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[NEW SERIES.]

NEW YORK, JUNE 13, 1874.

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IN ADVANCE

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.

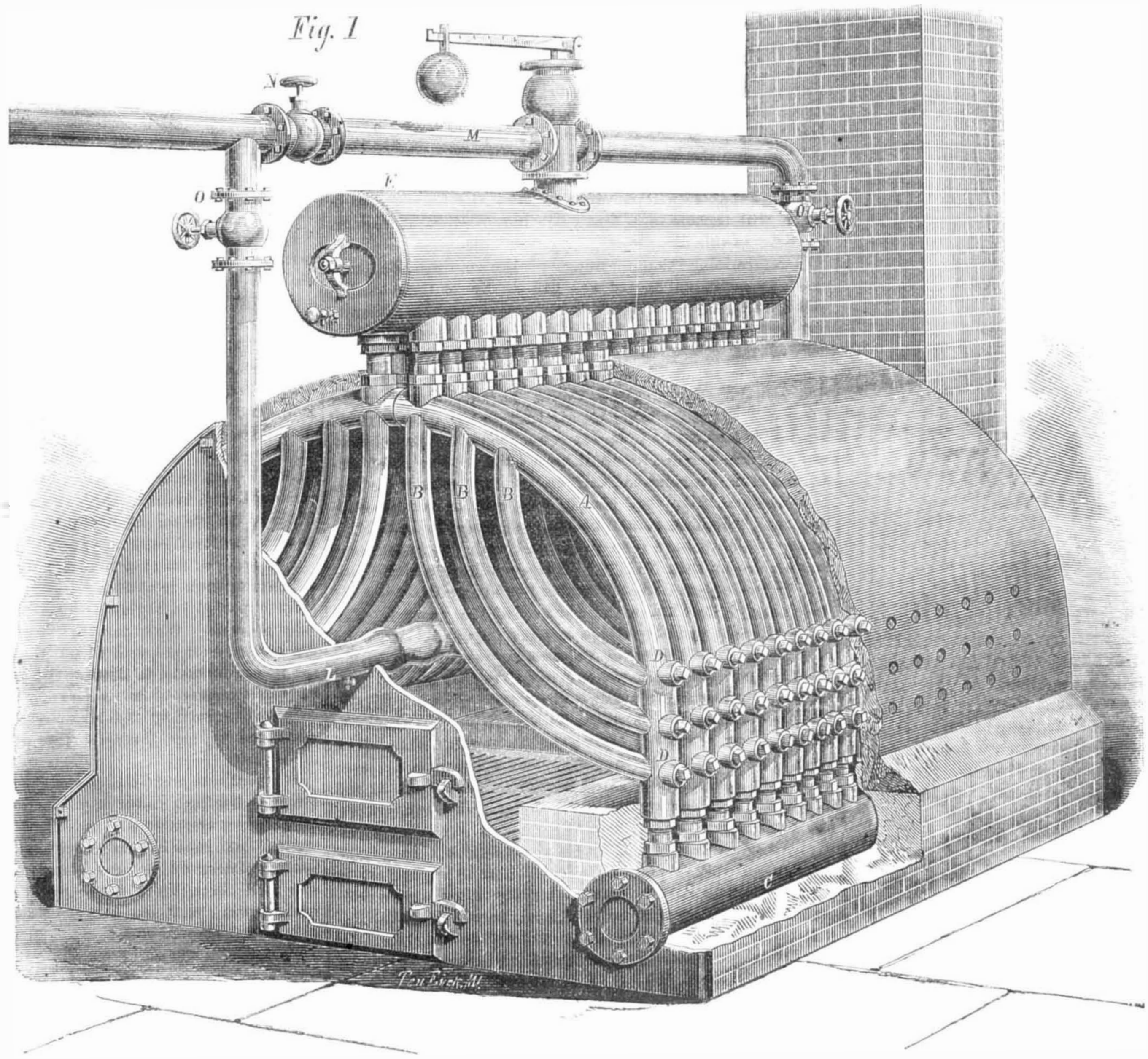
In Fig. 2 the boiler is represented somewhat differently constructed. A bridge wall, F, passes longitudinally through the fire box, along which extends the pipe, G, from which rise vertical tubes, H, which connect directly with the steam drum. To flanged projections on tubes, H, are connected the curved 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.

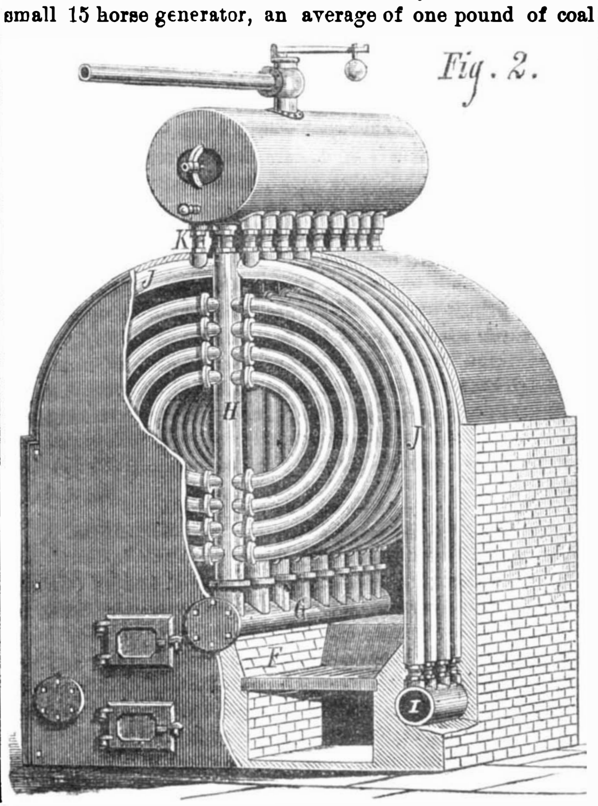
In connection with the boiler, in Fig. 1, a simple superheater is shown, consisting of a pipe, L, which extends down through the fire box, completing a parallelogram, of which the steam pipe, M, forms the upper side. By closing the valve, N, the steam passes down through this pipe, and thus becomes superheated. 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.



RENSHAW'S PATENT SECTIONAL BOILER.



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 occassion 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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VOLUME XXX, No. 24. [NEW SERIES.] *Twenty-ninth Year.*

NEW YORK, SATURDAY, JUNE 13, 1874.

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 ¾ 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. E. 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:

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 |      |      |       |      |      |
—N—, —P—, —As—, —Sb—, —B—, —Au—; or —N=,
—P=, =As—, Sb≡, ≡B, —Au—.
                         |
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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.

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                      —H
For instance: H—N            or Cl—N=O, or Au≡P.
                      —H,
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Finally we will mention a few quadrivalent substances: Carbon, silicon, tin, platinum, of which the atoms are represented thus: =C=, =Si=, =Sn=, =Pt=, or,

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  |      |       |      |
—C—, —Si—, —Sn—, —Pt—;
  |      |       |      |
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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:

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H—     —H
    C       , O=C=O, and Sn≡Si.
H—     —H'
```

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, $C_3 H_5 N_3 O_9$, 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 report, 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 toward 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 52·63 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.

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.

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: 132 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.

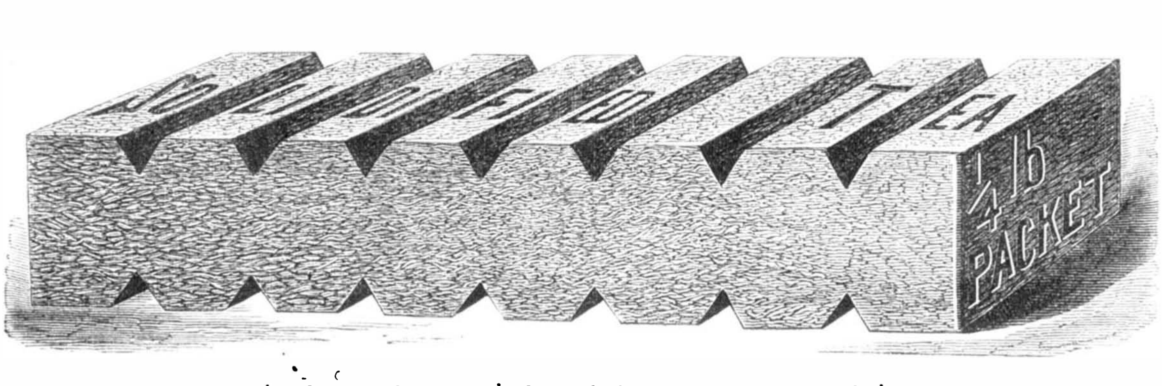
THE spring or summer season opened with unusually hot weather in Europe, but soon afterwards severe cold seems to have set in. The sudden change is accounted for by M. De Fonvielle, a French savant, by the fact that the earth is passing behind a ring of asteroids, which absorb a portion of the sun's 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.

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.

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.

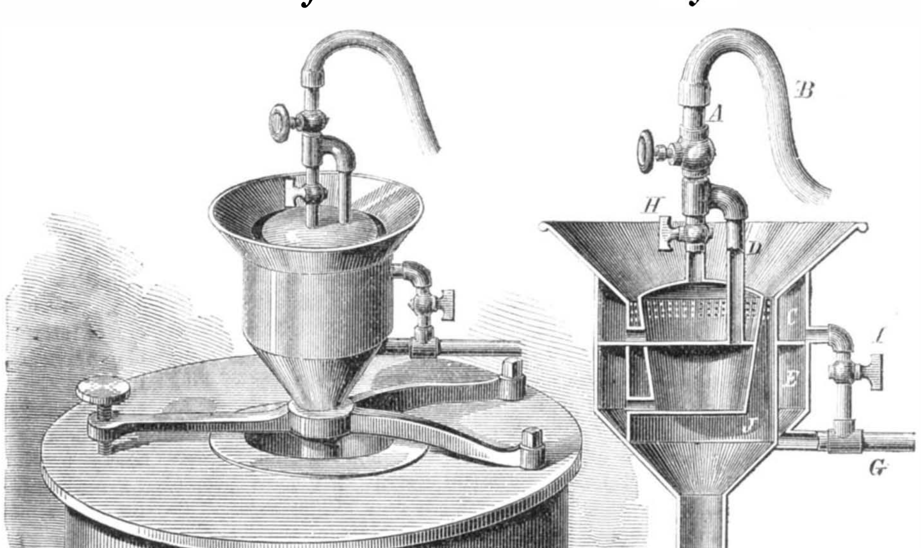


State and county rights for sale. Address James Spratt, 54 Knowle Road, Brixton, London, S. W., England. Samples of the solidified tea may be seen at this office.

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.

Fig. 1 Fig. 2



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.

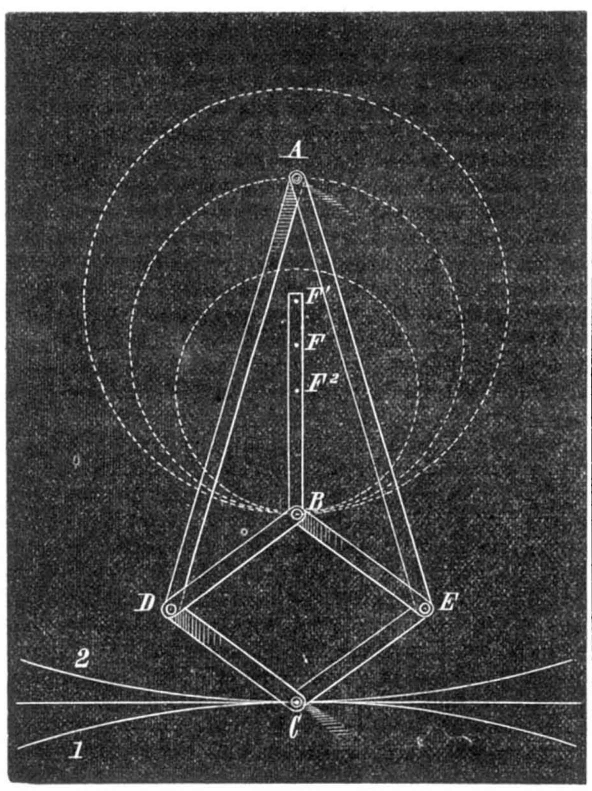
The Vallejo (Cal.) *Independent* describes the following singular search for a gold mine: A short time ago Smith and Barr sold a chicken to a customer. A day or two ago the customer returned and was anxious to learn from whom Smith & Barr had purchased that chicken. At first he declined to tell why he 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. Veaucellier, 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 F^1 F^2, as centers. If now the center of this circle be fixed at F^2, 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 F^1, 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.

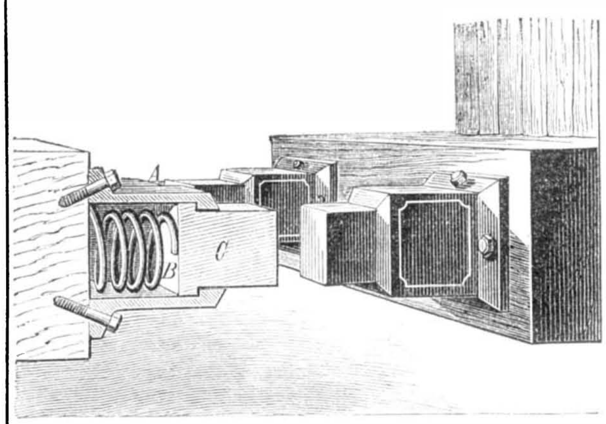
Absorption of Hydrogen by Gray Pig Iron.

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.



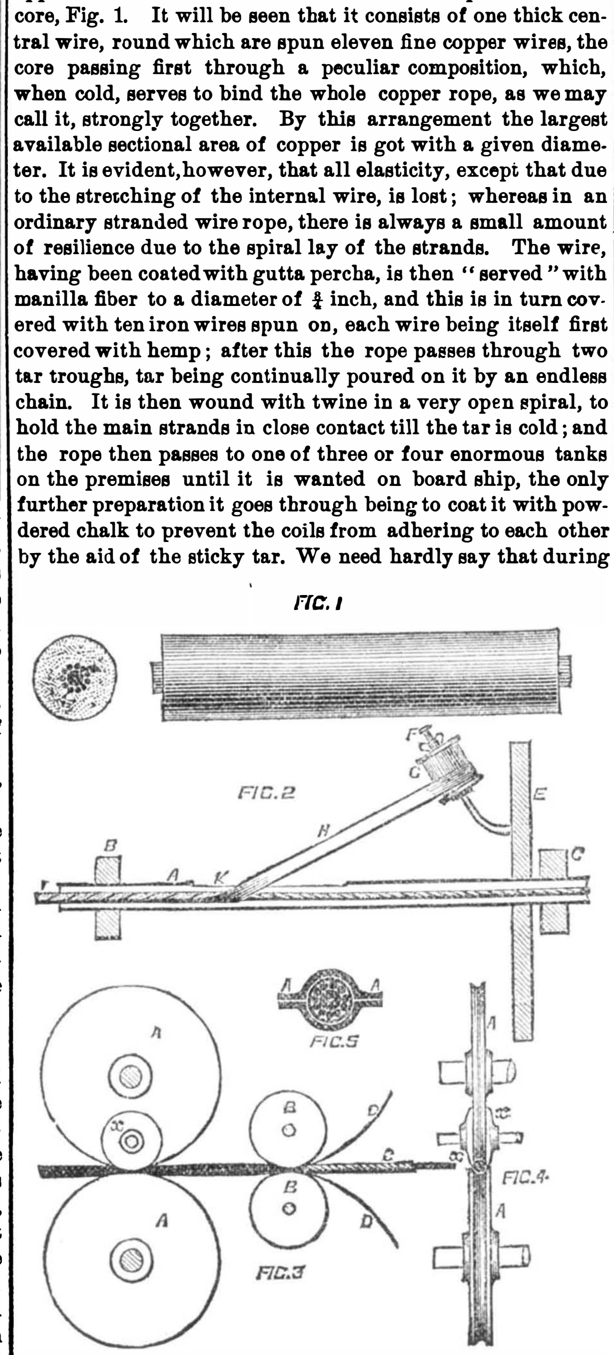
A is a shell of cast iron, surrounded by a flange by which it is bolted to the timber of the car truck. Within the shell is a spiral or rubber spring, B, and on the interior of the former is a shoulder, with which the head of the bumper block, C, projects sufficiently to engage. The head and shoulder 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 ⅞ 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

FIG. 1



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

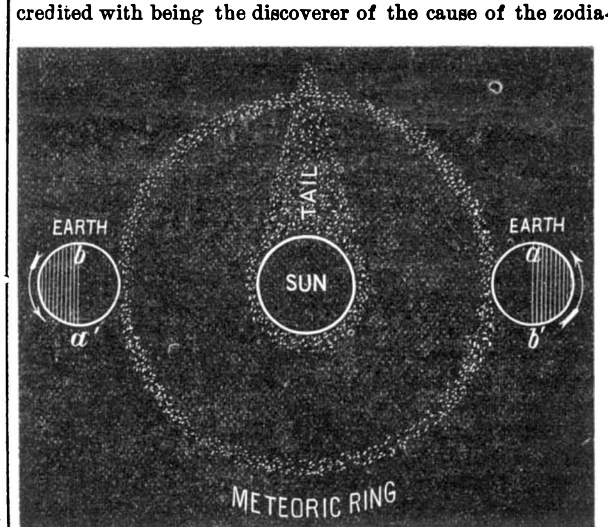
We cannot leave the subject, however, without describing the way in which india rubber is used to cover cables, as the process is exquisite and totally different from that employed when gutta percha is used. At the time of our visit some cable was being made, for what locality we do not know. The core 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 ⅜ 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 ⅜ 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 1¾ miles, except such sound as might reach the observer by divergence from the waves above; whereas when there fraction is least—220,000 feet radius—or where the sky is cloudy, the range would be extended at 2½ 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 1⅞ feet in width, or 5⅝ 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.

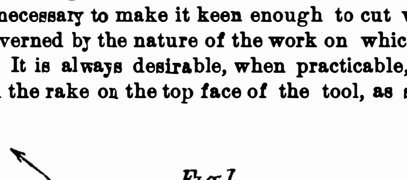
The machinist is to iron what the carpenter, joiner, cabinet maker, wheelwright, etc., are to wood, with the disadvantage that he has to design and determine the shapes and temper of his tools, which vary so much (to suit the work) that the tool suitable for one piece may be totally inadequate to perform 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.

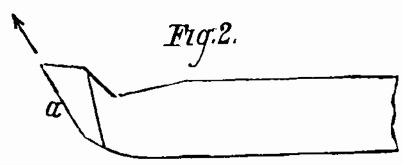
Machine Tools.

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



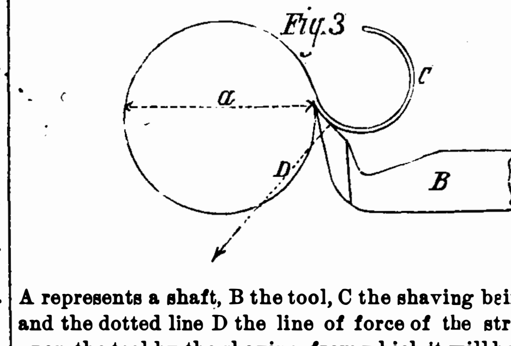
The line a represents the top face, the rake being its incline in the direction of the arrow. In those cases (to be hereafter specified) in which top rake is, from the nature of the work to be cut, impracticable, it must be taken off and given proportionately to the bottom face, as shown in Fig. 2,



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.

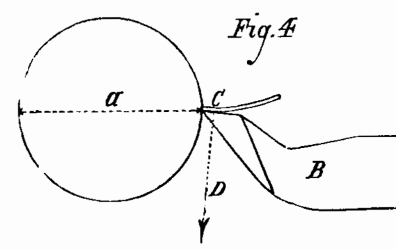
The tool possessing the maximum of top rake, as shown in Fig. 1, is the strongest, because its cutting edge is the best supported by the metal beneath it, and is so presented to the metal to be cut that the tool edge cuts freely, having no tendency to scrape.

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 maximum 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,



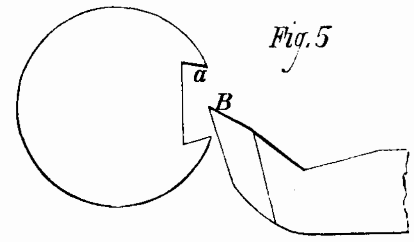
a being the shaft as before, B the tool, and C the shaving, the dotted line D is the direction of the strain put upon the tool by the shaving, which has but very little, if any, tendency to spring the tool into its cut.

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.

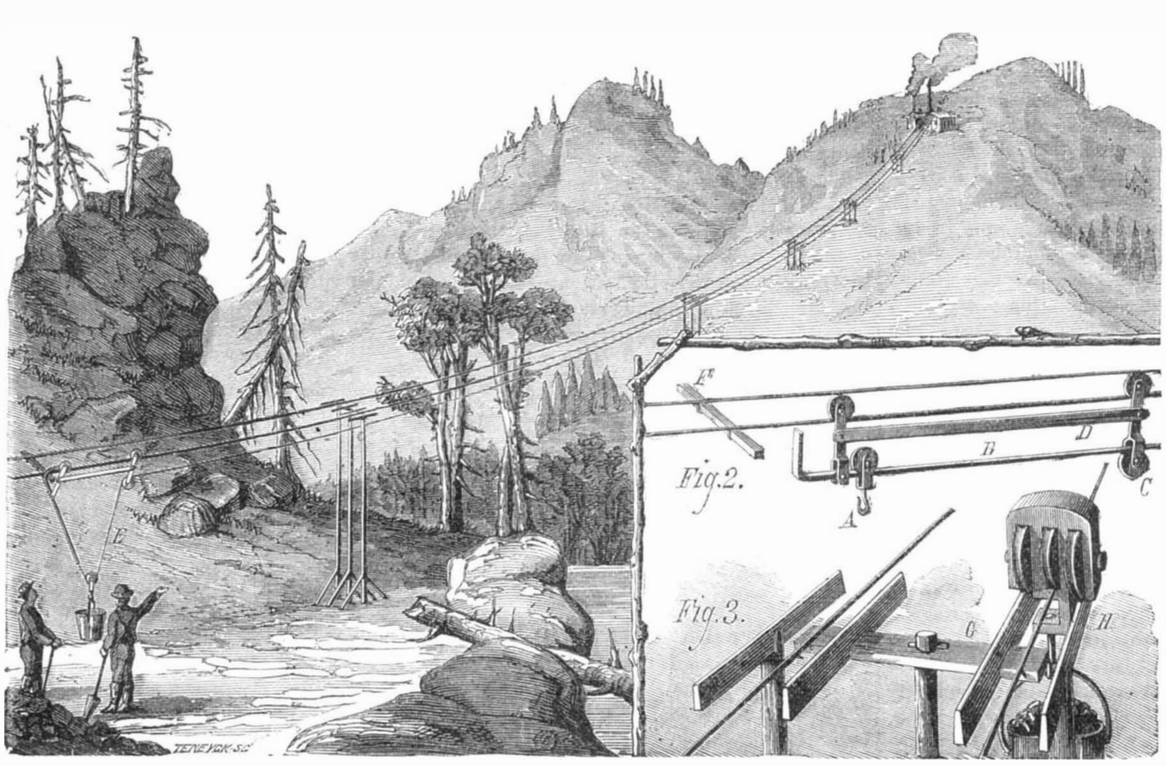
An empty bucket, starting on its downward course, is lowered by the rope, E, until the point at which the filling is to take place is reached. On the way, and directly at such point, is secured a crossbar, F, which the hook end of rod, B, strikes against. The effect of this is to disengage the rear end 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.

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.

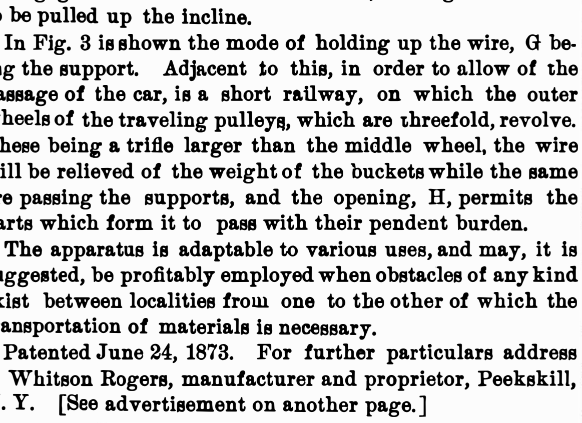
Patented June 24, 1873. For further particulars address J. Whitson Rogers, manufacturer and proprietor, Peekskill, N. Y. [See advertisement on another page.]



WIRE WAY FOR TRANSPORTING ORES, ETC.

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.

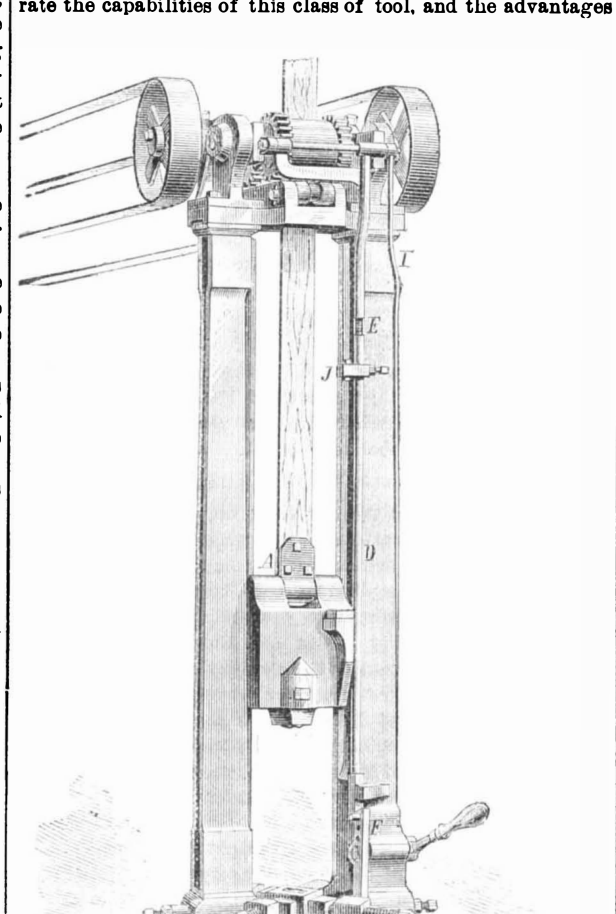


Iceberg Alarm.

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.



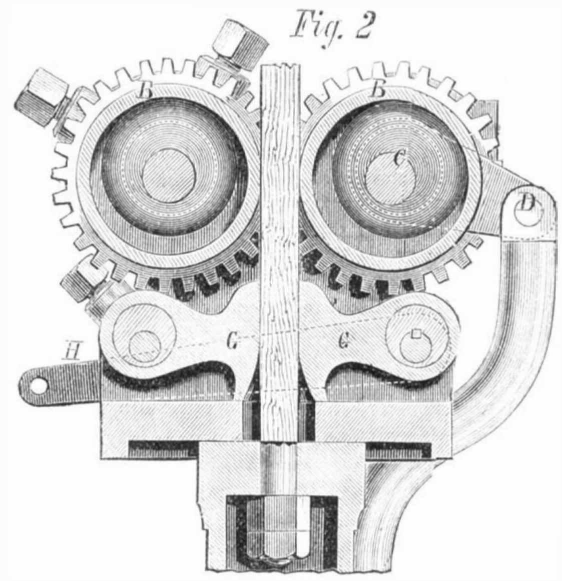
The machine represented in our engravings possesses certain improvements, covered by the patents of Messrs. Hotchkiss & Stiles, which are claimed to add materially to its efficiency. It will be noted that the device belongs to the class of tools in which the hammer is raised by a stiff belt or board 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 gracefully 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.

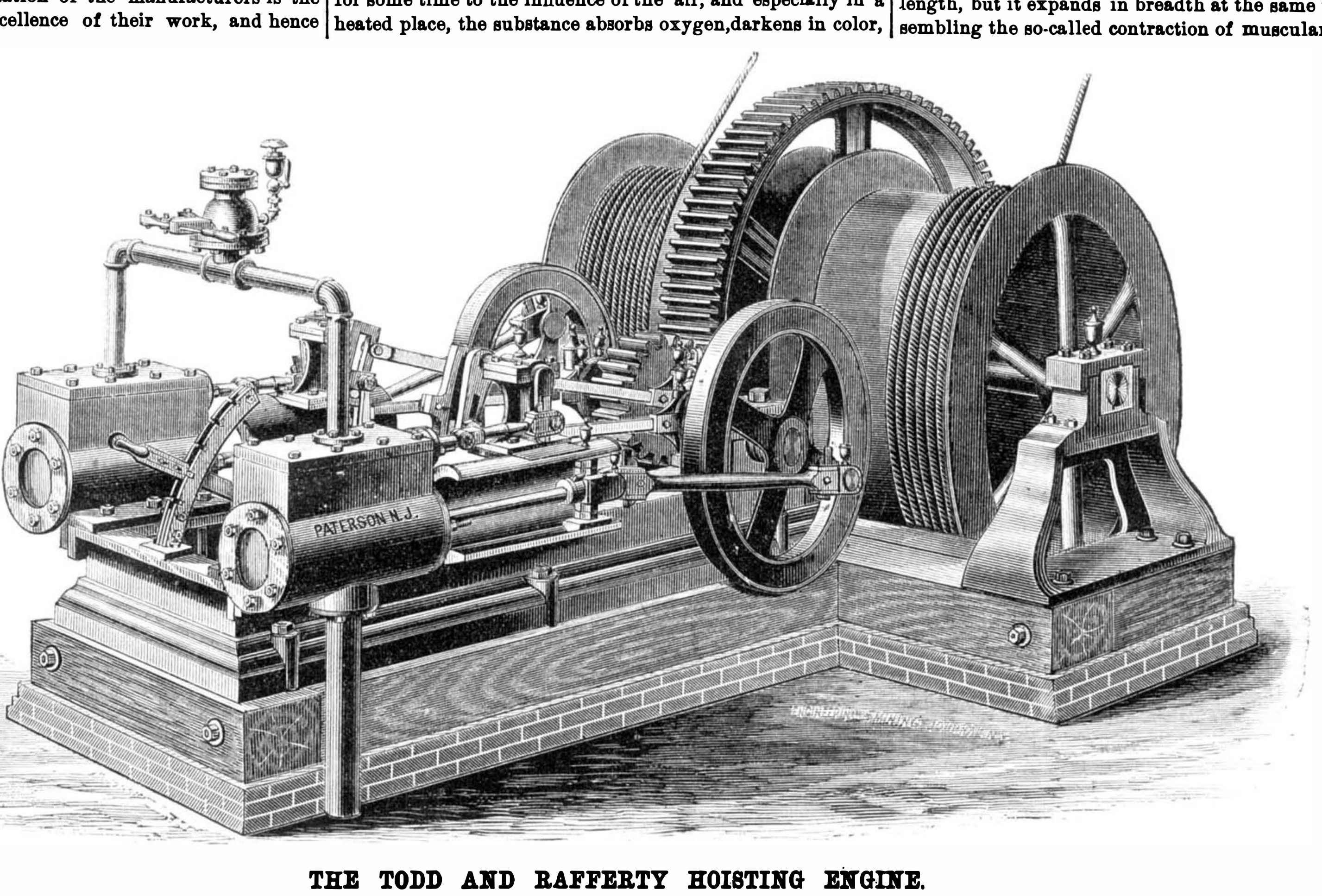
An Amusing Chemical Experiment.

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.

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.

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.

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.

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.

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.

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.

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 origiual 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 through out 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 different diameter, 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 merchandize, 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 $2 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.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

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. 362, 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 1¼ 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 ⅛ 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 1½ inch bore and 3½ 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 20 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 3 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 2 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-crystallizable condition. 2. What is the chemical process of converting sorghum molasses into sugar? A. The conversion of the non-crystallizable into the crystallizable cane sugar. 3. 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 carbon plate, 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 0·0000294 17 of its length for each degree centigrade, when heated between the freezing and boiling points of water; lead 0·0000283 75, and tin 0·0000217 3. 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 carbureted 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, 1¼ ozs. cudbear, and 6 ozs. logwood. Cool to 20° 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 crystalization? 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, $14 \times 14 = 196$; area of upper base, $10 \times 10 = 100$. Square root of the product of these areas, $\sqrt{196 \times 100} = 140$. Perpendicular distance between the two bases, $20 \times 12 = 240$ inches. Contents of timber, $(196 + 100 + 140) \times 80 = 314{,}880$ cubic inches. Contents in cubic feet, $134{,}880 \div 1728 = 20\frac{5}{7}$.

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 (2x4, oak) in picket fences drawn apart 8¼ 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 lightstraw 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.]

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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:

29,236.—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.
30,381.—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.

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 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 13, 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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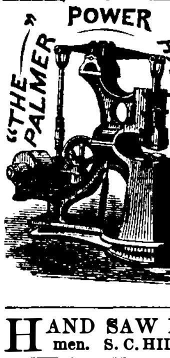

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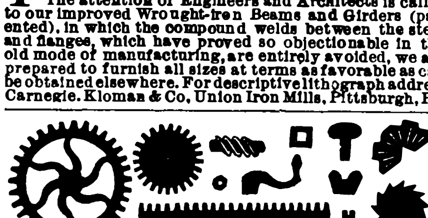

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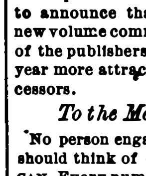

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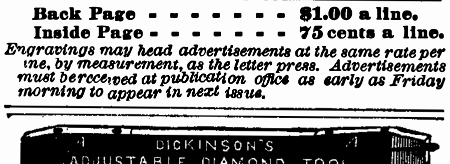

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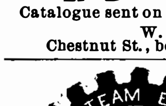

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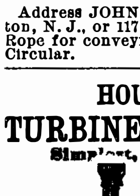

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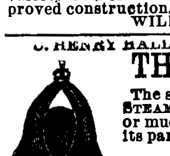

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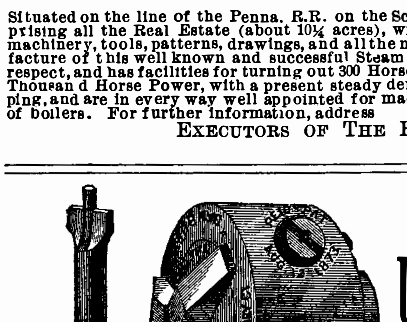

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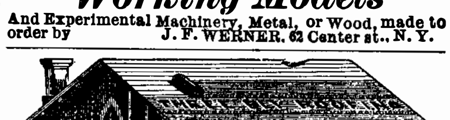

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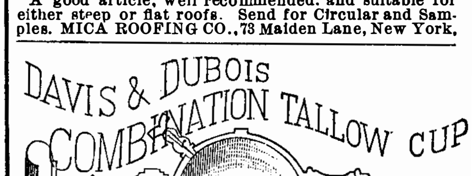

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