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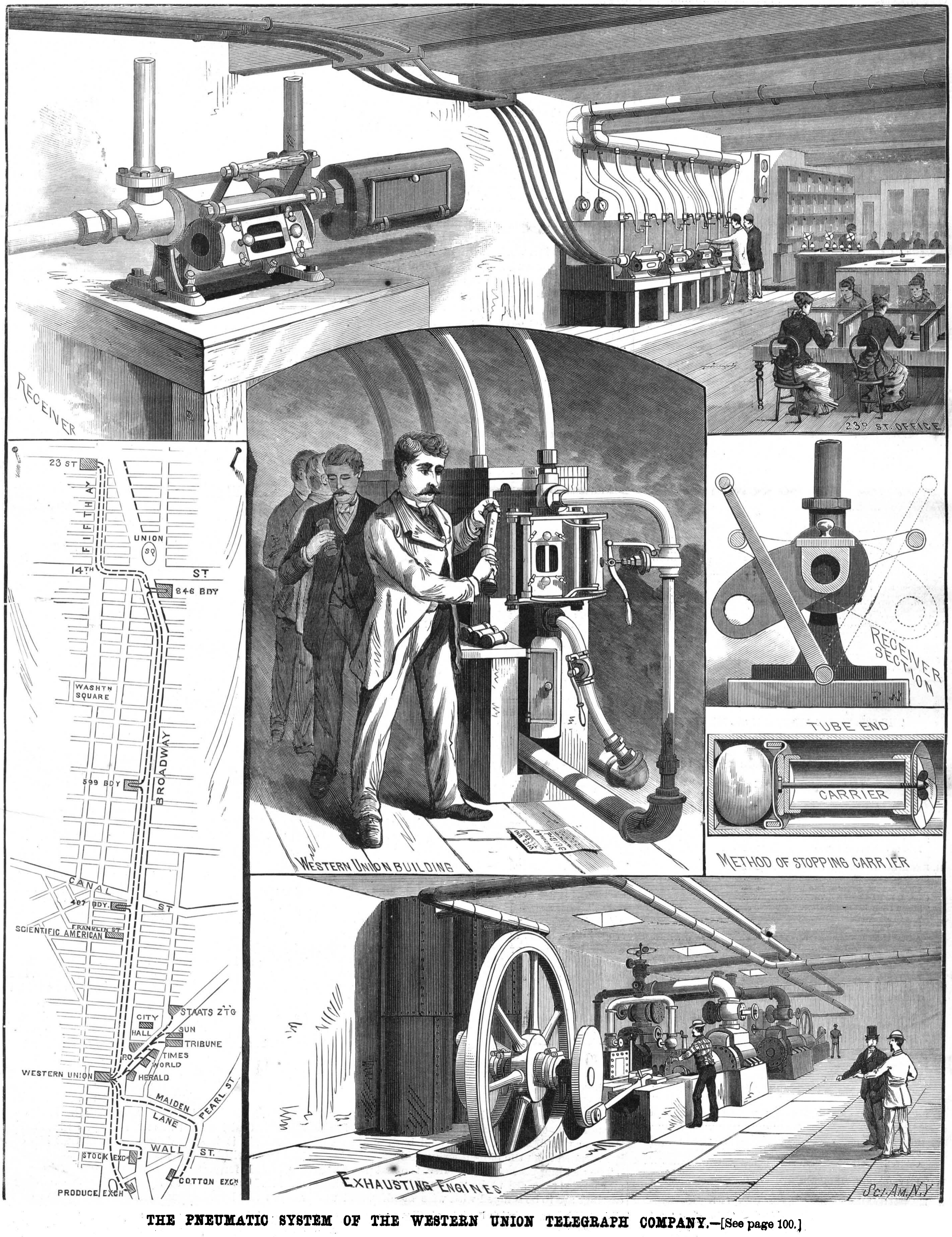

THE PNEUMATIC SYSTEM OF THE WESTERN UNION TELEGRAPH COMPANY.—[See page 100.]

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NEW YORK, SATURDAY, FEBRUARY 14, 1885.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT,

No. 476,

For the Week Ending February 14, 1885.

Price 10 cents. For sale by all newsdealers.

SHOP REMEDIES.

A series of lectures by resident physicians and surgeons is being delivered in an Eastern city with the object of giving instruction in "first aid to the injured," including accidents by scalding, burning, cutting, bruising, loss of members, and other accidents. The project of instruction comprehends, for its pupils, members of the police force, nurses, drivers of vehicles, superintendents and foremen of machinery establishments, and the public generally. There is a large amount of common sense knowledge, involving some appreciation of the facts of human bodily structure, that is generally accorded to the medical profession, but which should be the common property of all. It is this sort of knowledge that this movement is intended to impart. There can be no doubt that lives have been lost for want of prompt remedies in extreme contingencies, as in suffocation by drowning, asphyxiation in foul air, and syncope in fits. In most cases the spectators are willing, and even anxious, to aid, but have not the requisite knowledge to make their aid useful.

Probably no occupation—saving that of the railroad engineer and fireman—is so liable to serious accidents as that of the machinist; and every shop ought to have its remedies for accidents; and if such instruction as is being given in Hartford, Conn., this winter is available, some authorized men, foremen, bosses, contractors, and ready men should be sent to the lectures, or they should be given elsewhere. The chances of injury in a shop where machinery are used are greater than the opportunities of immunity from injury; machinery has no conscience, no compassion, no consideration; the victim of its clutches is a victim without hope of redemption. If the shop or manufactory is provided with measurably safe appliances, there is still left the possible contingencies of personal injury; for belts, and pulleys, and connecting gear wheels with shearing, tearing cogs, cannot always be covered against ignorant meddling or unconscious contact.

There should be kept in every shop some ready appliances for accidents, when preventives against accidents are not sufficient. Most shops have their own local remedies, better at home than elsewhere, and generally favorably regarded where tested. So it would be improper to advertise any one remedy as better than another. But there are general remedies, of which there can be no question. A tincture of arnica is known, the world over, as a remedy for bruises, burns, scalds, and fresh wounds, as an external application; so is the salve of diachylum used in all portions of the country. There is also a common sticking plaster that may be bought in sheets or rolls, which is very useful in cuts and bruises. This is not the "court plaster" in common toilet use, but a solid basic linen, with a healing spread on it, that may be obtained at any apothecary's shop. Many ghastly wounds that would leave, in healing, livid and offensive scars are reduced and made merely trifling in character by timely application of adhesive plaster. There should be, in every shop and manufactory, some ready means of prompt attention to wounds, and men should be designated to antedate the arrival of the surgeon. There are plenty of such men in our shops, amply competent for the occasion if selected for the work.

CAST IRON FINISH.

Most of the iron castings used in the manufacture of machines are left in their natural state, that is to say, that legs, standards, struts, lengths, connections, entire frames, and all the attachments of machinery that make a machine an entity, are not machine finished or hand polished. As the casting comes from the mould it must be "pickled," to separate the burned-on sand from the iron. Then the casting is either handscraped with wire brush or with a broken file scraper. In this condition of cleanliness the casting goes into the machine shop. After all the machine work has been done, the painter is called in to "give style" to the machine, to "make it attractive," and meanwhile to "putty up holes."

A better way of managing cast iron is that of using it as iron. Brass and bronze, and even copper, from which both are produced, are used as competent metals; whatever is of bronze or of brass is reckoned in mechanics as of a simple metal; it has its acids to change its color, and does not depend on paint for beauty.

Iron has its capabilities as well as bronze or brass has. It is possible to use plain cast iron without artificial paint, as brass and bronze are used, by acid treatment, and produce very agreeable effects. More than this, the preservative effects of acid on iron are not half understood. A piece of cast iron that has gone through the pickling process from the foundry, and has been left out an entire winter, exposed to the storms of our northern climate, is as clean when taken in, in the spring, as though just from the acid bath—more so, as it is cleaned from the half-adhering scale.

The pickling process is, of course, the first process for all castings that are to be "cleaned." These pickled castings are to be scraped with wire brushes, and possibly to be scraped with broken-off files or similar contrivances. Then follows a rough filing to reduce small protuberances, and a hand chiseling to clean the surface. When all is done, the surface of the casting is in a very unattractive state; it is full of defects—of contour, of shapeliness, of color—so that the unappreciative observer might wonder what the resultant operations would produce. But paint and putty and deft ornamentation usually conceal defects and heighten attractiveness.

There are better means than paint and putty. Some recent experiments give very pleasing results. Small frames of sewing machines, amateur lathes, and reciprocating saws were subjected to a cleaning process by diluted acid, as in the ordinary "pickling" bath. Then they were either cleaned in the tumbling barrel or by hand, to free them from scale. The surface was then wiped or brushed over with rag or brush containing melted paraffine. This process was an easy and rapid one. If the waxy paraffine "held" on some protuberent places in cooling, the entire surface could be dressed to evenness by means of a piece of pine or other soft wood shaped like a chisel or a scraper. On this surface could be painted or gilded any device required by the conditions, the paraffine not forming an artificial and extraneous coating, but simply filling the pores of the iron so as to make a surface. The result was a pleasant gray base—the iron—on which decoration showed finely.

INSIDE CALIPERING.

Even now, with all the improved means of doing accurate work, the "cut and try" method is much too commonly practiced. During less than fifteen minutes' conversation with the proprietor of a first class machine shop recently, the writer noticed that a lathe man removed and replaced a short length arbor, trying it in the bored hole of a wheel, no less than four times; it is sufficient to say that this handling of the arbor occupied more time than did the actual turning of the arbor. Every machinist knows that such a method of doing work is slipshod, and only an exhibition of the "cut and try" no-system. If the arbor had been six inches diameter and as many feet long, and the wheel had weighed a ton, the frequent trials for fit by handling would not have occurred. And if a fit on a large surface can be made without the actual repeated placing of the parts together, it surely ought to be possible on a smaller job.

There is not care enough taken in the instruction of apprentices in measurements by calipers or its equivalent. The calipers may not be an absolute guide; but if it is not, it is as near as the boxwood rule or the steel scale—if it is properly used. The use of inside calipers, and especially of combined inside and outside calipers, ought to be discouraged. Inside calipers is a very deceptive tool; half a dozen measurements may be taken by it from the same hole. Perhaps this uncertainty is owing to the fact that the points of contact and the handling portion form angles with varying proportions as the tool is handled. And yet bored holes must be measured in order to make turned fits.

There is a very simple means of making this measurement—so simple that some readers may smile at it derisively. The method has, however, the merit of tested, practical usefulness. To get the diameter of a bored hole, use a piece of iron wire—a straight wire of about the hole's diameter—and point each end on the grindstone. Hold this wire inside the hole across its diameter. If it is too long, it will bind, and it cannot be readily moved; if it is too short, it will fall if left standing or placed across the diameter. In the one case it may be shortened by filing, and in the other be lengthened by a few light hammer raps. When the two points of the wire engage, and possibly a faint gleam of light may be seen between one and the side of the hole, the diameter is obtained, and by setting the calipers to these points the stud, arbor shaft, or crank pin can be turned to size. The same method is applicable to small holes, and there is no danger of a misfit if the measurement by the pointed wire be well done.

TREATMENT OF STEEL.

Methods of using steel are as many and diverse as are its users; at least, there are few steel using mechanics who agree in all the methods of forging, shaping, hardening, and tempering a tool. The writer was told, recently, by an old, experienced mechanic, that no turning or planing tool for iron should be drawn to temper; they should be left as hard as fire and water could make them. This was news to one who forty years ago used Sanderson's and Jessop's steels, and always drew the lathe and planer tools down to, at least, a straw. But on seeing the process of the older mechanic it was noticed that he permitted the steel to become only a dull red in the lead bath before cooling it. It is probable, also, that the steel was not so high as Sanderson's or Jessop's; it was an American steel that has come into favor within a few years.

A certain forger makes a practice of dressing a tool, after he has forged it to form, by light hammering as long as the hammer can make an impression on the metal. This hammering is continued after the color of heat has left the steel. He insists that this dressing "fines" the steel, that is, that it packs its particles and makes the grain closer. But when he tempers the tool, he is careful not to heat above a dull red, and then draws to a straw color.

A manufacturer who uses mills (milling machine cutters) in his work continually will not have a mill that has not been well forged from a bar. He prefers the drop forged blanks, which are usually made from a cut-off "chunk" from a bar of square steel. He insists that the tool must be forged to form and not cut from the merchantable bar, however well adapted as to size the bar may be.

Yet another takes a bar of three inch steel, or perhaps three and a half inches diameter, and cuts off a disk of the proper thickness for the mill he wants, chucks and drills it, mounts it on an arbor, finishes it to size, cuts the teeth, and hardens and tempers it. There is not a particle of forging in the work. The same man makes taps and reamers from the bar, choosing a bar to size, and refuses to subject the steel to the hammer. He claims that even the bar commercial steel is overworked in getting it into shape.

INVENTION AS AN ART.

To the popular mind the inventor, like the poet, is born, not made. Genius, it is thought, independent of education or practice, is its sole prerequisite. In some mysterious way Nature endows some men with power to conceive and produce new things and processes, which the world consciously or unconsciously needs, but, in the absence of the inventor's genius, is unable to get. Without a born capacity to invent, invention is deemed impossible, and rightly enough; but—herein arises the popular error—it is assumed that the faculty of original creation is a rare one, possessed by few, and not to be attained by others, however earnestly they may strive for it. On the contrary, the faculty is one common to the majority of men, more or less, and always ready to be made more under favorable conditions.

The singers in any community are relatively few; yet the most experienced teachers of music, who have had much to do in teaching music to large and unselected classes, unite in asserting that all men can learn to sing if they want to, and most men to sing fairly well.

It is much the same with invention. The innate capacity is common; its practical and profitable development is much less common, for the reason that comparatively few try to develop it, the multitude believing that the fundamental "gift" is not theirs. Accordingly, it is only by accident, or through the stress of special circumstances, that most inventors discover that there is any chance for them in that field of productive effort. Once enlisted in the work, successfully or unsuccessfully, they are pretty sure to discover that invention is an art which must, for the most part, be mastered as other arts are, by diligent study and patient effort. Unlike other arts, however, its boundaries are not limited to any one field of thought or knowledge or action, but are in every direction limitless, though practically bordered on the hither side by what men have already discovered and done.

Practically bordered; for while the reproduction of an old device may, from the inventor's standpoint, be as perfect an act of invention as the newest and most original invention might be, the field for profitable invention lies mainly in regions new and unexplored. An invention must be novel to be patentable; and, except for practice, it is only patentable inventions that are worth making. Knowledge, therefore, specific, positive, and comprehensive knowledge, of what has been done in the field in which the inventor's work is to be done, and a clear apprehension of something that remains to be done, are important elements in the successful inventor's outfit. The wider his range of such knowledge, the more numerous his opportunities to invent must naturally be, provided the manner in which his knowledge has been gained has not unfitted him for independent thought and action. A man may load himself with so many tools that he cannot work with any of them. In like manner overmuch learning may spoil a man for doing. The pack mule of an explorer's train is not likely to make many novel observations or discoveries.

To succeed in the art of invention it is commonly the rule that a habit of inventing must go hand in hand with observation and study. Sometimes a lucky hit may be made by an inexperienced inventor, just as men ignorant of minerals have stumbled on valuable mines. Nevertheless, the man who has trained himself to invent, and is in the habit of regarding every new fact or experience from the standpoint of its possible utility as a basis for invention, will excel the untrained inventor as surely in the long run as the practiced prospector will the unintelligent and inexperienced "tenderfoot." And the case in favor of the practiced inventor is even stronger, for the ability to recognize the need of an invention, though of primary importance, is less important than the ability to see how the need may be supplied and demonstrate the solution of the problem by doing it.

"Practice, practice, practice," said Demosthenes, is the first requisite for success in oratory. Equally is it necessary for sure success in invention. It does not follow that the would-be orator must get his practice wholly in the forum; no more need the inventor get his practice in absolutely new inventions. The numerous preliminary failures which have led up to the great success of many greatly successful inventors, while they emphasize the need of practice in this art, quite as clearly indicate the wisdom of not confining practice to what promises to be patentable. The work of the novice in invention may be, frequently is, valuable in itself; but if large success in the art is aimed at, it will not pay to suspend practice for the lack of novelties to work on. The resolution of old problems affords excellent and useful practice for the beginner, who may find a ready test for the value of his work by comparing its results with those exhibited in the perfected inventions of more practiced minds; and the habit thus gained of independently rebuilding and critically examining existing inventions will furnish admirable training for original work in fields entirely new.

The time may come when a systematic training in the art of invention, with practice in reinventing machines of greater or less complexity and the standard devices and movements of practical mechanics, will form a part of every first rate machinist's education; and similarly in other departments of productive industry. But until then those who wish to fit themselves for the cultivation of this most inviting and profitable art, the art of invention, must be their own guides.

Not the least advantage in purposely reinventing for the sake of practice comes from the circumstance that such practice-work cannot lead to loss or disappointment, while it cannot fail to lead the student to a practical working knowledge of the materials and methods employed by the most successful inventors.

Such self-training is sure to pay. Much as our inventors have already accomplished, the art of invention, as an art, is yet in its infancy; and it is safe to say that the prizes offered for its successful cultivation in the future are vastly greater and more numerous than those it has awarded to its votaries in the past.

HAS ELECTRIC LIGHT ANY EFFECT ON THE GROWTH OF PLANTS?

In conversation last week with Mr. Isaac Buchanan, one of the best known florists of New York, this question came up, and he stated that his observation inclined him to believe that when plants were used for decorative purposes in rooms where the electric light was used instead of gas, they seemed to have all the health and vigor as if growing under the light of a conservatory. He furthermore said that he had long ago observed that on moonlight nights there was always a better development of the flowers of camellias and roses during the winter months than when there was no moonlight. Hence he inferred that light, no matter how obtained, was beneficial to the growth of plants. This opinion from such an authority as Mr. Buchanan, who is well known to have had nearly half a century's experience, and who has always been a close observer, is certainly worthy of great attention.

Not long ago a French savant made extensive experiments with the use of the electric light to assist in forcing flowers during the dark days in winter, and from which wonderful results were claimed; but unfortunately the experiment was not a comparative one, being made with only one conservatory in which the light was used. To make the value of such an experiment certain, the only way would be to use two greenhouses, both growing the same kind of plants, in the same temperature, and the same soil and moisture—one to be lighted with electricity for three or four months at night, and the other left in the dark, and the results noted.

It is well known to all cultivators that the greater the amount of sunlight, the greater will be the development of the flowers. We all know that in the dark days of December and January the growth development of rosebuds, carnations, etc., is less than half of what it is in the months of March and April, when the days have lengthened, and the increased sunlight gives nearly twice the amount of light. Few commercial florists have the means or time for such expensive experiments as would be necessary to determine whether the use of the electric light in forcing flowers and fruit in greenhouses during winter could be profitably employed. It is a matter of sufficient importance, it would seem, for the Agricultural Department at Washington to take hold of. Certainly thousands of dollars have been expended by that department, in the past, on experiments which would have been of less general interest even had they proved successful. For be it known that the greenhouse industry now in the forcing of vegetables, fruits, and particularly flowers, has millions of capital invested in it throughout the land, and gives employment to tens of thousands of men; and if nature can be aided by this wonderful electric light, it will be a leap forward that the discoverer might well be proud of.

PETER HENDERSON.

Jersey City Heights, N. J., Jan. 30, 1885.

Progress of Gas Engineering.

Sir F. J. Bramwell, in his recent inaugural address as president of the Institution of Civil Engineers, made some interesting references to coal gas as a source of light, of heat, and of power. Dwelling upon the improvements that have been made in the application of gas as a prime motor, he pointed out that, whereas in the gas engine as originally introduced, 74 cubic feet of gas per hour were required to generate one indicated horse power, in the engines now made that consumption was reduced to less than one-third, each indicated horse power being the result of a consumption varying from 20 to 23 cubic feet of gas per hour. Further, that at the current low price of gas in England the cost of that hourly consumption was only about seven-eighths of a penny; and that this would compete on favorable terms with the use of coal (at ½d. per hour), on account of the attendant saving in other other directions, and consequent advantages in the abatement of smoke and reduced risk of explosion. In reference to the use of coal gas as an illuminant, Sir Frederick compared the two years 1862 and 1884; and showed that whereas in the former year 5 cubic feet gave a light of 12 candle power, at the price of 4s. to 5s. per 1,000 cubic feet, at the present time 16 candle gas costs but 2s. 10d. per thousand. Moreover, the improvements effected by regenerative burners and other modes of burning gave promise of a large increase in the candle power per cubic foot, even to the extent of more than double.

The Bell Telephone in Canada.

The Minister of Agriculture has delivered a decision in the case of the Bell Telephone Company, of Canada, declaring the patent void for the reason that the company or its representatives had imported the patented articles after twelve months from the date of the patent; also for not having manufactured in Canada such articles to the extent required by law after two years of existence of their privilege, and also for having refused to sell or deliver licenses to persons willing to pay a reasonable price for the private and free use of the patented invention.

On September 2 a petition was addressed to the Hon. J. H. Pope, Minister of Agriculture, asking that A. G. Bell's telephone patent be declared invalid. Counsel for the appellant based his claim on the failure of the Bell Telephone Company to comply with section 28 of the Patent Act of 1872, which provides as follows:

"That every patent granted under this act shall be subject, and expressed to be subject, to the condition that such patent, and all the rights and privileges thereby granted, shall cease and the patent shall be null and void at the end of two years from the date thereof, unless the patentee or his assignee or assignees shall within that period have commenced, and shall after such commencement carry on, in Canada, the construction or manufacture of the invention or discovery patented in such manner that any person desiring to use it may obtain it or cause it to be made for him at a reasonable price at some manufactory or establishment for making or constructing it in Canada, and such patent shall be void if after the expiration of twelve months from the granting thereof the patentee or his assignee or assignees for the whole or part of his interest in the patent imports or causes to be imported into Canada the invention for which the patent is granted, and provided always that in case disputes arise as to whether a patent has or has not become null and void under the provisions of this section, such disputes shall be settled by the Minister of Agriculture or his deputy, whose decision shall be final."

This decision will not make so very much difference with the company, as they are in possession of the field, and doing about all the business there is to do, having a well established plant in every town of importance in the Dominion.

Carbon for Electric Arc Lights.

Carbons for arc lights may be made, says a well informed writer, by thoroughly incorporating a mixture of finely divided carbonaceous material, such as the purer forms of coke or gas retort carbon, with some liquid substance, such as oil, tar, or sugar sirup, that, when subjected to a high temperature, is capable of being carbonized. The finely divided ingredients are thoroughly mixed and made into a stiff paste with the carbonizable liquid, and then forced by heavy hydraulic pressure through circular apertures in plates. The continuous cylindrical rods thus obtained are cut into suitable lengths, carefully dried, and then heated to incandescence in ovens while out of contact with air. By this process the carbonizable liquids are reduced to a carbon, which thoroughly binds together the various ingredients. Experience has shown that the higher the temperature and the greater the length of time during which the carbons are subjected to the baking process, the greater their hardness and the higher their electrical conductivity. In order to insure freedom from slight porosity, in most cases the carbons are subjected to a rebaking. After removal from the oven they are soaked in strong sirup, and again placed in the oven and heated to incandescence as before.

Nebraska Coal.

Professor L. E. Hicks, of the University of Nebraska, writing in the *American Journal of Science*, says:

It has long been a mooted question, both in the minds of geologists and of practical miners, whether there is coal in Nebraska that will pay for mining. The citizens of Brownville, Nemaha County, have been making a practical test of this matter, for which they deserve much credit, since their test well has brought to light facts of great scientific interest and value irrespective of the economical results.

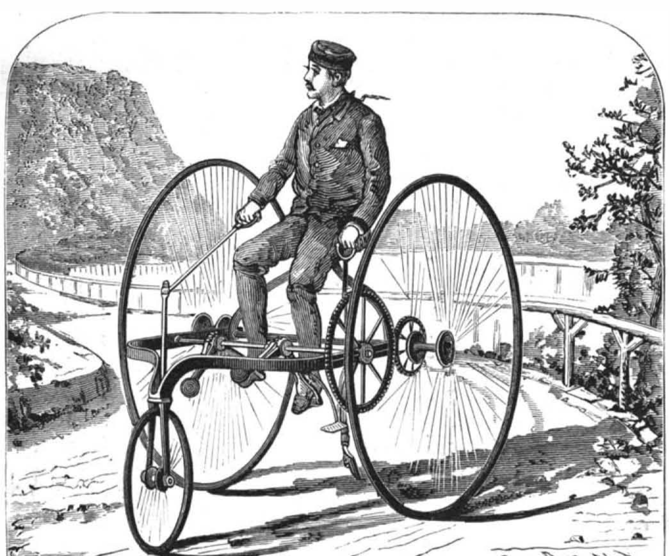
The boring was begun at an elevation of 919 feet above the level of the sea, and carried to the depth of 1,000 feet 10 inches, or 81 feet 10 inches below sea level. The surface rocks at Brownville are upper carboniferous, and show traces of coal, as, for instance, in the west bank of the Missouri River just above the railway station. The drill penetrated the lower coal measures, but did not pass through them. These are the productive measures of the carboniferous in Iowa and in the States farther east. Here, therefore, is the place to find coal if it exists at all in paying quantities in Nebraska. The only seam found in the lower coal measures was one of bituminous coal of fair quality, 30 inches in thickness, at a depth of 820 feet 8 inches. The boring was carried 180 feet further without encountering any more coal. Below the 30-inch seam nothing was encountered but the shales, limestones, and sandstones ordinarily found in the lower coal measures. This renders it improbable that any more coal would be found at greater depths, although the demonstration would have been more complete if the hole had been put down one or two hundred feet deeper.

Above the 30-inch seam three other thin seams were found; one 8 inches thick at a depth of 93 feet, another 14 inches thick at a depth of 242 feet, and a third 10 inches thick at a depth of 375 feet. These evidently belong to the upper coal measures, as there is an interval of nearly 400 feet of barren rocks between them and the 30-inch seam. Immediately below the 14-inch seam is a stratum of sandstone, 20 feet thick, containing water strongly impregnated with salt and other minerals in solution, which flowed out at the top of the well.

Whether the 30-inch seam can be profitably worked at a depth of 820 feet is a question for the practical miner rather than for the geologist. It would at once be answered in the negative where fuel is plenty, but in this land of prairies and magnificent distances from productive mines the answer is not so much a matter of course.

IMPROVED TRICYCLE.

The two driving wheels are mounted rigidly on the axle supporting the vehicle frame, which is provided at its rear end with two standards carrying the seat. The steering wheel is journaled in a fork turning in the front part of the frame; the wheel is turned by means of a rod extending to within easy reach of the rider. Near one end of the axle is mounted a pinion, which engages with a cogwheel mounted outside of the frame, on a shaft placed parallel with and a short distance in front of the axle. On the shaft are two ratchet wheels, at each of which is a rocking pawl frame, which has a weight on one end and pedals on the other. The weights swing the front ends of the frames down to give the pawls a fresh grip. The two frames are depressed alternately, and by means of their pawls acting on the ratchet wheels they revolve the axle through the gearing, which is so arranged that every time a rocking frame is depressed the driving wheels make one revolution. Great speed is thus obtained. The tricycle is simple in construction and strong.

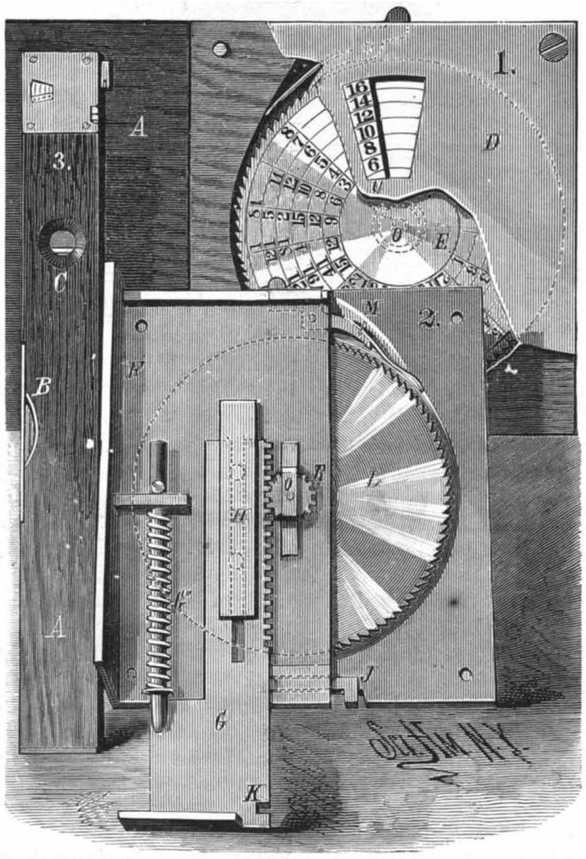


VOSSMER'S IMPROVED TRICYCLE.

This invention has been patented by Mr. F. W. Vossmer, of 726 West Huntingdon Street, Philadelphia, Pa.

IMPROVED SPIRIT LEVEL.

In the accompanying engraving of a spirit level patented by Mr. William Grams, of Sturgis, Dakota, Fig. 1 is an enlarged side view, partly broken away, of one end of the level, Fig. 2 is an inside view of the end casing, and its mechanism for moving the indicator dial, and Fig. 3 is a face view of the level. The body, A, of the level is fitted with the usual leveling tubes, B and C. The metal plate, D, is formed with an opening, through which the numerals on the dial may be read, and is let flush into the face of the level. An angle plate, F, has an inner flange plate lying just behind the dial and an end plate covering the end of the level. The slide bar, G, has a foot plate which rests on the work to be leveled. This bar is held so as to slide on the plate, F, by means of pins, fixed on which is the plate, H; these pins work in a slot in the bar. A spring on the rod, G'', acts to force the slide bar outward, as indicated in Fig. 2. A slide pin, J, may be passed into the notch, K, to hold the slide bar flush with the edge of the level, so that it will not interfere with the use of the level in setting work plumb by the spirit glass, C. The indicator dial is formed upon a plate, L, having ratchet teeth which are engaged by a pawl pivoted to the plate, F. The dial is fixed rigidly to a shaft, O, which carries a pinion, R, meshing with teeth formed on the edge of the bar, G. As the bar is moved in and out, the dial will be turned to carry its radial rows of figures in front of the opening in the plate, D. The dial is divided into spaces by concentric and radial lines. Each space represents by one radial row of figures sixteenths of an inch, while the larger radially arranged figures represent full inches. The graduations of the spaces indicate the extent to which the work is out of level, and as each space passes the opening, the numerals placed at U, along one edge of the opening, serve by comparison with the numerals of the spaces to show the extent to which the work stands out of level for any given length, all the numerals reading outward. The dial is graduated according to the length of the level. The pawl, M, extends beyond the upper edge of the level, so as to be pressed with the finger.



GRAMS' IMPROVED SPIRIT LEVEL.

The bolt, J, being withdrawn from the notch, the bar, G, is forced outward by the spring, the teeth of the dial escaping freely past the end of the pawl. The level is then laid on the work, the end of the pawl is depressed by the finger to disengage it from the dial, and the end of the level is depressed to carry the bar, G, inward until the spirit glass, B, indicates that the tool between its lower end and the foot of the bar, G, stands level. The pawl then being released holds the dial in the exact position to which it was carried when the true level was indicated. The dial will then show just how much the work stands out of level for any given length in the level, shown up to sixteen feet in length, and for any length beyond that the variation from a true level may be readily calculated.

A FRIEND at our elbow says he is tired of hearing the cry of *overproduction* so generally repeated as the cause of our hard times. He suggests, for a change, *lack of consumption* to be the cause.

Genius Should Be Recognized.

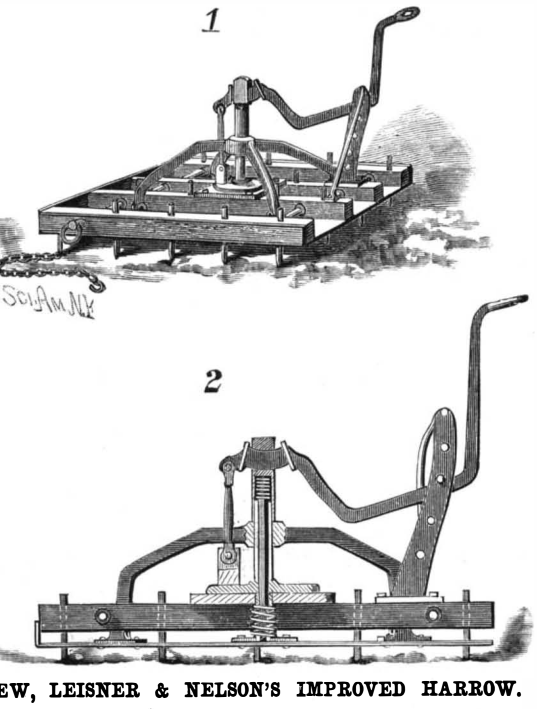
It is not generous to withhold an expression of sympathy for those who have failed in the accomplishment of great undertakings, in which they have embarked all their pecuniary, physical, and intellectual resources. As a general rule, people are hardly considerate enough toward the unsuccessful. There is too much disposition to forget their pluck and perseverance, and sneer at their trustfulness. We ought to bear in mind that it is this sublime audacity of faith to which we are indebted for the marvelous achievements of our age. The struggles, trials, repulses, defeats, which have preceded most, if not all, of the triumphs of ingenuity which steam and electricity have wrought must have been very wearing to the nervous system. The patience and courage of inventors are proverbially heroic, but we seldom know, or care to know, anything about them till they have won the crown of victory. Happily, genius is irrepressible, and not easily daunted because it lacks appreciation. It is continually astonishing the its world with fresh exploits, and there is little fear that its progress will be stayed by obstacles of any sort. Still, it could be wished that the recognition and commendation of every effort to benefit mankind were more general and hearty than they are. It is a wise policy to encourage and foster the inventive spirit, in whatever useful channel it may be directed. The mechanical arts have been completely revolutionized within a generation by the introduction of novel machinery. In our own trade these appliances for utilizing labor have been wonderfully multiplied, and are constantly increasing. The results of them are seen in such a limitless capacity for production that the only way we can prevent the supply from running ahead of the demand is by lightening the toils of our artisans.

IMPROVED HARROW.

A thin plate of steel or iron, of the same area as the harrow, is fitted on the teeth in such a manner that it can be moved up to the under side of the frame or down to the points of the teeth, in order to force down the trash collecting on the teeth and make it leave the points; it is also used as a gauge to regulate the depth of the teeth in the ground, and also for a smoothing plate to smooth the surface of the ground, by setting it down to the points of the teeth, when it will run upon the surface. To the center of the top of the plate is connected a rod which extends through a tubular standard supported on top of the frame. This standard acts as a stay for the rod and as a guide for a spider frame, the lower ends of the arms of which are attached to the plate. The top of the rod connects with a presser which surrounds the top of the standard, and rests on top of the hub of the spider frame. The upper end of the presser is joined to a hand lever, whose short arm is connected to a link jointed to the top of the harrow frame. The long arm of the lever swings along a standard attached to the top of the frame, and formed with a series of pin holes to hold the lever in different positions, according to the distance it is required to set the plate down along the teeth. The plate is raised by a coiled spring surrounding the lower end of the rod. A second coiled spring, fitted in the socket of the presser, is so arranged as to act in conjunction with the lower spring to lift the plate. The lever passes through a slot in the upper part of the presser, and has a curved notch in the upper side—the presser being correspondingly curved—to form a good bearing and easy working joint. The plate is formed with flanges on its forward edges to prevent earth from collecting between it and the under side of the frame.

1

2



DREW, LEISNER & NELSON'S IMPROVED HARROW.

This invention has been patented by Messrs. C. Drew, A. W. Leisner, and Philip Nelson, and further particulars can be obtained by addressing the latter at Las Vegas, New Mexico.

NAVIGABLE TRAINS OF AIR SHIPS.

Two very complete and interesting models of an air ship—one designed to be used as a war vessel and the other for the carriage of passengers and merchandise—invented and patented by Captain Carl W. Petersen, an experienced master mariner, are now on exhibition at 231 Broadway, this city. The inventor states that he now has seventy-eight improvements in air ships protected by the patent laws of this country, and will soon present to the Patent Office about two hundred and fifty more. His genius in this line is apparently boundless.

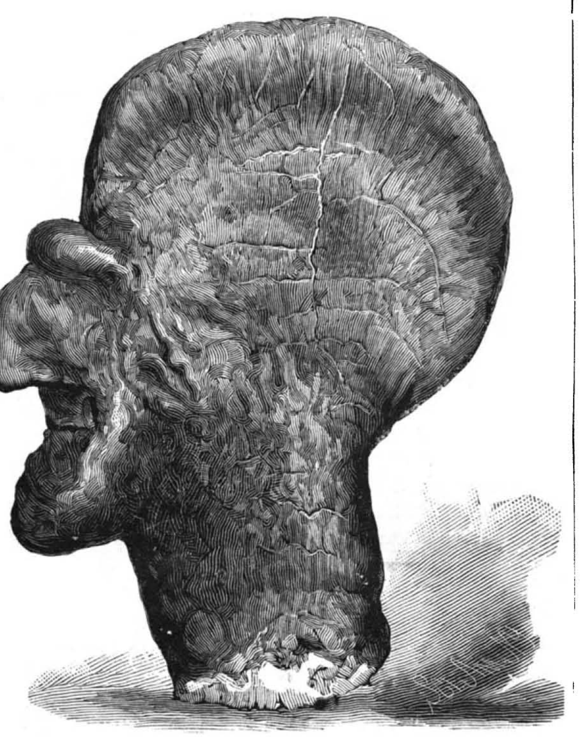
The framing is so arranged as to strengthen the structure, and as the car suspension gear is connected to the lateral framing, no suspension netting or covering is needed, thus doing away with the dangerous chafing and rubbing on the upper surface of the balloon. The weight saved by this method of construction may be applied to strengthening the outer surface of the gas vessel, so as to enable it to easily withstand the pressure of the air caused when the train travels with great velocity. One of the most important features of this invention is the coupling or uniting of separate balloons into a row or train of balloons, thereby increasing the length and lifting capacity to any desired extent without adding to the transverse sectional surface presented to the air. Wire cables are used in the car suspension gear, which is not only fireproof, but much lighter than any heretofore employed. The cables pass through the cars—the openings being made watertight—between the car frame and sides, so as to show a smooth outside surface. The cars are shaped so that a cross section is a true circle; this form presents less resistance to the air, and can be given maximum strength with the minimum weight of material. By means of the central row of rudders, the train may be turned in a very small circle by setting the front and rear rudders properly. The central rudders serve as centerboards, and when all the rudders are set at the same angle to the center line, the train of ships will be moved to the right or left without altering the real course; or in other words, the ship can be held head to the storm while moving to either side. The various parts of the train are so constructed and arranged that either end may be used as the head, the speed being the same in both directions.

To allow the train to ascend or descend at pleasure, one or more rows of adjustable screws are provided. This obviates the necessity of allowing gas to escape from the balloons, or of throwing ballast from the cars. Gas lost from any cause can be replaced at any one of the stations designed for the air ship trains. Waste of gas is prevented, and as the rows of screws allow the train to travel through the air at an elevation of only a few feet from the ground, the danger to life and property is reduced.

When rows of stationary screw propellers are used in place of adjustable screws, rows of guiding sails or wings are pivoted on each side, below the balloons; by these the train may be steered in vertical planes. The row or rows of electric or other motors forms a valuable part of the apparatus, since if one should be disabled there would still be ample power to insure good working.

A disabled air ship could be disconnected at any station, and a perfect one easily and quickly put in its place. In case of storm, the air ships composing a train could be increased in number, so as to furnish sufficient power to overcome the force of the wind.

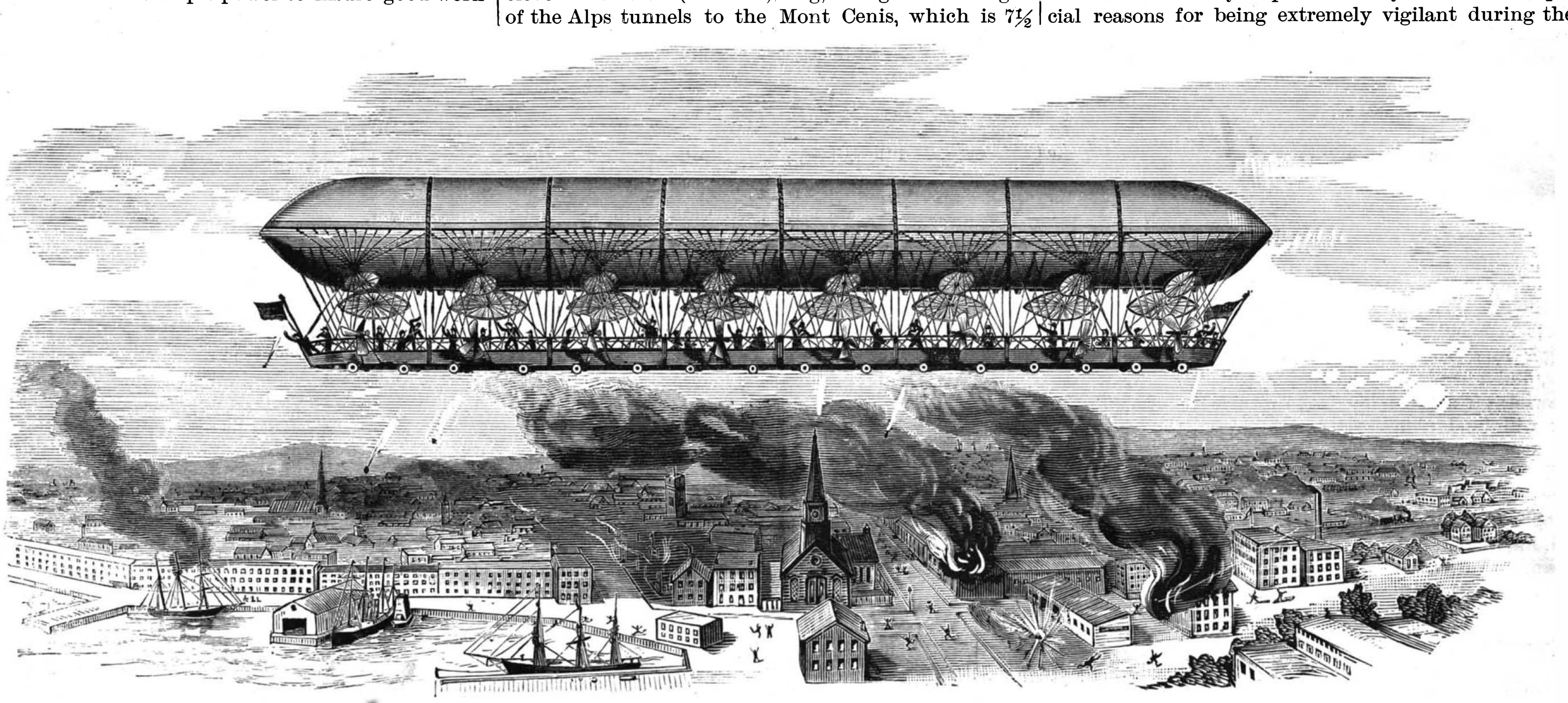
The inventor claims that the train principle of air navigation insures great carrying capacity, much motive power, great velocity, complete navigability, and the greatest safety to life and property. It is also claimed that as the end ships are tapered like a cigar, the train will easily penetrate the air, and the opening made by it will permit the other vessels in the train to follow without causing any resistance to the air. The vessel is expected to make from 20 to 80 miles an hour. The lifting power of hydrogen is about 68 pounds for every 1,000 cubic feet; from this it is easy to calculate the load the train will bear, but in addition to this load,



A REMARKABLE FUNGOID GROWTH.

it is stated that about 55 pounds more can be carried at an upward inclination of the train of about 2 degrees from the true horizontal line for every indicated horse power of the motors; and also that the real horizontal pull of each indicated horse power of the air propeller has been ascertained to be about 100 pounds. The general construction of the war ship is shown in the accompanying engraving.

To carry out the designs of Captain Petersen and build navigable trains of air ships, a company has been incorporated, under the laws of this State, with a capital of $100,000. Captain Petersen is president, and Mr. Henry Stevens secretary. The offices are at 231 Broadway, this city.



PETERSEN'S AERIAL WAR VESSEL.

The Arlberg Railway.

This new avenue of communication between Switzerland and Austria and Hungary, and which makes now the air line route between Vienna and Paris, was opened with an imposing ceremonial in August last. Its building has shown remarkable engineering skill. The Arlberg tunnel under the Vorarlberg mountain is eleven kilometers (5·8 miles) long, being next in length of the Alps tunnels to the Mont Cenis, which is 7½ miles long, while the St. Gothard is 9 miles long. The Mont Cenis tunnel, however, required 14 years to build, and the St. Gothard 8 years, while the Arlberg tunnel has been built in about 3 years. A considerable portion of the line besides the tunneling proper was very difficult to build, winding along precipitous mountains and over deep gorges and ravines, but disclosing grand and beautiful views of the Alps hitherto rarely seen.

A REMARKABLE FUNGOID GROWTH.

The illustration herewith given is a drawing, exact size, of a mushroom or toadstool sent us by Mr. Geo. B. Gordon, of Wellsville, N. Y. Its likeness to a profile view of the Duke of Wellington is striking. It was found growing from the side of a partially decayed hemlock log, with the face side up, which now has the seamed and wrinkled appearance shown in the illustration, and which may well pass for a fair illustration of the face of the Iron Duke in his later years. The shrunken mouth and lips and the prominent nose are all plainly indicated, and our correspondent suggests whether Darwin might not, from this specimen, be inclined to accept the idea that the toadstool, rather than the ape, was the real father of mankind.

Mushrooms embrace a large number of species, of which several are edible. Those untested, or known to be poisonous, together with other fungi of similar appearance, are popularly called toadstools. Mushrooms are largely cultivated abroad, especially in France, whence most of those used here are imported. In Paris their cultivation forms a large business, and they are grown in large caves, in some of which are over 20,000 beds growing at one time.

Exudations on Brickwork.

According to the *American Architect*, the simplest and least expensive method for removing saltpeter exudations from brickwork, when the efflorescences are in positions where the sun and wind do not have free access, is to wash it off with diluted hydrochloric or common muriatic acid of commerce. This acid is very inexpensive; twenty-five cents' worth would be sufficient to clean a front of twenty feet wide by sixty feet in height, if such a front was totally covered with the objectionable exudation. About one-half pound of the acid is used with an ordinary pailful of water, the application being made with a sponge, which can be held in the naked hand or attached to a stick to reach the spots, as may be desired. When the efflorescences have been thus removed, it is perfectly useless, in the present state of knowledge, to attempt to stop a reappearance, for when circumstances are again favorable, the saltpeter exudations will promptly spread themselves over the walls.

Smoke Testing of Drains.

Cosmo Innes, the Secretary of the London Sanitary Protection Association, writes to the *Journal of the Society of Arts* suggesting a smoke test, instead of that of some strong volatile liquid, for detecting defects in sewer pipes, as the smoke test will be apparent to the eye as well as the nose. That such testing may be done cheaply, he has devised a style of smoke rocket, charged so as to burn for ten minutes; the fuse is to be lighted and the rocket inserted in the drain with a plug behind it, when the observer is to walk through the house to see if any smoke escapes, finishing on the roof, where the smoke will come in volumes from the ventilating pipe. If it is desired to increase the severity of the test, a wet blacket may be thrown over the top of the ventilating pipe, giving a slight pressure of smoke inside. As sanitary inspectors everywhere have especial reasons for being extremely vigilant during the coming year, this method of testing pipes and drains may prove valuable in many instances where it is not convenient to apply other tests.

EIGHT parts of black tin, two of antimony, and one of copper, if melted and mixed over a hot fire, form Babbitt metal. If made with care, it is one of the best materials for fast running machinery there is.

THE PNEUMATIC SYSTEM OF THE WESTERN UNION.

A few years since, pneumatic tubes were laid over short routes in this city and in some of the larger cities of Europe, and they operated so successfully in what might be termed the experimental stage as to soon form a most important auxiliary to aid in the transaction of the regular business of the telegraph office. Some plan to facilitate the quick delivery of dispatches to points at some distance from the main office became necessary, since it was impracticable to send them direct to the branch offices nearest their destination, and since messenger service consumed too much time.

In 1876 the Western Union Telegraph Company laid a pair of tubes, having an inside diameter of 2¼ inches, from the general office, corner of Broadway and Dey Street, this city, to the Stock Exchange, and a second pair to the Cotton Exchange. One tube was for sending and the other for receiving messages. In 1879 a single tube, 1¾ inches in diameter, was laid to each of the six morning newspapers—the *Times*, *Tribune*, *Herald*, *World*, *Sun*, and *Staats Zeitung*. Last year four tubes, 3 inches inside diameter, were laid from the operating room at the central office to the basement of a building, erected by and specially adapted to the wants of the company, at the corner of Fifth Avenue and 23d Street. Two of these tubes are only used for the transmission of through messages, while the others may be used as direct tubes, or may be connected at will to either of three way stations, located at Nos. 407, 599, and 844 Broadway. The line passes from Dey Street, through Broadway to 14th, to Fifth Avenue, to corner of 23d Street. It is the intention in time to extend the system so as to take in the principal hotels, depots, etc., and also private residences, if the business of the occupant should warrant it.

It will be seen that this method divides the city, for all practical purposes, into two main or central stations, the communication between which, by means of the tubes, occupies less than three minutes, each connected with intermediate points, and while lessening the amount of messenger service and repeating, also permits the company to better arrange its force of operators by locating a large part in the 23d Street building.

The tubes are of brass, are of lengths of 20 feet, and are laid in masonry trenches, provided with manholes suitable distances apart. Upon each end of each tube section is a collar, held by the tube being expanded, as in boiler work. The faces of the collars are turned down, and in one is formed an annular groove, in which fits an annular ridge upon the face of the adjoining tube. Thin paper is the packing used. The ends are held together by six bolts passing through loose sleeves placed behind the collars. To provide for expansion and contraction—a most important point, especially in the neighborhood of the steam heating pipes—a slip joint is formed at every 900 feet. The joint is made by slipping the end of one piece of tube inside of the next, which is slightly enlarged to receive it. The inside of the end of the inner tube is ground out to form a sharp edge, which is tempered, so that anything running through will not be likely to get caught. Between the sharpened end and the point where the outer tube is contracted to its normal diameter there is a short space, not exceeding 2 inches in length, where the diameter is so great as to allow the air to shoot past the flange of the passing box; but as the latter is 6¾ inches long and flanged at each end, there will always be one flange in the tube where the diameter is normal. The joint is made air tight by means of a packing box.

Leather boxes or carriers were tried, but had not sufficient strength to resist the concussion caused by their stoppage at each end of the line. The form of the boxes now used, made of vulcanized fiber, is clearly shown in the accompanying engraving. They are 2 inches in diameter, and at one end is a thick pad of felt to take up the force of the blow. The cap consists of three pieces—a flanged cap proper, a leather washer a little longer in diameter than the tube and having radial cuts, and a fiber disk. The cap is held on by a wing nut screwing on a rod extending through the box. Each box will hold about 100 messages on the common blanks.

The plant is so constructed that the system can be operated by the exhaust and pressure methods combined, or by the exhaust alone. At each of the main stations are four pumping engines, built by the Knowles Steam Pump Works, placed in pairs and so arranged that each of the engines can be used independently or in combination with any of its neighbors. The steam cylinders are 18 inches in diameter, air cylinders 32 inches, and the stroke 36 inches. The engines are connected with two sets of iron tanks, one set being for air under pressure and the other for vacuum. Pipes lead from the tanks to the underground tubes and to the tubes used for carrying messages to various parts of the building. Each engine is so constructed that it can be used either for pressure or vacuum, this being accomplished by means of two-way valves placed in both the suction and delivery pipes. The speed of the engine when working as a compressor is automatically regulated by a piston operated by the air pressure in the reservoir; this device is independent of the regular speed governor. The method of cooling the air cylinders is most interesting. The cylinder is trimmed and then bushed with a brass cylinder upon the outer surface of which is formed a spiral groove, similar to the thread of a screw. A small pump forces water into the groove at each head, and after traversing around the cylinder several times the water escapes through a passage at the center. By this plan cold water is applied to the cylinder at each end of the stroke, or at that point where the greatest heat is generated. There are three sets of packing on the cylinder; the center one is of hemp, and at each end of the stroke, where the piston rests, there is a lubricator that feeds oil to the hemp packing, which distributes it through the cylinder.

At each end of each tube is a receiver, those in the downtown office being placed vertically and those at 23d Street being placed horizontally, owing to the want of sufficient space. The arrangement of pipes and receivers at each station is clearly shown in the engraving. The receivers are 16 inches long, and consist of two cylinders mounted upon a frame, so journaled that either cylinder may be brought in line with the tube through which the messages pass. The cylinders move between face plates placed one on each end of the tube. One cylinder is of the same inside diameter as the tube, so that when placed in line with the latter it will permit the box to pass through. The other cylinder is provided with a door held in place by nuts. Beyond the receiver on the end of that tube through which the boxes arrive is the receiver which is now used to stop the boxes, the use of the other having been discontinued on the through line. This consists of a box 12¾ inches long and 6 inches in diameter. The carrier strikes upon a cushion made of leather stuffed with hair.

At the end of the pneumatic tube proper is a pipe, furnished with a valve, that leads to a larger pipe extending to the vacuum tanks. This valve being opened, it will be readily seen that anything placed in the other end of the tube will be drawn through. (Such good results have been obtained when using a vacuum alone, that both vacuum and pressure are not necessary with the present development of the system.) The momentum of the carrier is depended upon to take it to the receiver at the end of the tube; but should it stick midway, a "coaxer" is brought into operation to help it along. This consists of a small valved tube connecting the vacuum pipe with the delivery tube at a point between the two receivers. By opening this valve the carrier will be brought forward.

At the end of the sending tube is a pipe leading to the pressure tank. When the valve in this pipe and the receiver are closed, the engine at the other end of the line is exhausting the air from the whole length of tube. When the receiver—in this case it is used as a sender—is opened, the far engine is pumping air through the tube. To send the carrier, the door of one of the cylinders is removed, the cylinder being in line with the tube. The valve is opened and the carrier placed in the end of the tube, when the air catches it and quickly hurries it along its journey. Back of the receiver is a pipe leading to the compressed air reservoir, so that if necessary the speed of the carrier could be increased by forcing air behind it.

To reach way stations along the line, the tubes curve out of the street and up into the operating room. When a box is to be sent to a way station, the operator of that station is notified by an electric alarm. He at once swings the cylinder having a lid in the line; a wire screen in the cylinder stops the carrier. He then swings this cylinder out, when the second cylinder enters the line, which is then unbroken, so that other boxes intended for other stations can pass on.

In some of the European systems the carriers are dispatched in trains at intervals of from ten to fifteen minutes; but in this system the carriers are sent as often as required, so that there is no time lost in waiting. The capacity of a tube is about 1,000 messages, or ten carriers, per minute. Boxes have been sent between the two main offices, a distance of 14,500 feet, in 2 minutes and 12 seconds.

Capture of a Whale.

After an exciting chase and a terrible encounter lasting over an hour, recently, a mammoth right whale was captured in the ocean off Southampton, L. I. After being killed several miles out from shore, the monster was towed to land by the combined efforts of three boats' crews. It is nearly 40 feet long and 30 feet in circumference, and will yield about 70 barrels of oil, besides the whalebone. Seven hundred dollars have been offered for its head by speculators. It is valued at about $1,200, and is the third whale captured off this coast lately, which is an unusual occurrence.

The whales captured recently are claimed by old whalemen to be members of a school which have been forced close to shore by hunger. The right whale lives by suction, and subsists on a minute insect. Immense quantities of the insects have been washed ashore along the coast of late, which would indicate that they had been driven inland during recent storms. A school of nine whales has been sighted within 15 miles of land, and other captures are expected.

Caring for Wounded by Railway Accidents.

General Superintendent Gallup, of the Boston and Albany Railroad, has recently issued an order to the freight dispatchers and freight train employes of his road which might well, we think, be followed by like action on all railroads, and especially on coal carrying roads. The order provides that the conductor shall carry, as part of his necessary equipment, what is styled an "emergency case," for use in case of injuries. The case contains eleven articles, as follows, with the instructions for use:

No. 1. Styptic Cotton.—To control bleeding by applying to wound. See No. 3.

No. 2. Absorbent Cotton.—To apply to a bruise on any part of the body.

No. 3. Bandages.—To bind up wounds, also to bind over styptic or absorbent cotton, to stop bleeding.

No. 4. Plaster.—To strap wounds.

No. 5. Rubber Bandage.—To bind around arm or leg, when it is crushed, to arrest bleeding.

No. 6. Artery Forceps.—To pick up a spurting blood vessel.

No. 7. Straight Scissors.

No. 8. Needles.—To sew up wounds.

No. 9. Oiled Paper.—To apply over burnt surfaces. See No. 11.

No. 10. Silk Thread.—To tie up blood vessels after being taken up by forceps.

No. 11. Bicarbonate of Soda.—To sprinkle over burnt surfaces, before applying oiled paper.

These cases are to be supplied by the train dispatchers, the conductors to be held responsible for their contents, and to make written reports of all occasions they have for their use.

We do not see why such provision should not also be made for caring for those wounded by accidents on passenger as well as on freight trains.

Nevada at the Exposition.

The New Orleans *Times-Democrat* has the following to say in regard to the Nevada exhibit at the big Exposition: The exhibit from this State is now well under way, and already presents features of surprising interest. It was to be expected that a State containing the great Comstock lode, a State which can boast of the Sutro tunnel, a State the mineral resources of which have enabled Mackay, Flood, and O'Brien, and the other "bonanza kings" to amass their enormous fortunes—it was to be expected that such a State should send an unequaled collection of minerals and ores. But it is with some surprise that one sees in the midst of the exhibit from Nevada specimens of the cotton plant bearing cotton equal to that of the sea island plantations, potatoes weighing more than four pounds, apples rivaling the finest shown in the collection of any fruit growing State. It is there that the impartial observer may be excused if his enthusiasm becomes unbounded. However, notwithstanding the excellence of the agricultural display, the main feature of the exhibit is the collection of minerals and photographs relating to the great mining industries of the State.

The State Commissioner is Colonel C. C. Thomas, the superintendent of the far-famed Sutro tunnel, and it is to his energy, unaided by any State appropriations, that Nevada owes this magnificent exposition of her resources. The collection is made of specimens from a large number of Nevada mines and several fine collections from private cabinets, notably those of Senator Jones, J. Shaw, S. Dowling, the State cabinet, the cabinet of the Pacific Coast Pioneers, an organization made up of Forty-niners, and W. H. Havenor, who will remain here in charge of the display. The collection is a large one, well classified and labeled.

Specimens of ore are shown which assay at $20,000 to the ton. Large photographs on the wall present vividly some of the picturesque localities of Nevada and views of the more prominent mines. The original drawings of the great Sutro tunnel are also displayed. This marvelous feat of engineering consists of a tunnel eight miles in length, driven into the side of a mountain at a depth of 1,600 to 1,700 feet. The diameter varies from 8 to 16 feet. This tunnel was driven for the purpose of draining the numerous mines clustering around the great Comstock lode. The yield of these mines and the fortunes amassed by their owners are almost beyond computation. But for this tunnel they would to-day be useless. The tunnel itself is no mean source of income to the members of the corporation maintaining it. The method of payment adopted is to collect from each mine drained $1 for each ton of ore taken out and yielding less than $30, and $2 in case the yield is more than $30.

Separation of Oils.

MM. Alexandre Fils, of Paris, have lately invented a process for the separation of the heavy from the light mineral oils. The mixture, after preliminary purification with sulphuric acid, is placed in closed centrifugal drums, which are rotated until the heavier portions settle on the walls of the drum, while the lighter oils are left in the center. After the process is completed, each portion is removed by suitable siphon arrangements.

Correspondence.

The Recent Boiler Explosion near Pittsburg.

To the Editor of the Scientific American:

The U. S. Local Steamboat Inspectors have completed their investigation of the explosion of the boiler of the steam tug M. Dougherty near here on Jan. 11. Their report is an indorsement of the Lawson theory of boiler explosions. The tug had landed to repair a broken valve stem. To facilitate that work, as the throttle leaked, a valve connecting the steam drum and steam pipe was closed. After lying at the shore perhaps thirty minutes, the water in the boilers was tried and showed scant three gauges. The steam gauge showed 170 pounds. The safety valve was tried and found clear. The work of repairing the valve stem being about completed, a deck hand was sent to open the valve at the steam drum. It was at that time that the explosion occurred.

In support of their finding, the inspectors, by the evidence adduced on their investigation, show that no deluge of water followed the explosion, and that the body of the deck hand was found abreast and 120 feet out in the river from the place occupied by the tug at the time of the explosion. The upper part of his clothing was torn away. The theory of the explosion is that upon opening the valve at the steam drum the pressure on the highly heated water was suddenly relieved, and it burst into steam. Rushing through the steam pipe it met with a check at the closed throttle. A concussion that no material could withstand resulted.

F. C. N.

Pittsburg, Pa., Feb. 1, 1885.

Electricity for Executing Criminals.

A few years ago there appeared in these columns an article suggesting the substitution of electricity for the scaffold and rope in the execution of criminals. A number of letters on the subject followed our editorial, and, if we recollect aright, several patents were granted on appliances for accomplishing the object.

The subject has come up again by Governor Hill, of New York, asking if "Science of the present day cannot provide a means of taking the life of such as are condemned to die, in a less barbarous manner?" To which the *Electric Review* replies: "What more scientific method can be devised than the application of electricity as an executioner? Persons who have read the series of interviews with electrical experts which have recently appeared in this journal [*The Review*] must have observed that an electrical current of 1.000 volts is considered the maximum which the human system can receive without fatal results, whereas the wires which feed the lamps with which our streets are lighted carry a current of 2,300 volts. How simple a process it would be to connect the place of execution in the Tombs with the system of electrical street illumination, so that electricity could be made the executioner of murderers! The criminal would be placed in a chair, with his head bound back against a bulb at the end of the wire through which the fatal shock would be communicated, and it would be possible to furnish the death seat with an automatic attachment so that the execution could be effected at a given moment by the action of a clock-like apparatus, and without the least movement of the hand of the officer charged with the infliction of the death penalty.

"What more scientific method than the one here proposed can be devised? Death would be instantaneous and perfectly painless, while at the same time the awfulness of the penalty thus inflicted would be profoundly impressive."

Balloon Ascension at Philadelphia, Jan. 19.

Sergeant Hammond, of the U. S. Signal Service, made an ascension with Prof. William S. King, from Philadelphia, at 4:15 P.M., Jan. 19, the capacity of the balloon being 25,000 cubic feet of gas. The wicker car was 6 feet long, 4 feet wide, and 2½ feet deep. The starting had been delayed, and was near being postponed for the day, on account of the low temperature. The balloon reached a height of 5,800 feet, and after being carried by brisk winds in several directions, finally landed about 50 miles southeast of the point of starting, near the Jersey coast, at 7:05 P.M. This is one of several trips to be made on behalf of the Signal Office, meteorological instruments being taken for making observations at various heights. It was too dark to make some of the desired observations during this trip, and it is proposed hereafter to provide the aeronauts with an electric light.

OLIVE OIL.—If fatty oils are cooled down to —20°, and kept at this temperature for three hours, they assume very different degrees of hardness, olive oil being the hardest. To determine this point the author uses a cylindrical iron rod, 1 centimeter in length, and ending below in a cone. Upon it is exerted a pressure measured in grammes until it penetrates into the oil with its entire length. The best olive oil required a pressure of 1,700 grms., while cotton oil required only 25 grms. —*Serra Carpi.*

A Model Fast Cruiser.

A practical turn has been given to the criticism on the navy by the submission to the Admiralty of a design for a barbette cruiser, the chief attributes of which are great speed, powerful guns, long steaming power, and unusual buoyancy. The designer is Mr. Pearce, of Fairfield Shipbuilding Yard; and although the vessel is a novelty when compared with the war ships of the present day, it is in reality nothing more than a development of the fast American liners, and an adaptation of their hull and machinery to the express purpose in view. The essence of the design lies in the speed, and it is concerning this quality that the designer can speak with authority. It has unfortunately happened in the immediate past that defective sailing qualities have been the chief characteristic of the British navy. Not only are the vessels unable to go fast, but they are capable only of steaming the shortest distances. Mr. Pearce's design contemplates a speed of 21½ knots per hour, or about 25 ordinary miles, and a coal capacity for steaming as far as the West Indies and back at a speed of 12 knots per hour. This high and enduring speed will be given in conjunction with great offensive power and great staying power. The design contemplates the vessel being pierced by 100 shots and still being able to use her guns or steam off at full speed.

What may be described as the vitality of the ship, its power of endurance, and its maintenance as a floating object, is secured by an elaboration of the cellular system of construction. The hull would consist of 122 water tight compartments. A bulkhead would extend down the center of the vessel for its whole length of 410 feet, and three transverse bulkheads would, with the center bulkhead, divide the vessel into eight main water tight compartments. Each of these transverse bulkheads would run from the skin of the vessel to the bulwarks, and would be carried up and be joined to a deck of steel. The foremost of these transverse bulkheads is in the form of a collision bulkhead, the second runs from the after end of the engine room by a middle line bulkhead, and the third runs up from the stuffing box carrying the screw shaft in the stern. This will give six large water tight compartments and four small.

Those at the fore part and those at the stern will contain nothing of vital moment either to the buoyancy or the locomotion of the vessel. The four other compartments will contain two complete sets of boilers and engines, each with its screw shaft and screw propeller, and each set being completely cut off from the other by the middle bulkhead running the whole length of the vessel. The mechanical arrangements are designed upon the basis of the possibility of the whole of one side of the ship being disabled without resulting in the destruction of the vessel. Not only would she float, but she would float well, and would still have the means of a comparatively high speed. But in addition to these separate water tight compartments, the vessel is still further protected by the hull being divided up into an extremely large number of small compartments. The whole of the hull has a double skin, and the girders joining the inner and outer skin form water tight compartments throughout the entire hull.

The steel deck, covering in the six large water tight compartments, is 3 inches thick, and is placed 5 feet 6 inches below the water line. It forms an arched roof, inclosing all the vital parts of the vessel—the engines, boilers, and screw shaft; and the means of access to the engine room is by a protected coffer dam running to the upper deck. The coal bunkers for serving the vessel are placed all along the sides of the ship, and occupy a space of from 10 feet to 15 feet in thickness. These coal bunkers are also divided at intervals of from 16 to 20 feet with bulkheads, primarily for the purpose of keeping the coal from shifting, but also for restricting the passage of water in the event of a ball having penetrated the compartment. There would thus be around the inner water tight compartments containing the vital parts of the ship a double skin, consisting of a great number of compartments, all of which might fill without sinking the vessel. The inside of these bunkers measures about 80,000 cubic feet; any one of them may be penetrated and filled with water in addition to coals without endangering the life of the vessel, and there is no projectile yet in existence that would penetrate through this double outer skin, the inner armor of coal, and the inner skin, to the inmost compartment. It is not proposed to put any armor on the bottom of the vessel, simply because the chances of attack from that quarter are practically reduced to nothing by the high speed.

The engines and boilers have been designed with a view to procure the maximum of power with the minimum of weight. The engines themselves would be constructed mainly of steel and manganese bronze, and in form they would be almost identical with those of the fastest American liners now afloat. In conception they would be precisely similar to those of the Alaska, the Oregon, and the Umbria, produced by the same builder, and the arrangement would be similar to the set of twin engines and twin screws recently dispatched to Italy from the Fairfield works for the Francesca Morosini, now being built by the Italian government at Venice.

The engines of the Francesca Morosini are calculated to develop 2,000 horse power more than any vessel at present in Her Majesty's navy, and for their power they are the lightest engines ever built. The engines, boilers, and propellers being an exact duplicate, wholly independent of each other, and each incased in their own water tight compartments, the use of sails becomes unnecessary, and there would be nothing required for purposes of locomotion to show itself above the deck. A military mast, however, forms part of the design, made of steel and hollow in the middle to permit the ascent and descent of marines for the purpose of working the machine guns placed upon the large military top. The main means of offense, however, is provided by a couple of barbettes. These are to be armor plated with steel plates of 11 inches, giving 13 inches thickness on a horizontal line.

The scheme contemplates the placing of 110 ton breech loading guns in each barbette, or two 65 ton guns. Arrangements are also proposed for placing eight 6 inch long range guns—four on each side of the vessel—amidships. Guns of this capacity would carry a distance of five miles, and given five miles as the utmost range, and given also a speed of 25 ordinary miles per hour, it will be seen that two minutes after a shot had been fired the vessel could be steamed to a distance of 6 miles from the object of attack, and quite out of range of the enemy's guns. The magazine and shell rooms are to be placed directly under the barbettes, with a hydraulic lift between them and the guns. Another element of attack consists in the torpedo room, which it is proposed to place in the forward part of the ship and in direct communication with the ejection tube. The precise dimensions of the proposed cruiser are:

Length, 410 feet; breadth, 64 feet 3 inches; and depth, 38 feet 6 inches. The displacement at a draught of 28 feet would be 10,500 tons, and at a draught of 26 feet 6 inches, 9,600 tons, with an indicated horse power of 18,000. The plan, with complete specification and a model, is now being considered by the Admiralty.—*London Times.*

Sleeplessness.

Sleep is a perfectly natural function. It is not a negative act, but a positive process. Herein lies the difference between real sleep and the poison-induced torpor which mimics the state of physiological rest. We ought to be able to sleep at will. Napoleon and many busy men—the late Mr. Wakley, for example—developed the power of self-induced sleep to such an extent as to be able to rest whenever and wherever they pleased, for longer or shorter periods, as the conditions admitted. We have been led to believe that Mr. Gladstone at one time possessed this faculty. If that be so, his recent insomnia must be assumed to have been the result of such intense brain worry as inhibited the control of the will; or there may, of course, be physical causes which render the apparatus of the cerebral blood-supply less manageable by the nerve centers.

In any case, it is much to be deplored that, in the study and treatment of insomnia, the profession generally does not more clearly and constantly keep in memory that what we call sleeplessness is really wakefulness, and that before it is justifiable to resort to the use of stupefying drugs the precise cause of disturbance should be clearly made out. This, of course, takes time, and involves a scientific testing of the relative excitabilities of the sense-organs, central or radial and peripheral. The discovery of the cause, however, affords ample recompense for the trouble of searching for it. With the sphygmograph and a few test appliances, such as Galton's whistle, an optometer, and other instruments, the recognition of the form and cause of sleeplessness can be made in a brief space, and then, and then *only* we protest, it can be scientifically—*i. e.*, physiologically—treated.—*Lancet.*

The True Source of the Mississippi.

Captain Willard Glazier, of the U. S. Navy, in June, 1881, organized and led an expedition with the object of finally settling the matter. The expedition proceeded in canoes *via* Leech Lake to Lake Itasca, and, accompanied by an old Indian guide, pushed forward to the south; and the captain was rewarded by the discovery of another lake of considerable size, which proved to be, without the shadow of a doubt, the true source of the Mississippi. It is in latitude 47° 13′ 25″, and the lake is three feet above Lake Itasca, the hitherto supposed source of the river. The Mississippi may, therefore, be said to originate in an altitude 1,578 feet above the Atlantic Ocean, and its length, taking former data as the basis, may be placed at 3,184 miles. The tract of country in which the river originates is a remote and unfrequented region.

ELECTROLYTIC DETECTION OF MERCURY.—The author has devised an apparatus by which it is possible to detect the 1-100 mgrm. of mercury in 100 c. c. of a liquid. The cathode consists of a pencil of fine silver wire, electro gilded, upon which the mercury is deposited.—*C. H. Wolff.*

A Subterranean River.

A correspondent of the London *Times* says that the underground phenomena found in certain portions of the southern and Adriatic provinces of Austria, including miles of underground caverns, lakes that disappear and reappear at regular seasons, and rivers that are swallowed up by the earth, and come to the surface again many miles distant, have recently been the object of much attention on the part of the Austro-German Alpine Club and of the Club degli Alpinisti, of Trieste. A section of the members of the former body determined, some time ago, to institute a systematic exploration of the subterranean course of the river Reka. Rising in the Schneeberg, in Carniola, this mysterious stream suddenly disappears in the so-called Karst caverns. At San Giovanni di Duino, twenty miles distant from the spot where the Reka is lost, a river of corresponding magnitude is found issuing from the foot of a hill. This stream is known as the Timavo, which takes a westward course, and discharges its waters into the Bay of Monfalcone. As to the identity of the Timavo with the Reka there cannot be a doubt, although until the present year no attempt had ever been made practically to demonstrate the fact. The members of the Austro-German Alpine Club, who had resolved to explore the underground meanderings of the river, made their preliminary reconnoissance on March 30 last.

Starting from the first great cavern, called the Rudolph's Dome, the expedition, consisting of four persons in two boats, proceeded on their eventful voyage. From the cavern just mentioned the river flows for 200 feet through a narrow channel between two perpendicular walls of rock, estimated to be upward of 100 yards in height. At the end of this channel the explorers, whose course throughout was illuminated by the magnesium light, found themselves in a vast cavern, where they were able to land. Fastening up their boats, they proceeded for some distance on foot past several cascades and rapids. They followed the course of the stream without much difficulty for a considerable distance, after leaving the newly discovered cavern, keeping to the left bank at first. At length they reached a spot where the river contracts to a width of barely twelve feet. Here they were compelled to cross to the right bank, which they did by help of a wooden ladder they had with them. The advance now became more difficult, the explorers being only able to get forward by creeping and climbing. At length they came to the sixth waterfall, which the party was unable to pass. The river here runs between two perpendicular walls of rocks, and suddenly takes a downward leap of over 20 feet.

From the Rudolph's Dome, where the start was made, to the sixth waterfall, the distance is rather over a furlong, and requires half a day to accomplish. At the third attempt the four gentlemen forming the expedition succeeded by help of suitable ladders and other apparatus in getting over this cataract, and advancing some distance beyond it. They soon, however, came to a seventh waterfall, where they were compelled to turn back. They found that to make any further progress it would be necessary to get a boat past the last waterfalls, as there is no standing room on either side of the stream, but sheer perpendicular walls of rock. The further exploration of the underground river will be resumed as soon as the requisite apparatus can be got ready. In the mean time the Alpine Club has decided to make the approaches to the Rudolph's Dome cavern more easy of access to the general public. The second cavern, which was discovered in September, is of far greater dimensions than the Rudolph's Dome, or any of the other caves of this district. Its height is upward of 450 feet, so that it could easily contain the Cathedral of St. Peter's at Rome.

With regard to the Italian Alpine Club, its committee has, during the past summer, done some good service by rendering the splendid cavern of Trebitsch, discovered by Herr Lindner forty years ago, accessible to the ordinary tourist. The cavern can only be approached by descending a deep shaft, down which visitors have hitherto had to clamber on the bare rocks. The Club degli Alpinisti have now caused a series of ladders, seventy-four in number, to be fixed. The Trebitsch cavern is 300 feet high, 400 feet in width, and 1,000 feet in length. Through it flows a river, which several authorities believe to be identical with the Reka and Timavo, but the hypothesis is repudiated by many observers. The question can only be settled when the Austro-German Alpine Club shall have accomplished the interesting task it has taken in hand—that of following the subterranean course of the river Reka from its beginning to its termination.

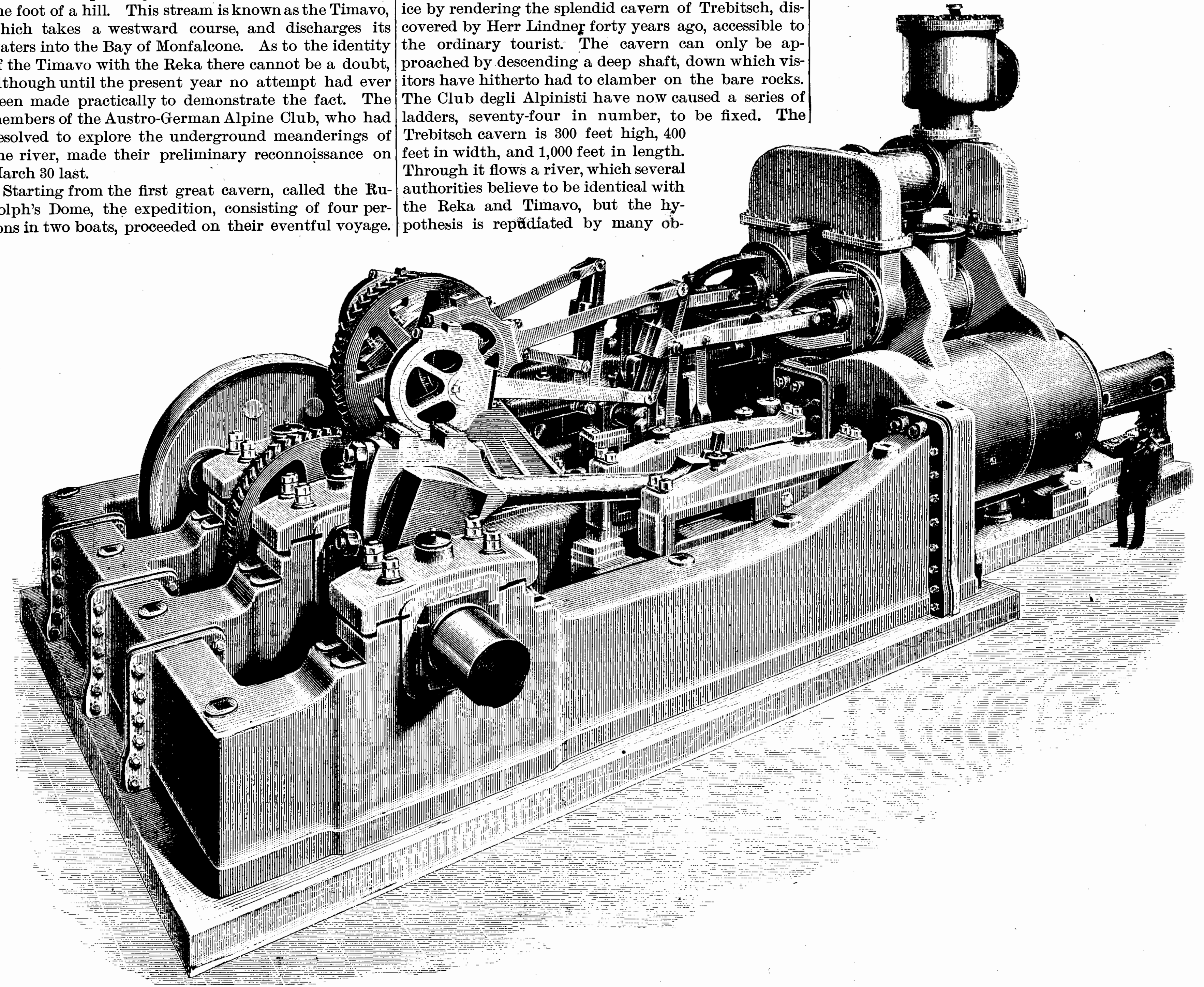
Changing the Style of Noses.

Several weeks ago an engraving of a contrivance for straightening crooked noses was published in these columns. It now appears that a Frenchman invented a machine some years ago for changing the style of noses, by which it is said he amassed quite a fortune. A representative of the *Philadelphia Times* recently interviewed a surgeon on the subject, and learned the following:

"The nose is simply a piece of cartilage, and its shape can be changed with ease. Many people are troubled with noses whose shapes do not please their owners or their owners' friends. The French machine consists of a small shell in two parts, hinged together. It is made of iron, japanned or enameled. It is in shape inside that of a perfectly moulded nose, according to the type of the features of the wearer. Thus you can obtain a Roman, Grecian, retrousse, aquiline, or any other shape you desire. To apply the instrument, the nose is first bathed in warm water at bedtime and thoroughly heated and softened. Then it is well greased with olive oil, glycerine, vaseline, or other oily substance. Finally the nose improver is fixed on and the sides clasped together, and the wearer keeps it on all night, taking care in the morning to wash in cold water only. It is a rather painful process at first, but after the first two or three applications of the improver there is no more trouble. In about a month the nose begins to take its new shape, and at the end of from eight to ten weeks the alteration is said to be perfect and permanent, that is, until the patient becomes tired of that particular shape and is desirous of having another, when the same operation with another instrument is applied. I have known people," continued the surgeon, "change their noses four or five times in as many years."

IMPROVED RAIL MILL ENGINES.

We publish perspective views of a very fine pair of reversing rail mill engines at the works of the Dowlais Iron and Coal Company, these engines having been constructed by Kitson & Co., of Leeds. We are indebted to *Engineering* for the engravings. The engines have 60 in. cylinders with 5 ft. stroke. The engravings are prepared from photographs, and the man shown in one of the views by the side of the engines will enable the size of the latter to be better appreciated.



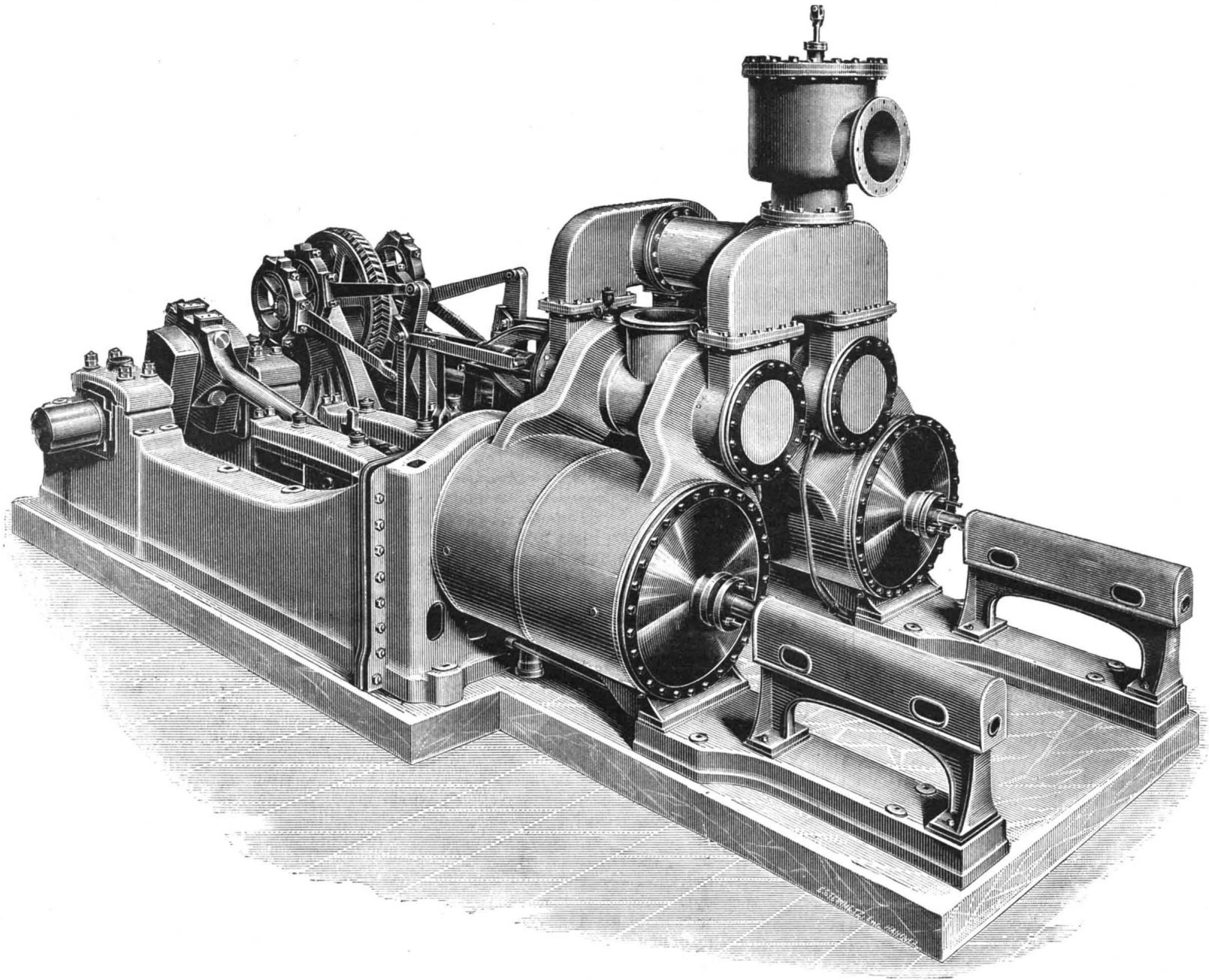
IMPROVED SIXTY INCH RAIL MILL ENGINES.

Galvanic Action as a Preservative.

At the present time, when so much has been said and written concerning the influence of galvanic action on fermentation and beer, it may be of interest to recall an experiment made by Andrew Crosse some years ago. He found that by subjecting milk to electric action it could be kept sweet for weeks together. He used the following simple arrangement:

"Two cylinders of sheet zinc and sheet iron were severally placed in two porous earthenware tubes, open at the top, but closed at the bottom, the same being filled with water, and these were connected at the top by a copper ribbon; the earthenware vessels were then placed in the fluid (milk or otherwise), and the electrical action commenced immediately, and the fluid became antiseptic in a few hours."

It is recorded that milk has in this way been kept sweet for three weeks in the middle of summer. It would seem that in this case the galvanic action was



IMPROVED SIXTY INCH RAIL MILL ENGINES.

fatal to the putrefying bacteria, and if so changeable a liquid as milk could be thus preserved, it seems feasible to successfully apply the same process to the preservation of beer. At all events, Crosse's experiments seem to show that galvanic action is not detrimental to the keeping qualities of such liquids as milk and beer.

AN AQUATIC VELOCIPEDE.

The apparatus shown in the accompanying engraving was constructed by quite a young man, Mr. Leon Bollee, one of the sons of a well known constructing engineer of Mans, Mr. Amedee Bollee. The aquatic velocipede in question has been experimented with several times upon the Huisne River, and the results obtained were satisfactory.

The apparatus consists of two spindle-shaped floats, which displace about fifty cubic feet, and which are connected by cross braces that serve to support a deck. Between the two spindles is placed a paddlewheel, which is moved by one or two persons actuating revolving pedals analogous to those found in tricycles. The person situated in front steers the boat, and the latter maneuvers with sufficient ease to turn in a radius equal to double its length. Finally, a railing adds to the security of the passengers.

With this boat there is obtained a mean speed of six miles an hour in stemming the current of the Huisne, which is quite swift. On descending the river the speed is much greater, of course. The power required for propelling the apparatus is so slight that a mere child can run it with the greatest ease.

As the apparatus weighs about 880 pounds, and the volume of water displaced is fifty cubic feet, there remain 2,200 pounds for the load, and the space between the spindles being quite wide, a change of position of those on board does not greatly affect the boat's stability. Our explanatory figure (Fig. 2) allows us to dispense with entering into longer details on the subject of a very simple arrangement that will interest the numerous friends of velocipeding.—*La Nature.*

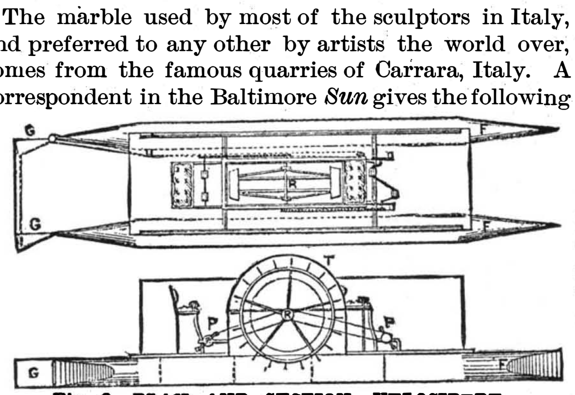


Fig. 2.—PLAN AND SECTION.—VELOCIPEDE.
R. Paddlewheel. T. Paddlebox. F. Floats made of iron plate. G, G. Rudders. P, P. Pedals.

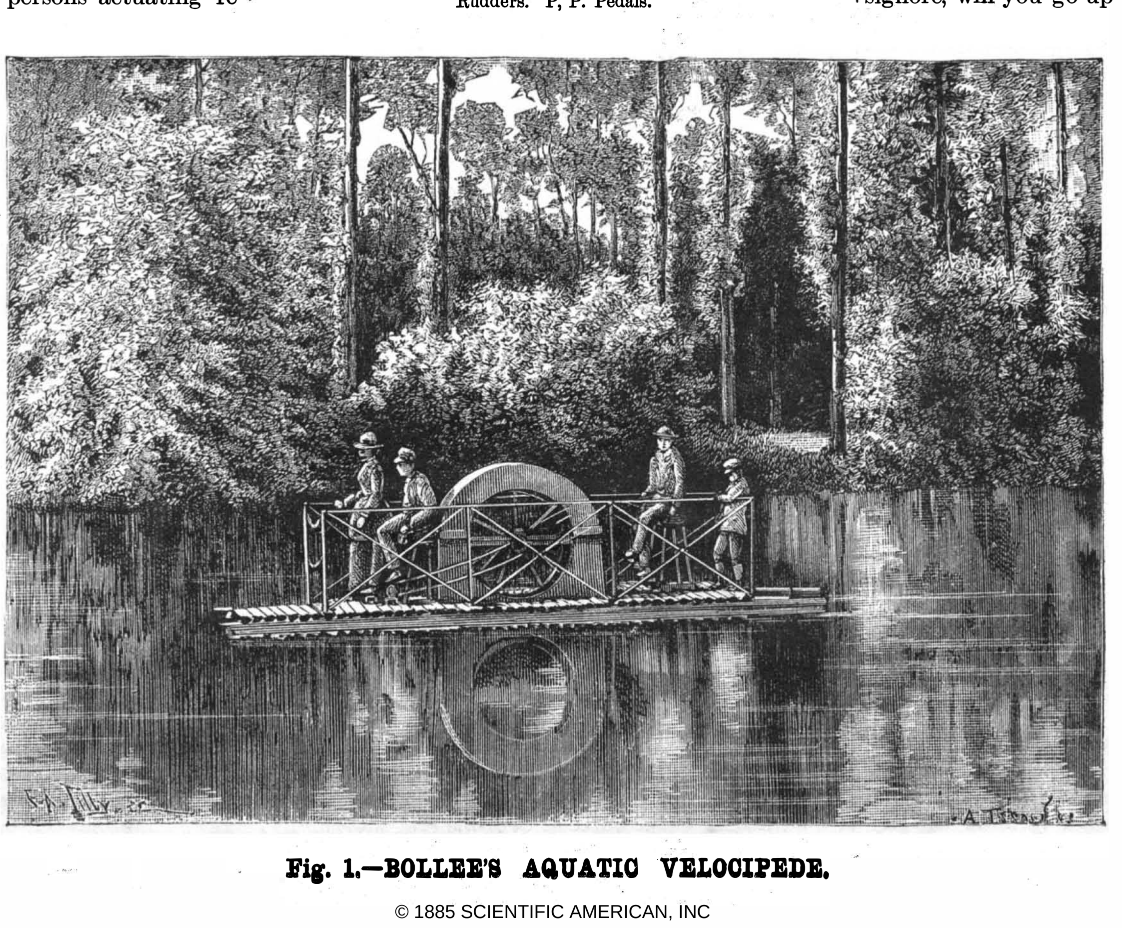


Fig. 1.—BOLLEE'S AQUATIC VELOCIPEDE.

The Quarries of Carrara.

The marble used by most of the sculptors in Italy, and preferred to any other by artists the world over, comes from the famous quarries of Carrara, Italy. A correspondent in the Baltimore *Sun* gives the following interesting account of his visit to the quarries. He spent several days at Carrara, and, according to his statement, there are some 6,000 men at work in the quarries, and there are 100 studios of sculpture at Carrara, 65 sawmills, and 25 polishing wheels, which brighten dull marble and smooth the slight fortunes of some 400 plodding workers. The hewing of rough rocks, huge in their proportions, is something approaching the marvelous here. The men are hoisted to the height of some 700 feet above the level of the quarry, and up aloft excavate colossal lumps of marble. Each gang, or the foreman of the gang, goes down with and on the lump as it is swung by derrick ropes out into the air and swiftly brought to mother earth.

One of these Italians will sing in lusty tones, "Viva, viva Garibaldi," from his dizzy eminence, and suddenly appear below where you are standing, his bright, big black eyes full of unequaled expressiveness and his white teeth glittering between unapproachable smiles—the inalienable gifts of these people—and say, "Ah, signore, will you go up with me again?" just as if it were a perfectly ordinary feat. The free, easy, and primitive style of this Carrara flying-trapeze work makes it appear doubly dangerous. Hundreds of accidents occur every year.

Children scarcely out of their swaddling clothes work amid the glare and dust of this lovely white marble, and die with sore eyes and stifled lungs. The food is dry bread, a raw onion, and dirty water. It is the only place in Italy where wine is not drunk. Worn out by incessant, severe toil, these people, insufficiently fed, fall into dissipation, violence, and crime, dying like dogs, and leaving on the white marble the sweat of their wretched lives. We see none of all this under the hand of art.

Fully $800,000 worth of marble goes out annually from these quarries, the bulk of it to France. The price of it varies according to its beauty. The first quality is priced at $60 to $80 per square meter at the seaport. This is what we term statuary marble. The second quality is priced at $45 to $62, and the spotted at $30 to $59. Then comes pure white, but not statuary marble. The price is $50 per square meter. The second quality is $35, and the third is $30. The veined marble brings on the first quality $50, and on the second quality $35. Violet-hued marble brings $70 to $100 per square meter. These are the ordinary tariffs, and on them the profits are absurdly high before the marble leaves the quarry.

DECISIONS RELATING TO PATENTS.

U. S. Circuit Court.—Southern District of New York.

TATE *et al. v.* THOMAS.

Wallace, J.:

When the language of the claim explicitly imports a certain arrangement into such claim,it is unnecessary to consider whether that arrangement is essential to the combination for the purpose of producing the result desired, and a machine which does not employ such arrangement is not an infringement of the claim.

The addition of certain elements to a patented construction which does not unfit it for performing its original result, but simply adds the results due to the new elements, does not avoid infringement.

Infringement is alleged of the patent granted August 22, 1871, to William John Tate for an improvement in quilting machines.

It is obvious that Tate was the first to invent a quilting machine which would produce the various complex and elaborate patterns which before his invention were produced by hand work. The nearest advance in the art before his invention had been made by William Muir, whose quilting machine is described in his patent of April 20, 1869. This machine could quilt in straight parallel lines like the stitching of the sewing machine, but it could also quilt in coincident zigzag lines, and thus form patterns defined by such lines. This latter result was effected by a single row of needles combined with devices for feeding the fabric to the needles, which would impart both a forward or longitudinal and a laterally vibrating movement to the fabric, thus causing the stitching to be done in waved or zigzag lines. Tate conceived that by employing two rows of needles and so organizing the feeding devices so that those for each row would operate successively, and not simultaneously, the zigzag lines of stitching of one row of needles could be made to meet those of the other row at the angle of the zigzag, and thus produce the desired diamond shaped pattern.

The defendant has incorporated Tate's alternating needles into the machine and then duplicated Tate's arrangement, and when this has been done each needle in one row is opposite a needle in the other row. No new result is obtained by the change, although an aggregation of results is accomplished. If the additional needles had not been inserted, the defendant's machine would quilt diamond patterns just as it does now. The machine is held to be an infringement. A decree is ordered for the complainants.

The Management of Scarlet Fever.

Scarlet fever is spread by contagion—by the transfer of particles of living matter from a person suffering from the disease. These particles of living matter come from the skin, from the membrane lining the mouth, nose, and throat, and perhaps also from the intestines and urinary organs. It is a disease which it is specially desirable to prevent the occurrence of in young children, partly because the susceptibility to its cause diminishes greatly with increase in age, and partly because it is much less dangerous in adults. There is reason to question the wisdom of using costly and troublesome methods of preventing the spread of measles, because the susceptibility to the cause of this disease remains in adult life, and it is, if anything, more liable to result in dangerous lung complications in advanced age than it is in children; but there can be no doubt as to the wisdom of restricting the spread of scarlet fever as much as possible.

The precautions to be taken when a case occurs in a house are in many respects the same as for a case of diphtheria, viz., to isolate the patient in an airy room having the least possible amount of furniture. The room should have no carpets or curtains, and no upholstered furniture, such as lounges, sofas, stuffed chairs, etc.

All the secretions and excretions, and all articles soiled by them, should be disinfected thoroughly and promptly while they are yet moist. A special and important precaution is to keep the whole surface of the body thoroughly anointed with some bland fatty matter, such as camphorated oil, vaselin, or cosmolin, and especial care should be taken to do this when convalescence has set in, and the peeling off of the skin has commenced. All toys, books, etc., handled by the child are dangerous, and had best be destroyed in the room by fire or by putting them into a vessel containing a strong solution of bichloride of mercury or of chloride of zinc.

No clothing, bedding, towels, or other woven stuffs should be taken from the room while dry; they should be placed in a tub or wash boiler containing scalding hot water, and thoroughly boiled before they are allowed to dry.

When the peeling of the skin has entirely ceased, the patient should be thoroughly bathed—using warm soap and water—be dressed in entirely fresh clothing, and the room and its contents should be thoroughly disinfected. The average period during which complete isolation of the patient is required, and during which he should not go out of his room or receive any visitor, is five weeks. Usually six weeks will be required to secure absolute freedom from danger.

The walls and ceiling of the rooms should be rubbed with damp cloths, which should be at once burned or boiled. The floor and all woodwork should be thoroughly scrubbed with soap and water.

The windows, fireplace, doors, and all other outlets of the room should be tightly closed, and sulphur be burned in the room in the proportion of one pound of sulphur to each thousand cubic feet—that is, if the room is fifteen feet square and eleven feet high, about two and a half or three pounds of roll brimstone will be required. Put the brimstone in an iron kettle, and place the kettle on a tray of sand three inches thick, or on a platform of bricks; pour a wineglass of alcohol on the brimstone and set fire to it, leaving the room immediately, as the fumes are dangerous. Let the room remain tightly closed for twenty-four hours, then open all windows and the fireplace, and let the fresh air circulate in it for from twenty-four to forty-eight hours. —*The Sanitary Engineer.*

English Law on Boundaries of Property

In Mr. E. L. Tarbuck's new work on "House Property," we note:

"In the absence of plans, figures, or rebutting circumstances, where a fence or hedge and a ditch are conjoined, the landowner on whose side either of the former stands claims the latter; the theory being that excavated soil was cast on the digger's land as groundwork for his barrier, which thus with the ditch forms the boundary, and the limit being the outer bank from the fence or hedge. Property in a fence or hedge between ditches or without ditch may be joint or rest on acts of ownership of long standing, as executing repairs, especially on demand.

"Posts and rails of paling are presumed to stand wholly on the owner's land, with pales outward and nails driven *home.*

"Joint proprietors of fences, etc., are not necessarily under obligation one toward another to preserve them, any more than a sole proprietor is similarly bound toward the adjoining owner or the public; but in both cases prudent precautions must be taken to obviate injury to others, as by scouring ditches, inclosing holes next public roads, preventing cattle straying, etc. Generally, the tenant (who must also usually preserve boundaries), not the landlord, is liable to actions in such cases. The time a fence has existed is one element in considering liability to repair it; and twenty years is the least period.

"Where a stream flows between properties, the presumptive boundary is the central line of water, use of which is shared between opposite owners, neither being entitled to injuriously affect the other or proprietors above or below by obstructing, diverting, diminishing, or polluting it.

"In the case of houses or grounds separated by walls used by both owners and built at joint expense, half on the land of each, and also where it is unknown at whose cost or on whose land such walls were erected, they are practically common to the parties, and either may exercise acts of ownership in building, etc., so that one does not prejudice the other. If a man builds on another's ground, the latter must set up his right within a reasonable period from cognizance of the trespass.

"In London, rights and liabilities of owners of party structures are regulated by the Metropolitan Building Act, 1855.

"At common law, a man has a right of natural support of soil, so that an adjoining owner must not by excavating cause it to fall. If a house has been erected above twenty years, there is usually a special easement of support from adjoining land or houses (as from party structures), the proprietor of which is liable for injury by settlement, etc., caused by him. In other cases general right to support or to notice to take precautions should be proved. Where a row of houses is built by one owner and sold to different parties, there is by implication right to joint support."

W. MILLS, of Bedford, finds the hydraulic or setting qualities of limes and cements are improved by mixing soluble sulphates, carbon, and certain other salts with the calcined material. The patentee prefers to heat silica, iron, and aluminum sulphates, iron oxide, carbon, and chalk, to redness in closed vessels; and then add the product, when cold, to fresh calcined limestone, grinding the whole intimately with some of the following salts, viz., potassium carbonate, ammonium sulphate, sodium carbonate, potassium sulphate, and iron sulphate.

Slipping Down by Sympathy.

The boys who render City Hall Park dangerous by day and night discovered a new diversion, on Christmas, so says the *N. Y. Sun.* A dozen or more of them were gathered at the southeastern corner about noon, tranquilly guying the passers-by, when a very large man slipped on the curbstone and waved his arms wildly in the air. He also yelled. After twisting himself into a dozen wild positions he regained his equilibrium, and continued on his way without having fallen to the ground.

It is a well known fact that a pedestrian will often fall to the ground in slippery weather out of pure sympathy for some one else who falls directly in front of him. Directly behind the big man who so miraculously escaped a fall was an earnest and sincere-looking woman, who was plodding along with her head bent down. She was in a reverie. Suddenly the big man leaped wildly into the air. As he did so he screamed. When a big man screams, the effect is eerie. At the same instant the woman sat down with a degree of heartiness that caused the bronze statue of Franklin, five hundred feet away, to totter on its base. The woman sat there and watched the man battle with the laws of gravitation until he conquered and went on his way. Then she arose and went on, looking snowy and uncomfortable.

The biggest boy in the gang, whose distinguishing characteristics were huge red hands and an unusually varied assortment of teeth, said to the others:

"Dat's a great steer, dat is. 'Th' nex' dame what comes along here'll do likewise if I bust a lung to show her. Youse bucks stand right here an' yell all your might when I slips. If we don't throw her widout layin' a hair, then I'll kiss a pig for luck. Watch me while I try it on."

The gang stationed itself beside a particularly slippery place on the walk, and the overgrown boy slouched down toward Broadway and loitered on the corner. Presently a nervous little old woman came trotting along. The Fourth-warder waited until she had passed, and then steamed up close behind, walked completely around her, and fell in her wake again. She halted, staggered, and then, with a look of wild surprise, trotted on again. Once more the awkward youth circled around her, and once more she increased her speed. Just as she arrived at the gang her tormentor came up for the third time, and, stepping directly in front of her, sent forth a howl of despair and sprang wildly aloft. At the same instant the gang yelled, "Ah, there? Stay there!" as one voice. It completed the confusion of the nervous little old woman, who clasped her hands over her breast, and went over backward as though struck by a thunderbolt. Chivalrously the gang assisted her to her feet, and sent her on her way, relieved of a few small things, and turned again to enjoy the sports of Christmas Day.

Vaccination against Yellow Fever.

The researches which have during the past two years been made by Dr. Domingos Freire have now reached a new point of departure. This investigator has prepared an attenuated virus with which he proposes to vaccinate individuals, with a view to rendering them proof against the occurrence of yellow fever. The Emperor of Brazil, having regard to the alleged innocuousness of the prepared virus, has authorized the practice of vaccination. Dr. Freire has accordingly vaccinated five hundred individuals. Three captains and all the crews of English vessels have been vaccinated with a view of escaping the infection from yellow fever, which prevails at Rio Janeiro. Thus far none of the vaccinated people have been attacked by the disease, and none of them suffered the least inconvenience from the operation. M. Bouley, who gave the facts to the Academie de Medecine, while implicitly believing the above narrated facts, does not yet implicitly accept the views of Dr. Freire on the Micrococcus xanthogenicus.—*Lancet.*

Galvanic Action upon Iron in Sand.

Writing to the *Engineer* on electric light cables, Mr. J. Johnstone, of Edinburgh, mentions the galvanic action set up by natural process between the metallic bases of earths and metals. He says that his attention was first drawn to the subject upward of forty years ago, when he saw an iron water main lifted out of a street in Greenock, where it had lain in a small bed of sand crossing the line of the street. At this part the outside of the pipe was covered with nodules, which were conglomerates of sand and oxide of iron. Inside the pipe, opposite to each of the exterior nodules, was a corresponding nodule of oxide of iron. These interior nodules were shaped like those found in cavities of hematite. It was therefore assumed by Mr. Johnstone that the inner nodules were formed as a result of galvanic action, which was transmitted through the body of the metal of the pipe from the nodules of sand and oxide on its exterior. Mr. Johnstone has never seen sand similarly adhering to lead pipes unless there was also lime in the sand. He considers that galvanic action fully explains the pitting that takes place in iron pipes that have lain long in sand, and which are thereby eventually destroyed.

New Metrical Abbreviations.

The International Congress of Metrical Weights and Measures has adopted the following new abbreviations. Italics are to be used, and are not to be followed by a period. The abbreviations are to be written on the same line as the figures, and after the last of them, be the number either an entire one or a decimal:

LENGTH.

Meter	*m*
Decimeter	*dm*
Centimeter	*cm*
Millimeter	*mm*
Kilometer	*km*

SURFACE.

Square meter	m^2
" decimeter	dm^2
" centimeter	cm^2
" millimeter	mm^2
" kilometer	km^2
Hectare	*ha*
Are	*a*

VOLUME.

Cubic meter	m^3
" decimeter	dm^3
" centimeter	cm^3
" millimeter	mm^3
" kilometer	km^3

CAPACITY.

Liter	*l*
Deciliter	*dl*
Centiliter	*cl*
Hectoliter	*hl*

WEIGHT.

Kilogramme	*kg*
Decagramme	*dkg*
Gramme	*g*
Decigramme	*dg*
Centigramme	*cg*
Milligramme	*mg*
Ton of 1,000 kilogrammes	*t*
Quintal of 100 "	*q*

—*Chronique Industrielle.*

Management of Cats.

It only required a glance about Dr. Edwin M. Hale's office to convince the visitor that some one about the house held the cat in high esteem. On the walls were portraits of that animal in various positions, and the same model was reproduced in cards, bits of applique, and china ornaments that decorated the mantels. Near the porch door was a little stand, on which sat a big white cat with jet black eyes, a pink nose, and a large bushy tail, which was never still. At the first sound of footsteps the white creature pricked up his ears, raised himself on his feet, arched his back, and the moment the doctor entered the room was on his shoulder, rubbing his neck against his master's face and purring softly.

"Oh, yes," said the physician, "Hafiz and I are very good friends; I have had him about eight years. My daughter brought him from London, and her experience getting him was rather odd. It is a matter of no little comment among tourists to note the habit existing in England of advertising cats, dogs, birds, deer, and fine breeds of poultry in the daily papers. In answering one of these notices a long correspondence ensues, and finally the would-be purchaser is given an audience. As a rule these very exclusive dealers have nothing of the Yankee straightforwardness about them, and it is a long time before they can be made to come to terms. The ex-Duchess or shattered Countess will throw out suggestions without naming any definite equivalent, and after considerable maneuvering you are incidentally informed as to the amount expected. Well, my daughter thought she struck a bargain, for she got puss for $10, but he is worth ten times that amount now.

"I have always had a great fondness for cats. I have given them a great deal of attention, studied their habits and peculiarities, and have come to the conclusion that, in order to preserve the health, smoothness and gloss of the fur, and the temper, one must regard the food, drink, housing, and general management. No error is more common than that of starving a cat to make it a good mouser. The practice has arisen from the mistaken notion that a cat kills rats and mice for food, whereas it is quite as much for sport. The cat should have at least two meals a day at regular hours. After each meal remove the dish, and never use it a second time without washing it. The quantity requisite can best be determined by experience. Oatmeal porridge and milk, or bread and milk, sweetened, will make a good breakfast. Use the same for dinner, with an allowance of meat or fish. Horse meat is used in France, but liver or boiled lights are better. Use fish during sickness; oysters are relished and very healthy, and no cat will turn up her nose at raw beef. An excessive amount of meat is bad. Boiled eggs should be used occasionally, and any vegetables that the animal prefers. My cat lives on beans, peas, and celery. Though the food should be ample, it is not necessary to overfeed the animal. Fresh milk should be given in abundance, and this with oatmeal will be sufficient generally, as the mice she will contrive to get will be an adequate supplement. A cat's disposition is spoiled by feeding her with delicacies from the table. This habit should be discouraged, and a little training will induce her to patiently await her time, even if she sits by the table during meals.

"Cats will never thrive without grass to eat. It is a panacea for all their ills; keeps the stomach in order, cools the blood, prevents humors, and aids digestion. It is supposed to aid in getting rid of the hair swallowed during the process of washing. During the winter it can be procured by keeping a piece of turf in the cellar or hothouse, or it may be cultivated in a flower pot. Cats are fond of asparagus, which many persons raise especially for them, and their natural preference for catnip will suggest a like course.

"A cat should be washed regularly with warm water and mild soap, dried with towels, and kept in a warm place to prevent cold. For state occasions, if the fur be lightly sponged with sweet cream, pussy will polish her coat up to its pristine beauty.

"Cats are subjected to nearly as many diseases as the human race. Hafiz is just getting over typhoid fever, and he manages to get diphtheria, malaria, catarrh, and everything else that is epidemic. Cats have symptoms of disease, and show them as plainly as children. Almost the first is a neglect of toilet; another is the rough condition of the fur, which loses its gloss and the hairs stand out. A hot nose is a sign of fever or inflammation, and when the cat shows a desire for great heat, there is a chill. Cats are so much admired at the present day that physicians are constantly being called upon to prescribe, and no one need feel any loss of dignity in doing so humane an act. When medicine is not given in the food, it is well to put on thick gloves in administering, in order to avoid bites and scratches. Then wrap the cat in a strong cloth, carefully covering the feet, and let an assistant hold it between his knees and open the mouth. Fluid doses, as glycerine and castor oil, should be given from a spoon in very small doses. If pills are prescribed, put the bolus well back against the roof of the mouth; powders or small pellets will dissolve on the tongue. Gentleness will be necessary in the operation, and the mouth and fur should be carefully washed in order to remove the taste of medicine. Generally, food should be withheld for two hours, unless otherwise directed. Cats are frequently delirious during teething, when the gums should be lanced, and a light diet of warm milk with plenty of clean water and grass given. In the adult the symptoms are wild, staring eyes, bristling hair, restlessness, and a tendency to climb up the wall or break through a window. The squeal is piteous, and the cry frightful; she will hide in the darkest corner, and die there unless attended to. In treating put on a pair of gloves, grasp the cat by the nape of the neck, wrap a shawl round the body, and with a pair of scissors slit one of the ears slightly in the thin part. Wet the ear with a sponge dipped in warm water to make the blood flow; a few drops will give relief. Give a dose of belladonna or hyoscyamus in half a glass of water, and put to sleep in a cool quiet place. It should not be disturbed for a day, as the operation leaves it in a nervous state, in which a slight sound will alarm it and cause a return of the delirium. Convulsions or fits are confined to young cats, and are caused by too much meat. They are of such short duration that little immediate relief can be given. A whiff of chloroform or ammonia may do, and to prevent her from running into the fire or doing herself injury throw a cloth over her and hold her quiet. If fat, reduce the diet; if poor and scrawny, give warm milk regularly and a little raw meat twice a day. If worms are the cause, I should prescribe half a teaspoonful of cod liver oil three times a day. If, during the fit, the cat becomes rigid, give nux vomica; and a dose of belladonna will cure bloodshot eyes. For inflamed eyes apply a wash of weak borax and water. After catching cold, cats will sneeze and show all signs of influenza. They may have sore throats, with diphtheritic symptoms, which they catch from children. Wrap the throat in flannel, wet with cosmoline, and give a few drops of sulphate of soda in water."—*Chicago Tribune.*

Diffusion of Oxygen through Silver Foil.

Platinum and iron are, as generally known, pervious to hydrogen at red heat. This characteristic deportment is probably related to that exhibited by several metals, in state of fusion, of absorbing or uniting with gases to feeble compounds. When silver in state of fusion is exposed to the influence of atmospheric air, it absorbs oxygen, which on subsequent cooling of the metal is but partially emitted. The investigation of this phenomenon by L. Troost has established the fact that the behavior of platinum and iron toward hydrogen is paralleled by that of silver toward oxygen.

A silver tube of one-third of an inch diameter and one-third of an inch thickness was surrounded by a platinum cylinder, and ignited by means of cadmium vapor in a muffle furnace. It was then exhausted with a Sprengel's air pump, and the exterior surface brought into contact with oxygen. A little less than a cubic inch of oxygen entered the exhausted tube in one hour, a quantity equal to 1,700, or about 200 cubic inches per square yard of surface. On substituting atmospheric air for oxygen, the diffusion of the latter became protracted, yielding but 3·2 c. c. oxygen, with traces of nitrogen, per hour.

Reduction of the silver foil from 0·5 to 0·25 cm. increased the diffusive power. Such a tube yielded 12 c. c. oxygen, or 3,330 c. c. per square meter an hour, and the volume obtained from atmospheric air was found to be 59 and 1,640 c. c. respectively. Diffusion of oxygen through silver foil takes place, though at a low rate, when the tube, instead of being exhausted, is charged with carbonic acid or carbonic oxide; of all gases, nitrogen possesses the least diffusive quality.

Avoidable Illnesses.

If men were to reflect upon the amount of illness, not to mention other evils, which they bring upon themselves, a total which ever increases with their self-development in civilization, they would sometimes question the reality of a progress which includes so many errors. Even if we leave out of sight the known results of faulty practice, there is still a large margin of what seem to be anomalous mishaps which day by day are shown to have had an acquired and avoidable beginning. It is always satisfactory to get at the root of these unaccountable flaws, especially when they nearly concern one's personal health. Their removal is then usually assured, and our former discomfort or dread is covered with the satisfaction of enlightenment and of remedial success. Trade work has at all times illustrated, and does still continually illustrate, the truth of these remarks. Let us grant all that is due to its energy and enterprise, and still the value of its productions is heavily discounted by errors which are not only due to oversight or ignorance, but often to neglect. In so far every one will admit the need of correction. By way of example, consider the case of staining and its applications. We showed a short time ago that some of the aniline dyes in the market, from whatever reason, were found to possess poisonous properties and to be unfit for dyeing articles of dress. Further evidence has not been wanting to confirm those observations. Another and older enemy of health, arsenic, has never been extirpated, but shows its front among us from time to time. Cases of poisoning by arsenical wall papers have been reported quite recently. The symptoms described, it is true, did not include the gravest possibilities, but chronic and intermittent ill health was proved to depend upon the presence of a highly colored paper containing much arsenic. Mere color, we would add, however, is no test of quality in this respect. The most innocent looking hues may be arsenical, and, conversely, the same tints may be had without any such poisonous admixture. Undoubtedly the only guarantee for safety is to be found in the discontinuance of this or other similarly hurtful substances as dyes in dwelling houses. While there is any doubt about the matter, no custom in decoration can be safer or better than that of distempering walls and afterward oil-painting them with some plain color.—*Lancet.*

New Primary Batteries.

Much ingenuity is being exercised in the design and arrangement of primary galvanic batteries intended for domestic electric lighting. According to *Nature*, an iron cell, invented by Dr. Pabst, of Stettin, is finding great favor in Germany. Its electrodes are carbon and wrought iron, dipping into a solution of ferric chloride. It is described as practically unpolarizable and self-generating; and it works at the expense of iron and of the oxygen of the air, which is absorbed into the liquid, while ferric oxide is deposited at the bottom of the cell. Its electromotive force is about 0·78 volt. It is claimed that the Pabst cell ought to prove of value for domestic electric lighting, as its internal resistance is low, and its constancy remarkable. Another primary battery has the peculiarity of consuming carbon in the liquid with which it is charged. Professors Bartoli and Papasogli are the inventors of this cell. The electrodes are composed of platinum and a compacted mixture of gas retort coke and Ceylon graphite. The exciting liquid is hypochlorite of soda. The drawback to the extensive utility of this battery is the lowness of its electromotive force, which is only 0·2 volt at the most.

Perseite, a New Sugar.

Muntz and Marcano have described a new sugar obtained from the seeds of the *Laurus persea*, a tree growing in the tropics. This sugar had been observed by Avequin in 1831, and by Melsens later; but it was by them supposed to be mannite. It is extracted by boiling alcohol, from which it crystallizes on cooling. Analysis gives it the formula $C_{12}H_{14}O_{12}$, isomeric with mannite. Its point of fusion is 183·5°–184°, while that of mannite is 20° lower. It is very soluble in hot, less so in cold water. Even in concentrated solution it has no action in the polarimeter. On adding borax, however, to a 4 per cent solution, it gave a rotation to the right of 0·55°. It does not reduce copper solutions, and is not fermentable. Boiling nitric acid converts it into oxalic acid, without the production of mucic acid. A mixture of strong nitric and sulphuric acids gives a trinitroperseite which detonates violently by a blow, and spontaneously decomposes.—*Ann. Chim.*

Factory Shoemaking in Massachusetts.

That most workmen in any particular locality are familiar with but one line of work is the most prominent characteristic of the shoe trade in New England. This is the most stubborn fact manufacturers meet who attempt to move their factories from Haverhill or Lynn to the towns of New Hampshire and Maine. The workmen in these latter places are skilled on coarser grades, but it is impossible to get nice light shoes from their hands.

There was little of system in the methods of manufacturing and distributing shoes in the early days. As late as 1836, all kinds and sizes, without reference to uniformity in quality, were packed in barrels, odd sized boxes, and whatever packing cases were at hand. There was no attempt to have a uniform number of dozen pairs of regularly assorted sizes in each case. After shoes were cut in 60 pair lots, it was seldom that the full 60 pairs were given to one workman, and they were usually given out in one, two, or three dozen pair lots. Consequently if they were put up in 60 pair cases, they would not be uniform in make or finish. But in the absence of some system of classifying and packing, it was simply impossible to do a large business in distributing, *i. e.*, jobbing, boots and shoes. By the year 1836, however, the jobbers were establishing themselves in the young and growing cities of the West and South, and demanded that their shoes should be put up in such a shape that they could be handled with system. With characteristic energy the manufacturers both of Lynn and Haverhill met this demand. In a little while they had devised a simple, complete, and convenient method of assorting, classifying, and packing their goods, which not only introduced system into their own methods, but also removed from the jobber a weight that had long hampered his business.

The growth of the jobbing trade, the extension of the canal and railroad lines, and the classification of the product into cases of assorted sizes, all the shoes in each case being practically uniform in quality—these solved the most difficult problem ever encountered by the shoe trade of New England, the problem of distribution. For even at this early date New England had made wonderful progress in the rather simple art of shoemaking, and if need be, compared with the demand, could make great quantities of them. The people of the West and South wanted them, and would pay for them ; the problen had been to distribute them.

From the first the shoemakers of Haverhill had taken kindly to the manufacture of slippers. In the very early times it was not a large but a rather profitable business. As early as 1843 the trade had grown into considerable proportions, and there was regularly being made large shipments of slippers from that place. These were mostly "turns," generally without heels, and made by hand, of cheap kid, prunella, or light grain, and sold at $3 to $6 per dozen pairs.

Two other leading features of Haverhill trade at the same time were a half-heeled French edge pump, usually made of light grain, and sold at $8 to $9 per dozen pairs, and a cheap "welt" shoe for ladies' wear, mostly without heels, and sold at $10 to $12 per dozen pairs. Both these shoes were very popular in the South, and the pump was worn as a summer shoe to some extent in the cities of the North.

In 1857 there were nearly one hundred shoe manufacturers in Haverhill, and the yearly records show a steady increase in their number and the amount of their product. Meanwhile a new industry had sprung up, one that is now a necessity, one that has done much to simplify the process of making the factory shoe, and to cheapen, improve, and popularize it, viz., that industry which includes the manufacture, selection, and preparation of many of the parts that go to make a shoe. Included in this are sole cutters, the manufacturers of heel stiffenings, box toes, tips, staying blockings, etc. Although this industry had not then been carried to the perfection it has to-day, still as early as 1857 there were in Haverhill eighteen inner sole and stiffening manufactories.

In 1850 Haverhill manufacturers began to cut the Newark patent and enameled leather. At first this was made into "turned" shoes, later into a pegged Jenny Lind and a pegged spring heeled shoe, both for women's wear. For a time this patent leather was immensely popular.

In 1855, or thereabout, and from that time until the breaking out of the rebellion, fancy colored shoes were in demand. These were made of colored kids, sheep, and grain. There was a profusion of purples, bronzes, maroons, yellows, etc. Many, perhaps most, of these went South, and the trade dropped off very suddenly on the commencement of the war.

Shoes with heels had always been made in Haverhill, but very few had been made with high or anything but plain heels. In 1858, however, the trade began to call for a high, fancy heel. Workmen who could build such were not plenty. It requires considerable skill to make a high heel for a stylish slipper, building it up lift by lift, trimming each as it is put in place. It is no easy matter to get both heels alike. We are forced to admit that, however much the heel may lose in character, it certainly gains in uniformity when made and finished by machinery. But there was no heeling machinery in those days, no trimmers, burnishers, etc., and the expense of making these fancy heels by hand necessarily limited the sale of such shoes. The trade grew, however. and for years Haverhill has annually manufactured millions of pairs of fancy heeled slippers, low cut shoes, and ladies' boots.

Previous to 1857 the uppers were stitched by hand, mostly by the wives and daughters of the country shoemakers, and at their homes. But in that year the Singer sewing machine was introduced into Haverhill. The first cost $400. Experimenting with machinery was expensive business in those days. It required time, the outlay of money, and necessitated the damaging of a deal of stock to teach operators. No doubt the patience of the manufacturer was often sorely tried. If he overcame his own prejudices, he had to combat those of his operatives, and operatives in all lines of manufacturing have always looked with disfavor on the introduction of machinery. Under these circumstances it required some courage to take hold of and develop the possibilities of the new machines as they came up, one following another in such rapid succession.

To ourselves, says the Chicago *Shoe and Leather Review*, looking back over the history of the trade for the past thirty years, what were the grand possibilities outlined in the introduction of the first power machine into a New England shoe factory are all plain enough. It meant more than either the manufacturer or operative of that day dreamed, and yet to the wisest of these it was big with prophecy. To the manufacturer it meant the doubling and redoubling up of his product beyond even the dreams of his earlier experience; the opening up of opportunities for wealth and influence not possible under the old system. To the operative —well, to him it meant something vastly different, and in the light of the results one can hardly blame him for having fought stubbornly, step by step, the introduction of machinery. Under the old system, his wife and his daughter, in the intervals of their household duties, and in their own home, stitched the uppers. He in his own home, or in his own little shop, made the shoes. Through it all he and they were surrounded by the quiet, healthy influence of their New England home. Under the new system his wife and daughter in the heated, foul aired, and crowded factory, surrounded by the vicious and demoralizing influences of the factory system, work the long hours of the working day, he likewise. What does it signify that their wages are better? Are the conditions of their lives better or worse? But machinery came, and that, too, when once started, with wonderful rapidity. Closely following the Singer came the Grover & Baker and other sewing machines for stitching the uppers. In 1859 Blake brought out his sole-sewing machine. It was a crude affair at first, but Gordon McKay, then a capable mechanic about the mills in Lawrence, saw it, and seeing the possibilities in the machine, associated himself with Blake in its development. Improvements were devised, and, at last, ten machines were pronounced good and sent out. Nine of these were moderately successful, and of these nine Haverhill had one. The McKay machine almost completely revolutionized the business of shoemaking. In early times shoes were hand made, either by the welt or turn process, but on the introduction of pegs it had come about that nearly all medium and low priced goods were pegged. Pegs being cheaper that the two seams of the welts, and yet quite effective as a fastening, took the place of welted shoes.

When the success of the McKay machines had once been thoroughly established, however, the bulk of these goods—in fact, all the cheaper sewed grades, and many of the pegged—were made machine sewed, and but one seam was required in uniting sole and upper. The pegging machine, which has been used a good deal, soon followed. Then came the development of what may be called the finishing machinery, heel trimmers and burnishers, edge trimmers and setters, bottom finishing and buffing machines, and a score of others, until, as early as 1870, the factory sytem had been completely developed.

The Wish is Father to the Thought.

There is probably no human faculty that is more in need of faithful and patient cultivation than the judgment, for there is none that has more complications to deal with or more difficulties to overcome. Nevertheless, there is perhaps none which receives less systematic discipline or upon which people generally are less willing to expend labor and thought. They train their children's memory; exercise their powers of expression; school them in habits of industry, endurance, patience, and self-control; but seldom discipline their judgment or teach them how to draw correct conclusions. That, they suppose, is something which time and experience will do for them; yet when they see what hasty opinions and ill-advised judgments are continually formed by older people, they might infer that some definite education in this respect was necessary for both young and old.

There is a universal tendency to believe as really true that which is desired to be true; and to resist that tendency is perhaps the first and most essential step in this kind of mental discipline. Some new theory is propounded which excites human sympathies. It is hoped it can be established, and, with that feeling, those who like it proceed to investigate it. Although they doubtless mean to be impartial, they yet welcome the evidences in favor of it with alacrity, and listen to the objections against it with reluctance. Unless they are very much upon their guard against this influence, they will accept the theory upon insufficient evidence, and, whether it be true or not, their belief in it will only prove their weakness. Or some proposed reform is presented to them, against which their accustomed habits of thought and their prejudices rebel. Perhaps it may involve duties which they should dislike or sacrifices they are not ready to make, and they sincerely hope it may prove to be wild and visionary. Now with such a bias they are in danger of deciding against it, simply because they do not like it, although they may imagine they have given it the most impartial consideration. A charge is made or a report is circulated against their friend or their favorite candidate. How indignantly they resent it, and, when proofs are offered, how they struggle to refute them! But let similar charges be brought against their foe or the candidate of the opposite party, and how willingly they listen to them, how easily they can be brought to believe them! One man is by constitution and habit of mind conservative; he clings to old ideas, old habits, and old fashions, and his impulse is to reject new notions and new customs because they are new. Another by birth and training is radical; he lets old things slip from him without a pang, and receives all novelties with open arms.

Now all these impulses are natural and not to be condemned, but they are impulses for which due allowance should be made in forming any judgment and in drawing any conclusion. All preferences impose an obligation to give more weight to the opposite side. As men know they will be influenced by their wishes, they should insist upon dwelling longer and more carefully on the arguments that thwart them. They should practice a wholesome self-abnegation as far as possible, resisting the force that agrees with their wishes, and welcoming that which opposes them, thus doing all in their power to restore the balance which an intense desire has destroyed. Professor Faraday, to illustrate the rarity of impartial judgments, alludes to the very common amusement of fastening a ring to a long thread and holding it suspended over a glass to notice its movements, and see whether it will tap the glass at the mention of some name or letter, or other signal. Though every one who tries the experiment disclaims the possibility of an involuntary motion of the hand in the desired direction, Prof. F. said he had rarely seen any one who was willing to put it to the proof by screening the object from sight and having its position then changed. Yet it would seem that any one really desiring to discover the *truth* about even so trifling a matter would eagerly welcome every means that could throw light upon it.

One effect of resisting inclination in the exercise of judgment will be to prevent hasty decisions. There are emergencies when rapid judgments must be made and speedy action must follow. But it is likely the larger number of conclusions would be improved by delay. It is an easy thing to accept as true or best what we wish to be so without weighing or sifting the evidence. But to judge wisely and well takes both labor and time. Suspension of judgment at certain times and for certain periods is the best mental state men can be in. When we remember how many complex conditions are involved, and how difficult it is to understand and appreciate those conditions, and to accord to each its protionate value, we may well pause and reflect before committing ourselves to judgments which may prove to be wrong. When men attain a true conception of the knowledge, thought, and wisdom that are required to form wise opinions, or draw correct conclusions upon even ordinary subjects, they will be in less haste to proclaim their ignorance by forming rash judgments; and when they realize the importance of bringing energy, patience, and self-abnegation to the task, they will become better fitted to bear the responsibilities and arrive at the decisions that life requires at their hands.—*Philadelphia Ledger.*

A Japanese Dentist.

The Japanese dentist does not frighten his patient with an array of steel instruments. All of his operations in tooth drawing are performed by the thumb and forefinger of one hand. The skill necessary to do this is only acquired after long practice, but once it is obtained the operator is able to extract a half dozen teeth in about thirty seconds without once removing his fingers from the patient's mouth. The dentist's education commences with the pulling out of pegs which have been pressed into soft wood; it ends with the drawing of hard pegs which have been driven into an oak plank with a mallet. A writer in the *Union Medicale* says that no human jaw can resist the delicate but powerful manipulation of the Japanese dentist.

ENGINEERING INVENTIONS.

A mechanical movement has been patented by Mr. George M. Reed, of Leadville, Col. It is for an apparatus producing a motion simulating that given by hand to the trays used in developing dry plates and other photographic work, to be applied to the pans of gold concentrators, and similar work, and consists in a balanced table or platform combined with mechanism to rock the table on its pivots.

A cable railroad and tramway has been patented by Mr. Francis de Vooght, of Antwerp, Belgium. This invention covers means for retaining the cars on the rails on curves, and to hold them down to prevent tipping on steep gradients; means for conducting a cable through a shield or tube above or below the ground, and for avoiding friction; hooks of peculiar form for attaching and detaching cars; means for closing and unclosing the shield or tube to permit the car attachment to communicate with and be carried by the cable; means for passing other similar cables at crossings, and for adapting the same car to run either way on the same track, with provision for automatically disconnecting the hook from the cable and notifying the car driver thereof at crossings, and other novel features, to facilitate the propelling of cars by endless ropes driven by stationary motors.

AGRICULTURAL INVENTIONS.

A cultivator has been patented by Mr. John Feast, Sr., of Baltimore, Md. The invention consists in a wheeled "scuffler" combined with a rotary rake, and adapted to be drawn instead of pushed, so that it will rake the weeds to the surface, where they will be exposed to the sun, and at the same time by the rotary movement clear itself of them.

A corn planter has been patented by Mr. George H. Meyer, of Santa Rosa, Cal. At convenient intervals on a broad wheel, about sixteen feet in circumference, are seed openings, with automatic means of piercing the ground, and connecting with a hopper, whereby the seed is dropped into the pocket thus made, and the planter may be conveniently rolled by hand before the operator.

A corn and potato cultivator and hiller combined has been patented by Mr. William G. Parmelee, of Le Roy, N. Y. This machine is especially adapted for row or drill crops, such as corn, beans, and potatoes; it is for use with a span of horses, and straddles the row, the draught being so arranged as to draw straight, without side or zigzag motion, and requiring no labor for holding, the invention covering several novel features of construction and arrangement.

MISCELLANEOUS INVENTIONS.

A tricycle has been patented by Mr. Theophilus H. Paessler, of Malvern, Ohio. This invention covers a special construction and combination of parts for the propelling mechanism, to apply a man's power to greater advantage, and to utilize his weight in addition to the power of both his legs and arms.

A pencil holder and slate cleaner has been patented by Mr. Charles O. Patterson, of Augusta, Kan. It has a tube to be filled with water, with a cap from which a brush projects, and over which is placed a cap when the pencil is carried in the pocket; one end of the tube is also adapted to receive and hold a pencil.

A skate has been patented by Mr. Chas. E. Wardwell, of Holyoke, Mass. The invention covers a special combination of parts in a skate to be easily adjusted as a runner skate or roller skate, there being combined with the foot plate bar detachably held knees, with socket pieces and spindles held therein, and rollers or runners held on the spindles.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(1) W. M. P. writes: Would you be kind enough to inform me if I can get a machine for making pop corn into balls, and can you inform me of the process and ingredients used to make the corn adhere, and the process for coloring? A. There is such a patented machine in the market. The exact nature of materials used differs with different makers, and by some is claimed to be secret, but there is little doubt that the adhesive mixture is gelatine with a little molasses, and the coloring matter carmine.

(2) W. S. C. asks (1) why a screwdriver with a handle a yard in length will turn a screw into wood easier than one 9 inches or a foot long. A. The long handle not only gives a better grip, but is usually of larger diameter, thus giving increased leverage. 2. Please explain the manner or instrument by which it is ascertained how many inches of rain have fallen after a storm, shower, or blizzard? A. A rain gauge may be made of any cylindrical vessel with top and bottom of equal area, so that the rain catch may be measured with a thin rule. There are a variety of forms of varying proportions, requiring special scales, too intricate to describe here.

(3) P. J. H.—To find the pressure that will open a one inch safety valve: Multiply the weight of the ball in pounds by the length of the lever, and divide the sum by the length of the fulcrum (all in inches), add to this the weight of the valve and lever, divide this sum by the area of the valve in square inches. The quotient will be the pressure per square inch required to lift the valve. As in your case

$$\left.\frac{\dfrac{2\tfrac{1}{2}\text{ lb.}\times 12\text{ in.}}{1''}+2\text{ lb.}}{0{\cdot}78''}\right\}=41{\cdot}+\text{lb. pr. sq. inch.}$$

(4) A. G. asks (1) directions for varnishing violins. A. Use coarsely powdered copal and glass, each, 4 ounces; alcohol, 1 pint; camphor, ½ ounce; heat the mixture with frequent stirring in a water bath, so that the bubbles may be counted as they rise, until solution is complete, and when cold decant the clear portion. Add a little dragon's blood to produce the reddish color. 2. Does dipping fence pickets in strong lime water do much toward preventing decay? The pickets are in the water but a few minutes. A. Only slightly. It is not as good a preservative as some of the coal tar substances.

(5) J. D.—For the manufacture of potassium ferrocyanide, three things are necessary: first a nitrogenous animal matter, for your cyanogen; an alkali containing potassium, usually the carbonate, for the potassium; and iron, to form the ferro-(cyanide). One generally uses the cheapest materials available, and it is of no consequence which one is used, provided the proper quantities are obtained. The carbonate of potash is probably the best potassium to use. Hoofs, horn, feathers, and dried blood contain 14 to 17 per cent of nitrogen, while leather parings contain only 8 per cent, so that more than twice the quantity of the latter would be required to offset the first mentioned.—Saleratus is a mixture of sodium carbonate and salt, and therefore is a sodium mixture.—Copper is generally used for carbon connections; the ends, however, should be kept clean and bright.

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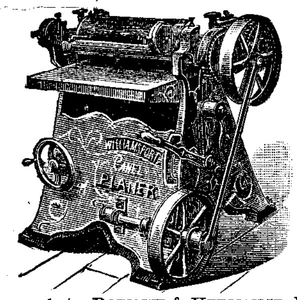

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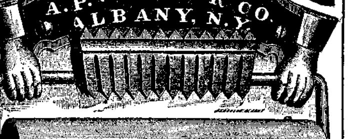

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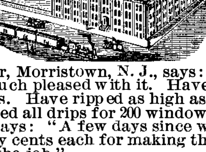

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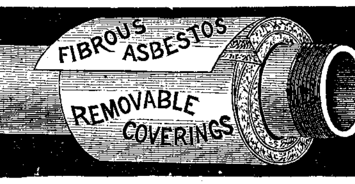

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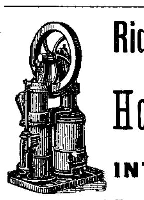

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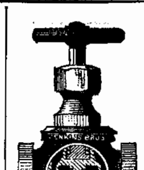

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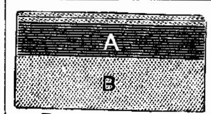

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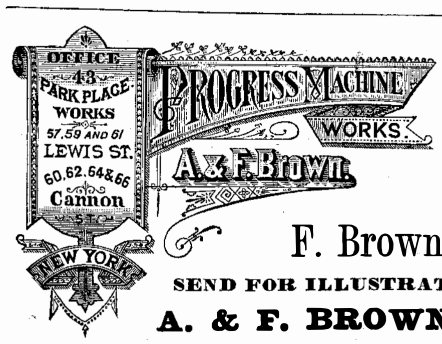

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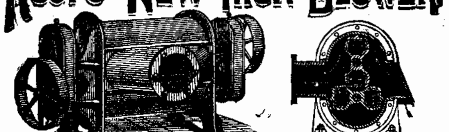

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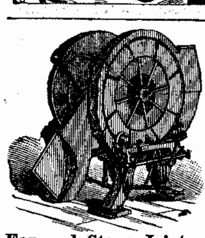

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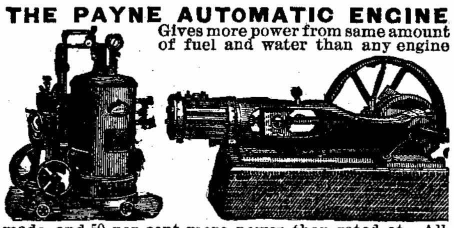

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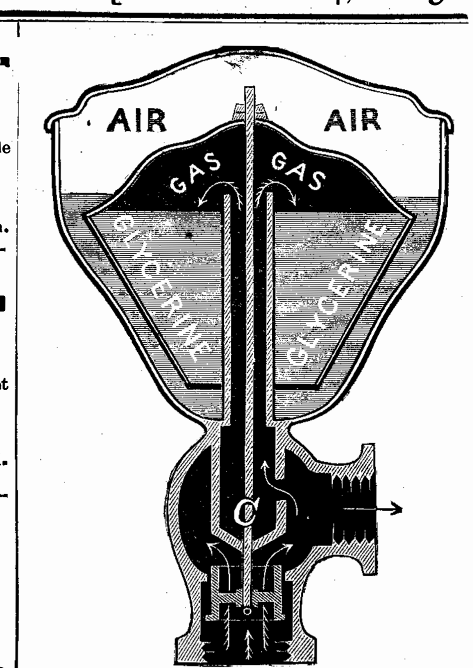

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