pushed down the oil hole, C, speedily forces out the pin, B, in case the same should stick. The top of the door is then moved out a little, when the lower hinge, D, is readily lifted out of its socket, E. F is a set screw, provided to prevent the door from sagging as the tenant of the lower hinge wears away




This invention is quite simple and easily applied, while it appears to be substantial and secure. Patented December 30, 1873, by Mr. Wm. F. Stevens, of Melrose, Mass., who may be addressed for further information.

## IMPROVED PATENT GANG SAW TABLE.

This is an invention specially adapted to meet the wants of users of flooring machines, who have found difficulty in supplying material, sawn in strips from mixed widths of boards, fast enough to keep the floorer in operation. A good machine of the latter description should plane and match from ten to twelve thousand feet, broad measure, of four to six inch flooring, in ten hours; but it is hardly possible for a man to saw more than from six to eight thousand feet, into strips, in the same time and over a single saw. Hence it is either necessary to buy strips prepared at the saw mill (and these are rarely accurately sawn), have two saw tables for the floorer, or else not work the latter up to its full capacity, none of which are economical operations. Made on an ordinary saw table, strips are produced in varying sizes; and perhaps after some hours work, not enough of any one size can be sorted out to keep the matching machine at work, thus involving changing the apparatus so frequently as to prevent its performing its full amount of labor.

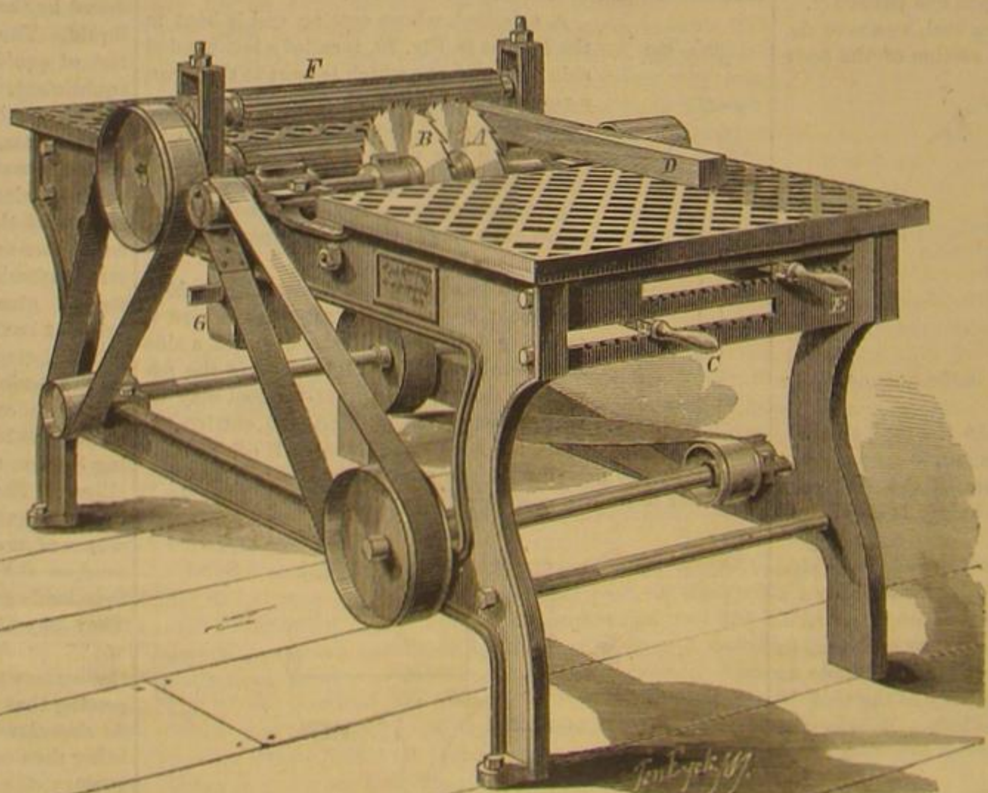
The device illustrated in the annexed engraving is claimed to meet the requirements above indicated. It is able to provide a supply sufficient to keep two matchers constantly at work. Two saws are used for slitting the lumber into strips of suitable width, one of which, A, is secured upon the arbor rigidly, and the other, B, is attached to a sliding and revolving sleeve and collar. This sleeve is provided with grooves to receive Babbitt metal, and works within a journal box which slides with it, and, besides, has a longitudinal channel to receive the feather by which it is made to revolve with the shaft while still sliding freely along the same. The lower part of the box is provided with a downwardly extending arm, at the end of which is an eye to receive a guide rod, which extends transversely across the machine. A mortise is made through the arm, between the box and the eye, to receive a lever which is pivoted at one end to the frame and terminates at the other with a handle, C, convenient to the operator. By means of this lever the arm, and with it the sliding sleeve and saw, B, is moved nearer to or further from the fixed saw, A, in order to govern the distance between said saws, and hence the width of the strip. At D is a gage which may be adjusted to any desired distance from the screw, A, by means of the hand lever, E which communicates with a sliding sleeve traveling on a guide rod, which sleeve is suitably connected with the gage.

The carrying or guide rollers, shown at F, grasp the sawn strips and carry them forward, thus acting also as feed rollers to guide the strips truly through the machine. The upper roller is made yielding by the application of the weight, G. It will be observed that no feed rollers are used to hold the lumber before the same reaches the saw; and by such arrangement, the operator is enabled to see, when the end of the timber is placed upon the table, whether the sliding saw or gage should be removed, so that all the material in the plank may be utilized.

The arrangement of two rows of notches, into which the hand levers are dropped to hold them securely in any position, will be readily understood from the illustration. The feed is driven from the saw arbor, so that a slip of the driving belt checks the feed correspondingly.

Though the machine is designed especially for planing mills, we are informed that it can be used as a strip machine in small saw mills, and the method of holding and moving the movable saw can be advantageously used on all the different makes of gang edgers. The gage can also be applied to the ordinary single saw table. The speed is from 2,500 to 3,000 revolutions per minute, and we learn that over 20,000 feet of dimension stuff can be made in a day from miscellaneous lumber, and a much larger amount from stock boards.

Patented August 12, 1873. For machines address the Erie City Iron Works (sole manufacturers of the apparatus for the United States), or George Carroll & Brother, Erie, Pa. For right to manufacture in Canada, address John McIntosh, Toronto, Ontario.




CARROLL'S PATENT GANG SAW TABLE.

### The Welding of Iron.

When two pieces of ice are rubbed against each other, fusion take place between the surfaces of contact, at a temperature below zero. As soon as the pressure ceases, solidification is again produced and the pieces are welded together.

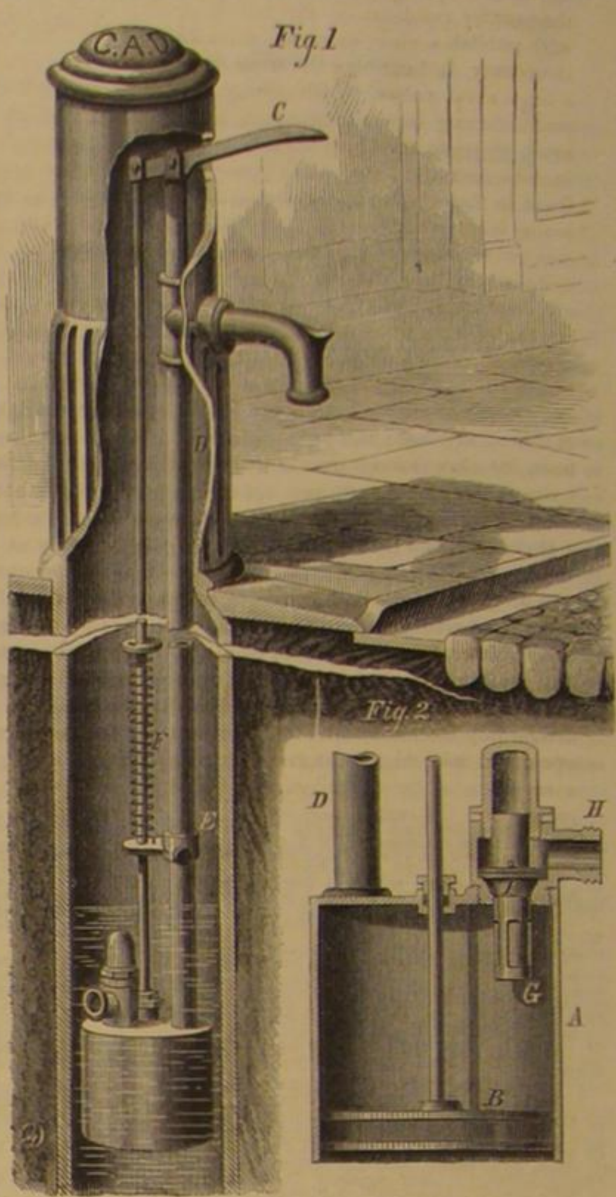
It seems to me that the welding of iron is a phenomenon exactly similar. The two pieces of iron are brought to a white heat, that is to say, more or less near to the fusing point. The repeated blows of the hammer, or the pressure of the rolls, lowers the point of fusion and causes a superficial liquefaction of the parts in contact, and thus welds the masses together; and this, because, like water, iron dilates in passing from the liquid to the solid state. Many other metals are similarly endowed; they all therefore may be welded like iron, if other conditions do not come in to oppose the manifestation of this property. Platinum welds easily at a white heat because its non-oxidizable surface, like that of ice, takes on a superficial fusion. To weld iron successfully, it is necessary that its surface should be clean, that is, free from oxide. Iron containng phosphorus welds more easily than pure iron, because its point of fusion is lower. Steel, which is more fusible still, welds at a lower temperature than iron, but the process is a more delicate one. Silver, too, like iron and platinum, has the property of expanding when it solidifies; but as it melts at a cherry red heat, it is easier to form it by casting than by welding. Bismuth and zinc are always included in the same class; but they are so very brittle near their fusing points that no one would think of attempting to weld them either by hammering or pressure. Iron in welding, therefore, only follows the example of water.

The fibrous state of iron is not a normal and regular one All crystaline iron, if the crystals are not too hard, breaks with a fibrous structure, if time be given, in the breaking, for these crystals to be drawn out into fibers. Iron which is fibrous is only iron in which the primitive crystals, surrounded by very thin films of slag—and thus separated from each other—have not been welded together during the rolling, but have been elongated into wires. A bar of such iron resembles a bundle of wires in its resistance to fraction, but it breaks with a granular fracture when exposed to a transverse blow, suddenly applied.—*M. Jordan.*

FOR a marking fluid, use coal tar dissolved in naphtha.

## DAVIS' IMPROVED HYDRANT.

The hydrant represented in the annexed engraving is claimed to prevent freezing and waste of water. It is of durable construction, and is self-closing. The valve is not liable to become choked with dirt, as the passage of the water




serves to clean the orifice, while the pressure of the fluid keeps the valve down.

A is a cylinder or chamber, sunk in the well and provided with a piston. B, the rod of which connects with the handle, C. D is the eduction pipe, having a suitable discharge nozzle, as shown. To this pipe is attached a guide plate, E, Fig. 1, which may be adjusted to various elevations by means of a clamp screw. On the piston rod is a fixed disk, between which and the plate, E, a spiral spring, F, is extended. The latter, being stretched when the hand lever is depressed and the piston, B, raised, will retract and throw down the piston into place as soon as the force on the lever is remitted. G, Fig. 2, is a gravity valve, having a subjacent slotted tube and an upper head working in a guide. As the piston rises, the valve is carried up until the slotted tube receives, through the inlet pipe, H, a supply of water, which is then forced up through the eduction tube, D, and discharged. The chamber, A, is thus kept always in a condition to receive the water that may be left in the tube, D, after the flow has ceased from the spout.

I is a leather or flat flexible ring that is secured to the valve by a metal ring or pin, and which acts, in case of gravel or other obstruction settling between the valve and its seat, as an auxiliary valve, being forced by the pressure of the superincumbent water to cover any crevice made and to form a watertight joint.

Patented through the Scientific American Patent Agency, April 28, 1874. For further particulars regarding sale of patent rights, licenses, etc., address the inventor, Mr. John T. Davis, 1,212 Eleventh street, Southeast, Washington, D. C.

WIRE WORMS.—These are found in the greatest quantities in fresh new loam, just brought from the field, and such soil, when used for valuable plants, should be carefully examined, and the wire worms crushed; their brownish red bodies are easily seen. Mr. Tillary writes to the *Garden* that slices of potatoes or lettuce stems will likewise entice them where they are numerous. The slices should be placed under ground, and then frequently examined. He saved a bed of seedling gladioluses that were planted in some new loam, which, he found afterwards, swarmed with wire worms, by placing slices of potatoes and lettuce stalks in the ground after he found that some of the plants were flagging.

### THE ROYAL GARDENS AT CASERTA, ITALY.

Most of our readers are familiar with the chief features of the Italian school of landscape gardening, the broad plateaus, the artificial lakes and waterfalls, and especially the formality of shape shown in trimming the edges and rows of trees. Of the pleasure grounds attached to the palace of Caserta, the country residence of the late King of Naples, we herewith publish a view, extracted from *The Garden*. Our contemporary, in describing the scene, says: "You enter through a huge royal palace, which seems admirably suited for accommodating several regiments of life guards, when the scene depicted in the illustration meets the eye—the huge cascade facing a distant hill covered with evergreen oak. Good as the engraving is, it can give little idea of the enormous length of these garden waterworks, long and well constructed stone reaches of deep clear water, broken here and there by falls, which are embellished by a rich display of sculpture and statuary. But, before reaching the waterworks, we have to traverse a very large space by habit called a garden, but which is simply a huge expanse of turf, on which stands clumps and squares, and avenues of trees. We have to approach these closely to see what they are composed of, for all are either clipped or mown, or in some way mutilated, till they lose all individual character, and merely form irregular walls of vegetation. Under one of the falls, there is a vast covered way, with well constructed rocky walks and walls, and here the maiden-hair fern grows everywhere as freely as meadow grass; it ventures out from the moist and shaded grottoes, and creeps into the eyes and ears of the spouting sea monsters outside in the sun—the only trace of life or Nature near. The distressing effect of all this gradually passes away, for one of relief, as the base of the great irregular (but also artificial) cascade is reached, till the eye dwells happily on the hills around, densely garlanded with evergreen oak. All this kind of art comes from allowing the space intended for a garden to be converted into an open air gallery for the exhibition of architecture, sculpture, etc., mostly of a mediocre, and often of a feeble or ridiculous character. Let us not, however, delude ourselves into the belief that, in creating such scenes, on either a large or small scale, we are making a garden. There is at Caserta, however, an example of one phase of real gardening which will repay the visit. It is what is called the English garden, a large piece of diversified pleasure ground, with many trees allowed to assume their natural development. Towards the end of the last century this garden was planted, and with a very happy result. The great geometrical district, so to say, gives one an idea that the region is not a fertile one; this is at once dispelled on entering the English garden. The cedars, cypresses, and deciduous trees have attained great size and beauty, and grow in stately groups, with open spaces between, so that their forms may be seen. Here is the first camellia ever introduced into Italy, where the plant is now so abundantly grown, and whence we get most of our new varieties. It is a specimen of the single red, now in full bloom, and about 20 feet high and 15 feet through. The camphor tree is seen in fine health here, in specimens nearly 50 feet. The garden is enriched by some grand cork trees, which may give many visitors a fair idea of what a noble tree this oak is when fully developed. The trees are huge in stem, picturesque in their branching, and about 80 feet high. Some of the scarcer pines attain much perfection here, as, for example, the Mexican (*p. Montezuma*), which is 60 feet high.

### The Possibilities of Future Discovery.

A striking illustration of the popular lack of scientific reasoning is to be found in an editorial which recently appeared in the New York *Herald* as follows:

"The wildest imagination is unable to predict the discoveries of the future. For all we know, families in the next century may pump fuel from the river and illuminate their houses with ice and electricity. Iron vessels, properly magnetized, may sail through the air like balloons, and a trip to the Rocky Mountains may be made in an hour. Perhaps within fifty years American grain will be shot into Liverpool and Calcutta through iron pipes laid under the sea. By means of condensed air and cold vapor engines, excursion parties may travel along the floor of the ocean, sailing past ancient wrecks and mountains of coral. On land the intelligent farmer may turn the soil of a thousand acres in a day, while his son cuts wood with a platinum wire and shells corn by electricity. The matter now contained in a New York daily may be produced ten thousand times a minute, on little scraps of pasteboard, by improved photography, and boys may sell the news of the world printed on visiting cards, which their customers will read through artificial eyes. Five hundred years hence a musician may play a piano in New York connected with instruments in San Francisco, Chicago, Cincinnati, New Orleans and other cities, which will be listened to by half a million of people. A speech delivered in New York will be heard instantly in the halls of those cities; and when fashionable audiences in San Francisco go to hear some renowned singer, she will be performing in New York or Philadelphia.

In the year 1900 a man may put on his inflated overcoat, with a pair of light steering wings fastened to his arms, and go to Newark and back in an hour. All the great battles will be fought in the air. Patent thunderbolts will be used instead of cannon. A boy in Hoboken will go to Canada in the family air carriage to see his sweetheart, and the next day his father will chasten him with a magnetic rebuker because he did not return before midnight. The time is coming when the *Herald* will send a reporter to see a man reduce one of the Rocky Mountains to powder in half a day. Skillful miners will extract gold from quartz as easily as cider is squeezed from apples. A compound telescope will be invented on entirely new principles, so that one may see the planets as distinctly as we now see Staten Island. Microscopes will be made so powerful that a particle of dust on a gnat's back will appear larger than Pike's Peak. And marvelous progress will be made in psychological and mental sciences. Two men will set in baths filled with chemical liquids. One of them may be in Denver and the other in Montreal. A pipe filled with the same liquid will connect the two vessels, and the fluid will be so sensitive that each may know the other's thoughts. In these coming days, our present mode of telegraphing will be classed with the wooden ploughs of Egypt, and people will look back to steamships and locomotives as we look back to sailboats and stage coaches."

### MEDICAL NOTES.

#### Cholera.

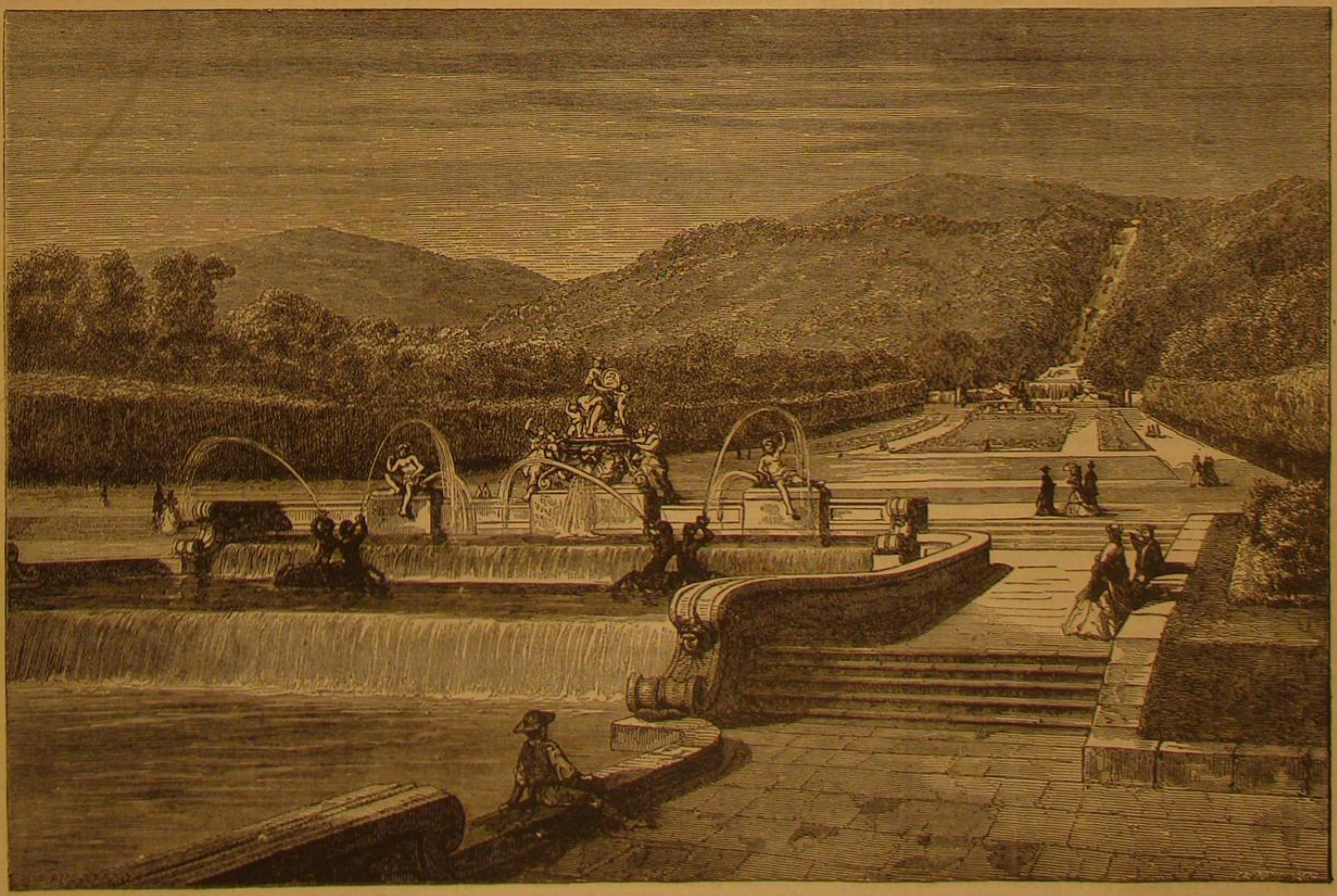
There may come another cholera scare this year; certainly there will come one before many years. Some doctors think the scare worse than the disease. At any rate, the nervous depression produced by reading and hearing alarming stories is a well proven semi-cause of death, by diseases which affect the nervous system, whether alone or conjointly with other disorders; and sometimes light ones are aggravated to the bitter end by imaginary fears. Knowing the force of this fact, as all experienced people do, it seems a happy thing to find an antidote, as far as cholera scares are concerned, in the following statement: Dr. Blakiston says, in the London *Medical Times and Gazette*, that it has been fully proved in the Paris hospitals that cholera is not communicable by the breath of the patient, or by contact with his body during life or after death. Most of the "stiffs," as they are called in technical vulgarity—that is, the subjects of dissection—were for many months victims of cholera in Paris, and yet no doctor and no student caught the disease. Therefore let no timid person have any fear about the infection of air or touch, but remember that the germs of cholera have been proved to be propagated through the *dejecta* (voidings in any way) which come in contact with water or food, possibly with air much breathed, though this is not fully shown.

#### Valerian in Diabetes.

Dr. Bouchard says extract of valerian is a powerful agent in diminishing the elimination of urea and waste of tissue seen in diabetes. He adds a curious fact, observed in long practice among the Indians of Lower California. The warriors, before entering on an expedition, go through a course of valerian regimen for a month, to get themselves into a fatigue-supporting condition. This fact suggests another, concerning the Peruvian Indians, who are able to go without food for five days, under a burdensome journey, when well supplied with the juice of the plant, so extensively used in that country, called coca. It seems to us that coca and valerian might be used in thickly settled countries as articles of medical nutrition, to say nothing of their possible value as substitutes for food of the common sort among the very poor.

#### Poisoning by Hydrate of Chloral.

In the case of a man who took six drams of chloral to commit suicide, electricity was first used to induce regular



THE ROYAL GARDENS AT CASERTA, ITALY.

breathing, and then subcutaneous injections of nitrate of strychnia to stimulate the heart's action. Finally the patient awoke, quite refreshed, thirty-two hours after swallowing the chloral.

### A Good Disinfectant.

A very weak solution of permanganate of potash is an excellent disinfectant for light purposes, such as rinsing spittoons, neutralizing the taint of diseased roots, cleansing the feet, and keeping the breath from the odor of tobacco smoke. Permanganate is not poisonous.

### A Preventive for Lead Poison.

Any soluble salt of lime (if plaster of Paris or gypsum is used, there should be added a little saltpeter or sal ammoniac) in the most minute quantity prevents the oxidation of lead in contact with water. Therefore it would be well to put a little chalk into wells which have leaden pipes, also in leaden beer pipes and other conduits, if people will use them. Perhaps it would be better to dip leaden pipes in a moderate solution of sulphuric acid (oil of vitriol) before using, and to dip the common soldered tin cans for fruit in the same, in order to form an insoluble coating of sulphate of lead. For, all wiseacres to the contrary, every good chemist knows that lead is easily oxidized by pure water, and still more so by water containing carbonic acid; and since lead is a cumulative poison, a very little of it at a time, taken into the system for weeks, months, or years, will be sure to produce some ugly disease, like neuralgia, painter's colic, hardened liver, or paralysis, the frequent foe of the aged.

### Improved Mustard Poultice.

The *Medical Brief* says: In making a mustard plaster, use no water, but mix the mustard with white of egg, and the result will be a plaster which will draw perfectly, but will not produce a blister, no matter how long it is allowed to remain.

### Anæsthesia.

At Bellevue Hospital, bromide of potassium, 30 grains previous to administering sulphuric ether and the same dose as soon as the patient can swallow after the administration, is now regularly resorted to. The effect is to prevent the vomiting which so commonly follows the use of ether.

## THE CONVENTION OF THE CIVIL ENGINEERS.

The sixth annual convention of the American Society of Civil Engineers was recently held in Tammany Hall in this city. About 100 delegates appeared, representing the principal cities in the country. Colonel Julius W. Adams, President of the society, presided; and in the course of the proceedings, a memorial was adopted urging upon Congress the necessity and importance of a series of complete tests of American iron and steel. We give below abstracts of the papers read.

Captain James B. Eads said that

#### UPRIGHT ARCHED BRIDGES

can be more economically constructed for railroad purposes than is possible with the suspension system, no matter what the length of span may be. He said that it is entirely practicable to brace the upright arch more effectually, and with equal, if not greater, economy, than is possible by any known method of stiffening suspension bridges. By any method of girder construction hitherto known, it is impossible to span a clear opening of 500 feet with less than three times the dead weight of the arch in the proposed system, with equal strength of girder and with the same material and allowable strain.

The objection to the combination of wood and iron in bridge construction, owing to the difficulty of repairing the bridge, does not exist in this method. In all others, the wood is either under tension or compression, and therefore difficult to be removed without endangering the stability of that arch, or of any other one of the series; for it is plain that, if any temporary weight were placed on the floor which would equal the weight of the cords to be removed, the equilibrium of the whole series would be undisturbed by their removal so long as the whole bridge remained unloaded. In repairing, it would never be necessary, however, to remove any one cord entire at once, but only to replace such pieces as were found defective.

Mr. Francis Collingwood read a paper on the

#### ANCHORAGE OF THE EAST RIVER BRIDGE.

The front face of the Brooklyn anchorage is 930 feet back from the center of the tower. The length of the base is 132 feet, and extreme width, 119 feet 4 inches. It consists of a timber platform of three feet thickness, thoroughly bolted. Below this platform are bearers, placed longitudinally with about nine feet spaces, the bottom of these being at the level of high tide in the East River. The extreme size of the excavation at the bottom was 122 feet 4 inches wide at the rear, 112 feet and 4 inches at the front, and 135 feet long. This space had to be excavated entirely to a uniform level before the foundation could be started; and the problem was to so support the banks as to effectually prevent damage to surrounding property, and at the same time not have the bracing interfere with the free movements of workmen, or with lowering or placing the timber and stone in position.

All materials for the anchorage had to be brought 1,000 feet through crowded streets from the dock at the river, and it was also desirable to transport the same from the excavation to the yard at the pier for storage.

The form of the masonry throughout is in plan the same as that of the foundation, the stone work being set back 18 inches all around from the edge of the platform. There are a series of offsets at the bottom, but its general form in elevation is that of a truncated pyramid with sides battering above ground half an inch per foot rise. The top of the masonry is also the grade line of the bridge, and has an elevation of 89 feet at front, and 85 feet 9 inches in the rear. The front portion is divided into three parts. The central of these will support and contain the two central anchor chains. Between this and the two exterior walls are spaces arched over to support the roadway above. Since diagonal braces could be used, this determined the use of two lines of through longitudinal bracing and six lines of through transverse bracing. At the intersections of the main lines, square timber piles were driven, before the excavation was begun, to a depth of about three feet below tide. The excavation was then started at the highest point, and the first stringer, etc., put in. After this was well under way, the second range of sheeting was started on the opposite side and ends, and before the pressure had become severe the braces between the heads of the piles were put in in each direction. In this way the work was carried down progressively, the excavation in the central portion being in every case the last removed.

#### THE EXCAVATION.

In driving the lowest range of sheeting, great difficulty was found in penetrating the fine, compacted sand below the water line. After trying several devices, it was decided to use a water jet. For this purpose a small rubber hose was provided, having a three quarter inch jet from pipe four feet long for a nozzle. This was attached to the city works, and by its use the planks were forced down very readily. Six inches below tide was the average depth driven. To overcome the last two feet of the excavation, it was necessary to pump the water out of the pit; and the question arose as to the size of pump required. To solve the question appropriately the following experiment was tried: A piece of 18 inch sewer pipe was set down into the sand at the bottom of the pit. The sand was then removed from the interior and the water bailed out. The time and depth below and top was then noted, and when nearly filled the time was again noted, together with the increase in hight. The average head under which the water entered did not exceed six inches, and it was thought that this would probably be as great as it could ever be around the sheeting, and, taking the relative perimeter of the two as a basis, to be pumped about 80 gallons per minute. At a time afterwards, when the pump was in regular working, the amount discharged was found to be 60 gallons per minute. This method would no doubt be safe in similar cases where no springs in the bottom were to be apprehended. The maximum pressure upon the sand underneath, caused by the complete structure, will be about 4 tuns per square foot.

The only remaining point of interest was the method taken to lower the four anchor plates into the pit. These were massive castings, 17½ feet by 16 feet and 2½ feet deep (over all), and weighing 53 tuns each. For this purpose, an excavation 20 feet wide, with slope of two to one, was made in the rear, and a hole cut through the sheeting. In this timber ways were laid, and two sticks were also bolted to each of the plates, for sliding pieces. They were then lowered by tackle without trouble.

Abstracts of several other interesting papers will be given in our next.

### Metallic Bedsteads.

The works of Mr. S. B. Whitfield are situated in Watery lane, in the Coventry road, Birmingham, Eng. They are called the Gladstone works, and occupy about 3,000 square yards, of irregular parallelogram, and are built on three of the sides.

First, we go into the cutting shop. Here the angle iron, round irons, and rods are cut into the lengths required for the parts of the bedstand. As many as 200 or 300 different lengths are required for the various parts. The rods are brought in bundles, and are cut by a machine worked by steam, as many as five rods being cut by one movement of the cutting press. These are for scrolls and other ornamental parts of the bedsteads. When the angle rods have been cut, they are then stamped straight by hand-worked presses. They are next passed to lads by whom they are studded, and on these studs the laths are put when the bedstead is made up. All these processes are executed with great precision, as all the parts of the same kind of bedstead are interchangeable, and the greatest exactitude is required in every part of the work.

From the cutting shop we pass to one of the galleries, of which there are two overlooking the casting shop. In the first gallery the rods, having been cut and studded, are brought to be bent into the various forms required by the pattern. This process is exceedingly simple. The pattern for the scroll or other design is placed in a vice and the rods are placed around it, the iron lengths used being either plain or bended, according to the design. In this gallery the iron is bent into shape for the bands or the bottoms of the bedsteads. In every case the work has to be done with great nicety, as every one must correspond with the rods with which they are to match. This department is very properly named the bending gallery, and every visitor will be struck with the beauty of many of the curves produced, and the elegance of many of the designs and patterns.

After having been bent, the various parts of the head and foot are taken into the casting shop, which is, of course, on the ground floor. These are placed on a frame, and the end of each of the parts is placed in a chill; in some elaborate patterns more than twenty chills are used. Into these chills is poured the molten metal, and from the pattern cast in them is produced the flowers, knobs, and other ornaments which are seen at the various points of jointure. As soon as this process has been performed, we have a head or foot, as the case may be, completely produced. This is the method of casting all the parts together, the invention of which produced quite a revolution in the trade. As soon as the metal is poured in, the chills are opened, and the work is ready for chipping. This process is done by hand, and by it the casting is cleaned of all superfluous bits, and thus made ready for the next operation. In this part of the premises all the casting is done. The sockets, into which the dovetails and ends of the angle iron are placed, are cast on the corners of the posts. This is done while the parts are still in the frame. The furnace is funnel-shaped in the inside, and is charged with coke and pig iron in the proper proportions, and the metal is taken from it in pots and carried to the various parts required by the casters. The casting finished, and the work chipped of the bits of metal which are left by the casting, it is ready for japanning and painting.

Before passing to this part of the works, we visited the stock room. This is not so called from its containing the stock in the ordinary name, but in a technical sense. A stock in a bedstead manufactory is a die or pattern, for producing the ornaments for the tops of the pillars and other parts of the bedstead. In fact a chill may also be called a stock, as both are patterns and dies by which the ornamental parts are produced.

In the top gallery, folders, chairs, and cabinet bedsteads are made. Here we saw some which would either serve for a chair, a sofa, or a bed. As a chair, you can, by adjusting a small check, obtain any inclination you wish. By a very simple arrangement, you can unfold it and make it into a bed. Having used it, it can be folded up into so small a space, and is withal so light and portable, that a not very strong man could carry his chair and bed about with him wherever he pleased.

#### PAINTING AND JAPANNING PROCESS.

We now pass into the japanning and painting. This work is carried on in separate shops, each mode of decoration requiring stoves of a different temperature. The common, or black japanning, is done on the ground floor. The bedsteads are taken from the casting shop, and then covered with a coating of black japan and placed in large stoves, or rather heated iron rooms, where they are subjected to a temperature of 250°. In the second or upper room, a better kind of work is done, and a green, a maroon, and other colors are employed. In this work the heat required for fixing purposes is still very intense, but much less so than for black japanning. In the top room the more artistic painting and ornamentation is done, and a still lesser temperature is required, often not exceeding 100°. This is a very pretty process. The designs in metal are made on slips of paper, which are fastened on the scroll, or pillar, or rail, to be ornamented. The pattern is then washed, and the paper comes off, leaving the design in gold and colors on the bedstead. The ornamentation is in gold and colors, and some of the designs are very beautiful and elaborate. Some of the work is decorated by hand. After the painting, the parts are placed in the oven to fix the colors.

From the painting and japanning rooms, the articles, now finished, are taken to the wrapping rooms. The best goods are wrapped in paper, the head and the sides and laths being made into different parcels. The inferior work is only partly prepared, and then banded up with straw, and sent away to various destinations. The more delicate work is packed in skeleton cases. Every bedstead is put together and tested before it leaves the works.

One very careful kind of work is stamping the holes in the laths for making the iron racking. These are flat slips of iron cast to the required length. The hole at one end is stamped out by a hand press. In stamping the hole at the other end great accuracy is required, and it has to be done by gage. If this were not most carefully executed, the result would be that the latter would not fall into the studs on the sides or angle irons. They invariably do so, however, so nice is the adjustment of the parts. This done, the stud has only to be screwed down, and the bed is made, no keys being used in putting up metallic bedsteads.

From the wrapping rooms we passed to the fitting shop, in which also all the stocks and chills are made. This is one of the most important departments of the works. Here the design for the pattern of a stock is made in wax, then the model is taken in plaster of Paris, and from this the stocks are made. The utmost care is required in planing, turning, and cutting the various parts of a stock; for unless everything is made to fit and work into the nicest exactitude, the stocks will not close on the ends of the different parts which are to be joined together by casting. It is in this shop, in fact, that the bedstead is made. The various parts of a head or foot are placed on a frame, and then the stocks are tried, and every defect removed, until each one is in perfect working order. Here also are made the molds in which are cast the dovetail joints for the corners. In this room the nick in the top of the studs is cut, and the machine employed in this work acts with such facility and ease that the work is done by a girl.

#### TREATMENT OF BRASS FOR BEDSTEAD WORK.

Up to this time we have been engaged with the manufacture of iron bedsteads; we now turn to brass work, which is a distinct part of the trade. It is most interesting to witness the various processes through which this work passes. The framework of the bedstead is of iron, and the pillars, tubes, rails, and other parts are covered with a brass casing of not more than 1-64 inches in thickness. Some of the ornaments of the brass work are exceedingly elaborate and beautiful. A preceding writer has somewhat minutely described one part of this work: and as any account would be only a repetition of his words, we prefer to quote them. He says: "Entering the yard from Watery Lane, we find, in an open shed facing us, one stage in the manipulation of or namental brass work. A number of finely formed vases o excellent design have just been delivered from the bras foundery. They are, however, the reverse of sightly being of a dull, spotty, copper color. The workman has a number of bundles of them strung on wire, and is treating them to a series of baths of diluted aquafortis. The vases are first immersed in a weak solution, which removes earthy matter and the outer skin. They are then moved to a stronger solution, in which the liquid, while the brass is in the bath, bubbles violently, giving off a strong vapor of sulphuric acid gas: it is then moved to the third bath, and, after a few alternate plunges, is ready for drying, a wonderful transformation having taken place during the process, the final dip giving the article a beautiful but evanescent color. The precipitate in these baths is copperas, which is readily salable. Following the vases we have been referring to, we find that they are thoroughly dried in heated sawdust, when they are ready for the burnisher.

BRASS BURNISHING.

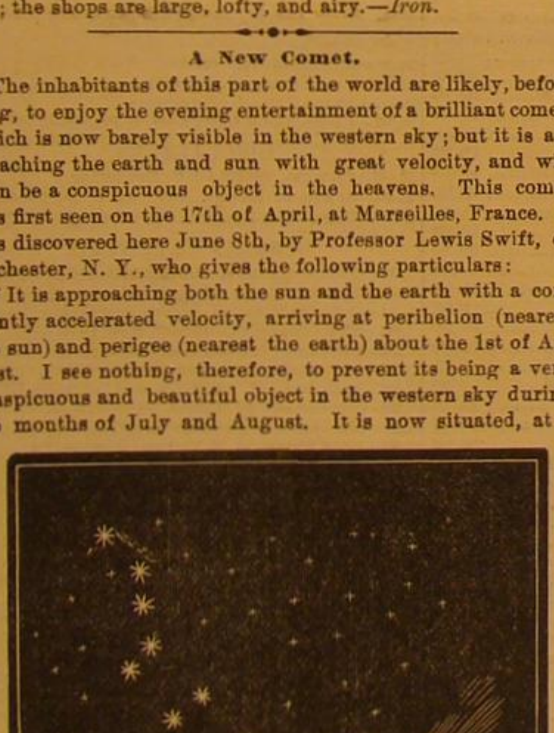
While the vases are being dried, we notice that some boys are very deftly filing the edges of brass castings, and learn that hundreds of boys are engaged at this work in Birmingham. One of the vases having been thoroughly dried is passed to the burnisher, who rapidly enhances its beauty greatly, by burnishing the shields and other projecting parts of the ornaments. His appliances are his burnishing tool, a Chartley Forest stone upon which to polish it, a solution of soda to keep his hands free from grease, and gall in which to dip the tool and help its slipping action. Gall is a very valuable commodity in Birmingham. From the burnisher the work is conveyed to the lacquering room. This part of the work is done very neatly and effectively by women, and is necessary, as may be known, to the preservation of the color of the metal and to the preservation of the surface indeed. Quick drying is essential here as in the painting room; and to provide this, the room is furnished with large flat-topped stoves, heated by gas, which obviates the smoke and dust that would be produced by stoves heated by coal. Brass tubes are lacquered upon an iron tube through which a jet of steam is passed. Any depth of tint can be given to the lacquer, but whether deep or light all brass work receives a number of coats. In this room we noticed a variety of brass bedsteads of very charming designs in twisted, taper, and plain pillars, with ornaments of great beauty."

About 200 people are employed by Mr. Whitfield in all the departments of the trade, and from his works bedsteads of every form and pattern, and of widely different prices, are sent to all parts of Great Britain. The works are admirably arranged, and every care has been taken for the comfort and convenience of the work people. The ventilation is admirable; the shops are large, lofty, and airy.—*Iron.*

### A New Comet.

The inhabitants of this part of the world are likely, before long, to enjoy the evening entertainment of a brilliant comet, which is now barely visible in the western sky; but it is approaching the earth and sun with great velocity, and will soon be a conspicuous object in the heavens. This comet was first seen on the 17th of April, at Marseilles, France. It was discovered here June 8th, by Professor Lewis Swift, of Rochester, N. Y., who gives the following particulars:

"It is approaching both the sun and the earth with a constantly accelerated velocity, arriving at perihelion (nearest the sun) and perigee (nearest the earth) about the 1st of August. I see nothing, therefore, to prevent its being a very conspicuous and beautiful object in the western sky during the months of July and August. It is now situated, at 1



o'clock in the morning, directly beneath the polar star, and about twenty-five degrees from it, and is just visible to the naked eye. With an opera glass it can be easily seen as a hazy nebulous mass, with a bright point a little to one side. Through my telescope of four and one half inches aperture, six feet focus, it presents a, tail filling the whole field, with a low power of thirty-six. So directly toward us is it moving it seems almost to stand still, its slight deviation from it giving an apparent motion toward β *Ursæ Majoris*. It is now visible all night, but will soon be so only in the early hours of evening, setting in the northwest.

If at the time of its nearest approach to the earth the moon should be absent, we may expect, from present indications, to be treated with a cometary display which may rival the transit of Venus in popular as well as in scientific interest. The comet will be brightest on the evening of August 3, being then 245 times as bright as at the time of discovery, while now it is only 5½ times as bright; and as the moon will be absent, it will be subjected to spectroscopic analysis under circumstances more favorable than may occur again in many years. It will then be about 5° from Denabola, the brightest star in *Leo.*"

To assist those of our readers who are not versed in astronomy to find the comet, we give a diagram showing the seven bright stars forming what is commonly known as the Dipper, from which the observer will carry imaginary lines down to three smaller stars below the Dipper, thence obliquely to the right, where the comet will be found. Just at present a spyglass or an opera glass will be needed to assist the vision; but in a few days the comet's tail will stand out clearly, and a special search will be unnecessary.

### Three Thousand Five Hundred Miles by Railway.

The new route between San Francisco and New York is thus composed:

| | Miles. |
|---|---|
| Central Pacific—San Francisco to Ogden | 878 |
| Union Pacific—Ogden to Kearney | 835 |
| Burlington & Missouri River, in Neb.—Kearney to Hastings | 40 |
| St. Joseph & Denver City—Hastings to St. Joseph | 226 |
| Hannibal & St. Joseph—St. Joseph to Hannibal | 206 |
| Hannibal to Louisiana | 25 |
| Chicago & Alton—Louisiana to Chicago | 275 |
| Michigan Central—Chicago to Detroit | 284 |
| Great Western—Detroit to Suspension Bridge | 230 |
| New York Central—Suspension Bridge to New York | 447 |
| Across the Continent | 3,446 |
| TO BOSTON. | |
| San Francisco to Chicago | 2,485 |
| Chicago to Albany | 818 |
| Albany to Boston | 201 |
| | 3,504 |

THE cheapest articles of which we have lately heard are alligators. A correspondent from the South says that you can buy them five feet long at Perry, Ga., for one dollar a piece.

ALUMINUM SILVER.—The following alloy is distinguished by its beautiful color, and takes a high polish: Copper 70 nickel 23, aluminum 7, total 100.

## Recent American and Foreign Patents.

**Improved Watch Escapement.**

George H. Knapp, Wapakonetta, O., assignor to himself and Harvey Brokaw, same place.—To prevent overbacking, the notched end of an escape lever with curved arms is so arranged as to guide the pin of a balance wheel back into a notch when the trouble occurs.

**Improved Children's Carriage.**

A C spring is attached to the front axle, and extends back over the hind axle, to which it is also attached, and then springs by a large curve around the body, which is suspended from it. The body of carriage is provided with a portion which may be made to serve both as a dash and a table.

**Improved Hoof Trimmer.**

Frederick R. Sutton and William G. Sutton, Wellington, Ill.—This invention consists of a pair of side bars pivoted to a toe piece, and connected, at the heel, by a right and left screw, constituting a frame, to be clamped upon the hoof by screwing the side pieces against it. On the frame is a cutter fixed in slots in the aforesaid side pieces, and provided with a cranked screw for forcing it up to the toe piece, to shave off the bottom of the hoof. At the toe is a gage, to regulate the amount to be shaved off, and on one of the side clamping pieces is a contrivance for quickly releasing the clamping frame from the hoof in case the horse becomes restive.

**Improved Cross Cut Sawing Machine.**

David R. Carter, Rockport, Ky., and Thomas H. Carter, Bremen, Ky.—This invention relates to a mechanical contrivance whereby a cross-cut saw may be operated by hand mechanism to so much advantage that one man may be made to do the work of six, the whole device weighing but about one hundred pounds, and being conveniently portable to the timber.

**Improved Carriage Door.**

F. Herman Jury, New York city.—This is a door pull handle and a holder for the sash-holding strap, combined in one device, and so arranged that both purposes are subserved by the one device better than by the separate devices as commonly arranged. The invention also consists of a novel contrivance of the device for connecting the strap holder, which holds the sash-holding straps up out of the way of the door when it closes to said strap.

**Improved Feeder for Grinding Mill.**

John Phillips and John E. Bradford, Scranton, Pa.—This invention consists of a hopper of two or more compartments, and a feed shoe, with a special compartment and regulating gate for each compartment of the hopper, all so arranged that two or more different kinds of grain, meal, or other material may be fed separately from different compartments into the stones at the same time. The object is to mix different kinds of grain substances more regularly and with less labor than they can be in the ordinary way of first mixing them and then feeding them together.

**Improved Mowing Machine.**

Frank H. Bryan, Troy, N. Y.—This machine may be reversed at each end of the field for cutting forward and backward along one side, for side hills and other places where it is not convenient to go around the field. It is also designed to effect the changes merely by turning the horses and the truck around without requiring the manipulation of any part by hand, except the raising of a catch pin.

**Improved Level.**

Dr. John Thornley, Charlottesville, Va.—This invention relates to an improvement in the class of levels provided with a hinged base bar for indicating different grades by the adjustment or angle to the body of the level proper. The improvement consists in arranging the block or prop piece to slide between the hinged bar and an inclined plane formed on the base of the level, so that the bar will be adjusted at an angle to the base corresponding to the distance it moves over the inclined plane. Means are provided for clamping the sliding block at any desired point, and the base is graduated to indicate the grade. The block is also connected with the base and hinged bar by a screw and dovetailed groove.

**Improved Grave Mound.**

Joseph R. Abrams, Greenville, Ala.—This invention relates to means whereby the dome of a grave mound is adapted to graves of different lengths and sizes by fitting thereto successively increasing elliptical pieces.

**Improved Cheese Mill.**

Abraham C. Brinser, Middletown, Pa.—This invention consists in a cheese mill in which are combined a vessel having a partially perforated bottom and rotary grinder, whereby cheese or smearcase may be ground and delivered free of lumps and in a uniformly granulated condition.

**Device for Registering the Slipping of Locomotive Wheels.**

James W. Boyle, of New Texas, Pa.—This invention consists of a couple of wheels or disks independent of each other, driven synchronously, one by the truck axle and the other by the driving wheel axle. They are arranged with a cam and ratchet mechanism, so contrived that, in case the driving wheel slips, and thus turns one of said pulleys faster than the other, the pawl mechanism will be caused to move the recording apparatures one degree for each turn of one wheel more than the other, and thu record the slip.

**Improved Wheel or Vehicles.**

Michael Mickelson, Ashland, Oregon.—By this device, a tire may be tightened without removing it from the wheel. The invention consists in the pieces or caps in combination with the tongue and socket blocks formed upon the ends of a cut tire, and with the wedge or key that draws said ends together.

**Improved Grading Scraper.**

Jonathan C. Smith, South Solon, Ohio.—This invention consists of a road, ditch, or grading scraper, having the front portion, which carries the blade, jointed to the body portion, and provided with springs and pushers adapted to tilt the blade down so as to run into the ground when the scraper is drawn along the surface. Latches and levelers are combined with the said jointed front part and the handles, to turn the blade upward to run out of the ground when a load has been obtained by pressing the handle downward. Cams throw the latches into connection with the levers so that the blade may be turned up when the handles are pressed down. The handles pass down below the spring catches, to be fastened to the body by the latter to raise the rear end to dump the scraper by causing it to ro over on the front end.

**Improved Boiler Flue Cleaner.**

John Dykeman, Green Island, N. Y.—This invention consists in the combination of three toothed rollers, whether made solid or of toothed disks springs, and levers with each other, and a box for cleaning the outer surfaces of flues; and in the combination of a loose arm and a set screw with a box that supports the toothed rollers, the springs, and the levers, to adapt the machine to be attached to the tool rest of a lathe. In using the machine, the levers and roller are turned back, and the flue to be cleaned is placed upon the rollers, and its end is secured to the chuck of the lathe The roller and levers are then turned down upon the flue, the necessary pressure is applied by the weight or spring, the lathe is set in motion, and the machine is fed forward with the feed screw, cleaning the flue thoroughly.

**Improved Spring Brace.**

Sidney T. Bruce, Marshall, Mo.—The brace is connected to the carriage body adjustably, by means of a slotted or grooved plate. The front half of this plate is bent downward to accommodate the pin above it. Thus the bottom and top of the front spring being both fastened to a common point behind, whatever depresses the body of the vehicle similarly depresses the free end of an inflexible bar, which cannot go forward so as to enforce a perpendicular motion of the carriage body. The bars being fastened to the springs at the top and bottom in front, and to each other a the center, no force can project the springs, either front or rear.

**Improved Movable Head Light.**

Horatio G. Angle, Chicago, Ill.—By suitable construction, as the truck of the locomotive turns in passing around a curve, the head light is also turned, so that the stream of light may always be thrown upon the track. The light from the lamp may also be thrown more or less from a straight line to adapt it to the curvatures of the road.

**Improved Kettle Scraper.**

Samuel A. Potter, Emaline Potter, and John Potter, Fowler, Ill.—This is a scraper plate with a round or otherwise shaped rear handle at one side and a pocket guard for the fingers at the other side.

**Improved Apparatus for Making Torpedo Envelopes.**

Mahlon Chichester, Shelter Island. N. Y.—The paper bags for torpedoes have been made, one at a time, with the aid of a piece of board having holes and a hand pin. The present invention consists in an improved apparatus whereby a number of bags are simultaneously made, the paper being cut with one motion, and pressed into the holes by another motion, for any desired number.

**Improved Fare Box.**

Joseph J. White, New Lisbon, N. J., assignor to himself and Howard White, Tullytown, Pa.—This invention relates to apparatus for collecting passenger fares on rail cars, and consists of a cash box supported from the waist or shoulders of the conductor, to which is attached a flexible tube, having at its end a hand piece or receiving box containing an endless carrier, which is arranged on pulleys, so as to be moved, by means of a ratche and pawl operated by a spring lever, by the conductor. The conductor carries a hand piece in his hand, and, by virtue of the flexible tube and belt, he is enabled to pass it round among the passengers to receive the fares.

**Improved Furnace for the Manufacture of Iron and Steel.**

Edgar Peckham, Antwerp, N. Y.—This is a new method and apparatus for manufacturing steel blooms directly from the ore. It consists in the furnace patented by the same inventor, June 24, 1873, improved so that it has two series of ore chambers instead of one, so as to treat the ore at different degrees of temperature to remove sulphur and phosphorus, and so that one series may serve for a flue to heat the ore in the other series when the coal is impure.

**Improved Hatchet.**

Guilford Norton, South Boston, Mass.—This is a combined claw hammer and hatchet. The bit has projecting threaded studs, by which it is connected with the hammer portion, so that, when worn out, it may be removed and a new one substituted.

**Improved Folding Desk.**

David H. Pierson, Fort Rice, Dak. Ter.—This desk is made in sections which are hinged together and so arranged that they fold together and form a compact body, resembling in shape and proportion an ordinary field desk.

## NEW BOOKS AND PUBLICATIONS.

A TREATISE ON BRACING, with its Application to Bridges and Other Structures of Wood or Iron. By Robert Henry Bow, Civil Engineer. With 156 Lithographed Illustrations. Price $1.50. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

This is an excellent and very explanatory book on the whole question of arranging the parts of any construction so that they shall be as little as possible affected by variation in the strains to which the erection is subjected. As a matter of course, the building of bridges is very extensively treated, and the examples explained and illustrated show that the author is a writer of considerable knowledge and very varied experience.

THE INTERNATIONAL OR METRIC SYSTEM OF WEIGHTS AND MEASURES. By J. Pickering Putnam. Price 50 cents. New York: Hurd & Houghton, 13 Astor Place.

A very able *resume* of the recent progress of the metric system in popular favor. Although many of the arguments used by the advocates of the method are well known, and are generally deemed irrefragable, they will bear repeating till the world has adopted this most simple and rational arrangement of weights, measures, and coinage, which, it must be now everywhere admitted, is only a question of time.

THE KEYSTONE BRIDGE COMPANY'S ILLUSTRATED ALBUM, embracing Iron Bridges, Roofs, Columns, Chord Links, and Shapes, with a Description of Long Span Bridges Quality of Materials, and Principles of Construction Pittsburgh, Philadelphia, and St. Louis: Keystone Bridge Company.

An elegantly printed and illustrated volume, which contains not only a full and interesting description of the large means and business operations of the extensive firm who issues it, but also much explanatory and statistica information, formulas, etc., of great value to the engineering profession to whose notice we cordially commend it.

## Business and Personal.

*The Charge for Insertion under this head is $1 a Line.*

Wanted—A reliable manufacturing firm to introduce and manufacture an improved lathe chuck. Patent for sale or disposed of on royalty. Address Fred. Van Fleet, Ithaca, N. Y.

For Small sizes of Screw Cutting Engine Lathes and Drill Lathes, address Star Tool Co., Providence, R. I.

A thorough Machinist and Draughtsman, an experienced foreman, desires employment. Address A. R. Wilson, Ludington, Mich.

Speed Counter, to carry in vest pocket. Every mechanic should have one. By mail, $2.10. Discount by the dozen. Samuel Harris, 119 West Washington St., Chicago, Ill.

Ice Machines.—Are there any machines made in this country which will manufacture Ice in quantity to suit one or two families? And if such articles are in market, where can I get one? A. H. McClintock, Wilkes Barre, Pa.

Iron Castings, from 100 to 4,000 lbs., made at a low figure. Address Box 117, Saugerties, N. Y.

Varnish Maker Wanted—Address, with reference, John S. Holmes, Philadelphia P. O.

Windmill Makers, send circulars to Box 3062, P. O., Cincinnati, Ohio.

Clapboard Planer, used slightly, S. A. Wood's, for sale, $350. S. C. Forsaith & Co. Manchester, N. H.

Bone Mill Makers will please send their address to Wills Passmore, Fairville, Chester Co., Pa.

"Old Reliable" Drill Chucks, $3, $5, $7. Anderson Brothers, Peekskill, N. Y.

For Sale—25 Horse Locomotive Boiler, run 3 months. J. H. Baldwin, Meriden, Conn.

A practical mechanic in wood and metal, with genius and judgment, desires employment, temporarily or permanently; wood preferred. Address M. J., "World" Office, New York city.

Vertical Tubular Boilers, all sizes. Send for reduced price list to Lovegrove & Co., Phila., Pa.

Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York.

Sure cure for Slipping Belts—Sutton's patent Pulley Cover is warranted to do double the work before the belt will slip. See Sci. Am. June 21st, 1873, P. 389. Circulars free. J. W. Sutton, 95 Liberty St., N. Y.

Stencil Dies & Steel Stamps, all sizes. Catalogue and samples free. E. M. Douglas' Brattleboro', Vt.

For Sale or Exchange—A first class Gear Cutter with Brown & Sharpe's Index plate. Also a Bolt Cutter; will cut bolts to ¾ in. Wanted in exchange, Crank Planers. George Barnes & Co., Syracuse, N. Y.

Makers Woodenware Machinery, send circulars to P. O., Lock Box 630, New Orleans.

Models made to order. H. B. Morris, Ithaca, N. Y.

Linseed Oil Presses and Machinery for Sale. Perfect order. Very cheap. Wright & Lawther, Chicago, Ill.

Magic Lanterns for Public Exhibitions. Profitable Business, requiring small capital. Catalogues free. McAllister, 49 Nassau St., New York.

Nickel Plating—Pure Salts and Anodes of all Sizes on hand; Polishing Powders also for sale by L. & J. W. Feuchtwanger, 180 Fulton St., New York.

Gas and Water Pipe, Wrought Iron. Send for price list to Bailey, Farrell & Co., Pittsburgh, Pa.

Forges—(Fan Blast), Portable and Stationary. Keystone Portable Forge Co., Philadelphia, Pa.

Silicates of Soda, Soluble or Water Glass manufactured by us in all quantities for Paint, Artificial Stone, Cements and Soap. L. & J. W. Feuchtwanger, 180 Fulton St., New York.

Boilers and Engines, Second Hand. Egbert P. Watson, 42 Cliff St., New York.

Mills & Machinery for m'f'g Flour, Paint, Printing Ink, Drugs, &c. John Ross, Williamsburgh, N. Y.

L. & J. W. Feuchtwanger, Chemists & Drug and Mineral Importers, 180 Fulton St., N. Y., manufacturers of Silicates of Soda and Potash, Soluble Glass, etc.; Hydrofluoric Acid for Etching on Glass; Nickel Salts and Anodes for Plating.

For the very best Babbitt Metals, send to Conard & Murray, Iron and Brass Founders, 30th and Chestnut Sts., Philadelphia, Pa. Circulars free.

Taft's Portable Baths. Address Portable Bath Co., 156 South Street, New York city.

Iron Planers, Lathes, Drills, and other Tools, new and second hand. Tully & Wilde, 20 Platt St., N. Y.

For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $5. F. C. Beach & Co., 263 Broadway, New York, Makers. Send for free illustrated Catalogue.

All Fruit-can Tools, Ferracute, Bridgeton, N. J.

Brown's Coalyard Quarry & Contractor's Apparatus for hoisting and conveying materials by iron cable. W. D. Andrews & Bro., 414 Water St., New York.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

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

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

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

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Ms.

The French Files of Limet & Co. are pronounced superior to all other brands by all who use them. Decided excellence and moderate cost have made these goods popular. Homer Foot & Co., Sole Agents for America, 20 Platt Street, New York.

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

Buy Boult's Paneling, Moulding, and Dovetailing Machine. Send for circular and sample of work. B. C. Mach'y Co., Battle Creek, Mich. Box 227.

Automatic Wire Rope R. R. conveys Coal Ore, &c., without Trestle Work. No. 34 Dey street, N. Y.

A. F. Havens Lights Towns, Factories, Hotels, and Dwellings with Gas. 34 Dey street, New York.

Best Philadelphia Oak Belting and Monitor Stitched. C. W. Arny, Manufacturer, 301 & 303 Cherry St., Philadelphia, Pa. Send for circular.

Steam Fire Engines—Philadelphia Hydraulic Works, Philadelphia, Pa.

Bone Mills and Portable Grist Mills.—Send for Catalogue to Tully & Wilde, 20 Platt St., New York.

Temples & Oilcans. Draper, Hopedale, Mass.

Dean's Steam Pumps, for all purposes; Engines, Boilers, Iron and Wood Working Machinery of all descriptions. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

Emerson's Patent Inserted Toothed Saws, and Saw Swage. See occasional advertisement on outside page. Send Postal Card for Circular and Price List. Emerson, Ford & Co., Beaver Falls, Pa.

Iron Roofing—Scott & Co., Cincinnati, Ohio.

Price only three dollars—The Tom Thumb Electric Telegraph. A compact working Telegraph apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 263 Broadway, New York.

Millstone Dressing Diamond Machines—Simple, effective, economical and durable, giving universal satisfaction. J. Dickinson, 64 Nassau St., New York.

Keuffel & Esser, largest Importers of Drawing Materials, have removed to 111 Fulton St., N. Y.

Portable Engines 2d hand, thoroughly overhauled, at ½ Cost. I. H. Shearman, 45 Cortlandt St., N. Y.

Engines, Boilers, Pumps, Portable Engines Machinists Tools. I. H. Shearman, 45 Cortlandt St., N. Y.

Rue's "Little Giant" Injectors, Cheapest and Best Boiler Feeder in the market. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

For best Presses, Dies and Fruit Can Tools, Bliss & Williams, cor. of Plymouth & Jay, Brooklyn, N. Y.

[OFFICIAL.]

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FOR WHICH

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WERE GRANTED IN THE WEEK ENDING

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AND EACH BEARING THAT DATE.

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### APPLICATIONS FOR EXTENSIONS.

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

29,760.—Hammer.—R. Boekler, August 5.
29,785.—Sewing Machine.—D. Haskell. August 12.
29,799.—Cultivator.—E. S. Huff. August 12.
30,415.—Gas Regulator.—J. G. Leffingwell. Sept. 30.

### EXTENSIONS GRANTED.

28,469.—Horseshoe.—R. A. Goodenough.
28,479.—Making Tube Joints.—S. J. Hayes.
28,482.—Cooking Stove.—J. C. Henderson.
28,482.—Coal Stove.—J. C. Henderson.
28,483.—Seeding Machine.—S. T. Holly.
28,488.—Rattan Machine.—J. Hull.
28,495.—Skate.—J. Lovatt.
28,512.—Car Wheel.—S. P. Smith.
28,517.—Stock Car.—L. Swearingen.
28,537.—Paper Bag Machine.—S. E. Pettee.

### DISCLAIMERS.

28,482.—Cooking Stove.—J. C. Henderson.
28,495.—Skate.—J. Lovatt.
28,537.—Paper Bag Machine.—S. E. Pettee.

### DESIGNS PATENTED.

7,452.—Faucet Handle.—J. G. L. Boettcher, Br'klyn, N. Y.
7,453.—Finger Rings.—F. Bohnenberger, N. Y. city.
7,454.—Drawer Pull.—J. Girard, New Britain, Conn.
7,455.—Fur Cloaks.—C. Hülster, New York c
7,456.—Stove.—J. S. Perry *et al.*, Albany, N.
7,457.—Statuary.—J. Rogers, New York city.
7,458.—Salt Box.—F. Schneider *et al.*, Chicago, Ill.
7,459.—Buckle.—S. G. Sturges, Newark, N. J.
7,460.—Moldings.—J. Nonnenbacher, New York
7,461.—Cook Stove.—J. R. Painter, Reading, Pa
7,462.—Ruches.—A. A. Rockwell, New York city

### TRADE MARKS REGISTERED.

1,800.—Wringer.—Empire Wringer Co., Auburn, N. Y.
1,801.—Moss.—Ferguson & Haber, New Orleans, La.
1,802.—Watches.—Lingg & Bro., Philadelphia, Pa.
1,803.—Matches.—F. Mansfield & Co., St. Louis, Mo.
1,804.—Shirts.—Neustadter & Co., New York city.
1,805.—Grinding Mills.—Straub Mill Co., Cincinnati, O.
1,806.—Oil from Petroleum.—Standard Oil Co., Cleveland, O.
1,807 to 1,810.—Shirtings.—Wamsutta Mills, N. Bedford, Ms.

### COMMUNICATIONS RECEIVED.

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

On Army Ants. By J. S. D.
On the Boiler Explosion at Philadelphia. By C. and G.
On Doubling the Value of the Currency By J. H.
On Botanical Scraps. By S. C. Y.
On the Insurance Question. By F. A. M.
On an Ear Trumpet. By J. E.
On Engineering Tables. By W. Z.
On Sun Stroke. By E. S. G.
On White Ants. By T. H.
On the Westinghouse Brake. By F. G. W.
On Bullets Impacted in the Air. By H. A.

Also enquiries and answers from the following:

I. X. L.—L. M. B.—J. H. J.—W. M. R.

Correspondents in different parts of the country ask Who makes a hoisting apparatus to be run by water supplied by city waterworks? Who makes portable canvas boats? Makers of the above articles will probably promote their interests by advertising, in reply, in the Scientific American.

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## MISCELLANY.

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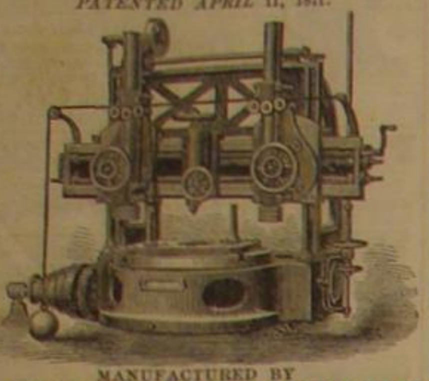

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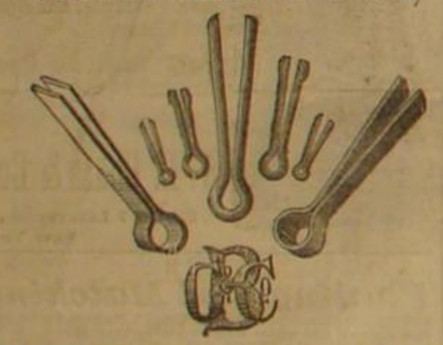

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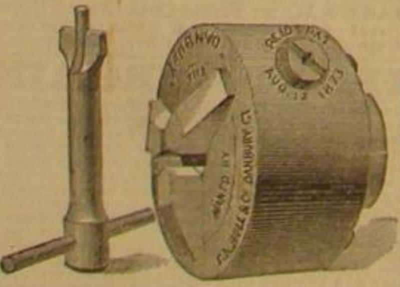

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